International Conference on Rivers and Civilization

Multidisciplinary Perspectives on Major River Basins

Program and Abstracts

June 25-28, 2006

La Crosse Center
300 Harborview Plaza
La Crosse, Wisconsin

Conference Co-Hosts

UW-L
University of Wisconsin-La Crosse

National Mississippi River Museum & Aquarium
In association with the Smithsonian Institution

Welcome

Welcome to La Crosse, Wisconsin, and to the third International Conference on Rivers: Multidisciplinary Perspectives on Major River Basins. The first in this series of international conferences on large river basins was held at Dubna University (Russia), along the Volga River in 2002, and the second was held at Assiut University (Egypt), along the Nile River in 2003. We hope that you will enjoy La Crosse's historic downtown waterfront and the beauty of the Mississippi River and surrounding area during your stay. We also hope that you will leave the conference with new insights and understanding about the great rivers of the world and that you will make new contacts and renew prior acquaintances.

Acknowledgements

The La Crosse Local Planning and Program Committee wishes to recognize and thank participating staff of the conference host institutions (University of Wisconsin – La Crosse and the National Mississippi River & Aquarium), conference sponsors, session organizers and moderators, and exhibitors for their efforts in organizing and supporting this conference. Special thanks are extended to Tracy Noyes and Jan Olson (Continuing Education), Larry Sleznikow (Educational Technology), and John Ready, Art Department from the University of Wisconsin – La Crosse (UWL) and to Jerry Enzler, Teri Hawks Goodman, and Christie Trifone for organizing and coordinating activities of the National Mississippi River Museum & Aquarium. We are grateful to Gretchen Benjamin and Terry Dukerschein (Wisconsin Department of Natural Resources), Melinda Knutson (U.S. Fish and Wildlife Service), and Joseph Tiffany (UW-L Mississippi Valley Archeology Center) for their leadership in organizing the tours of the Upper Mississippi River and valley and to the many individuals in governmental and academic institutions who assisted with the tours and other conference activities.

La Crosse Local Planning and Program Committee

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Jane Rada Community Member La Crosse, Wisconsin	**Jennifer Terpstra** Associate Professor, Theatre Arts Department University of Wisconsin–La Crosse

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- Poster and exhibits session (first showing)
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- Late afternoon and evening Performance/Presentations

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- Morning plenary session
- Featured luncheon speaker
- Morning/afternoon concurrent oral sessions (special and contributed)
- Poster and exhibits session (second showing, open to public)
- Two evening Performance/Presentations (open to public)

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- Featured luncheon speaker
- Morning/afternoon concurrent oral sessions (special and contributed)

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Major Sponsors

The Nature Conservancy
University of Wisconsin – La Crosse Foundation, Inc.
University of Wisconsin – La Crosse Office of International Education
University of Wisconsin – La Crosse River Studies Center

Supporting Sponsors

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National Great Rivers Center for Research & Education
Ron and Jane Rada
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Session Sponsors

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U.S. Fish & Wildlife Service, Region 3
U.S. Geological Survey, Upper Midwest Environmental Science Center
University of Wisconsin-La Crosse

Donors

James and Gloria Wiener
Dorothy Zeisler-Vralsted
School of Arts and Communication, University of Wisconsin-La Crosse

General Information

Registration/Information Desk
- Located in the main lobby of South Hall, La Crosse Center (hours are posted in the program overview)
- Check at the desk for lost items

Bookstore/Gifts
- Located in the lower level foyer

Phones
- As a courtesy to presenters and conferees, please turn off cell phones during session events and luncheons.
- Pay phones are located in the lower level foyer.

Conference Evaluation Forms
- Your feedback is important—please complete your conference evaluation form and drop it off in the main lobby.

Continuing Education Credits (CEUs)
- Individuals interested in receiving CEUs should contact the Registration Desk for information.

E-Mail Access
- Complimentary, limited email access is available in Board Room D (upper level). Please limit your use to no more than 10 minutes. The La Crosse Center is a wireless facility.

Emergency/First Aid/Health Care
- Contact the Registration Desk.

Meals/Refreshments
- Continental breakfasts are served in the upper level foyer back Monday through Wednesday from 7 am to 8 am
- Luncheons with featured speakers will be held in the Arena (access from the lower level) Monday through Wednesday. Check the program schedule for times each day.
  Morning and afternoon breaks, South Hall A. See program schedule for times.

Message Board
- Located in the main lobby

Name Tags
- Please wear your name tag throughout the conference; it serves as your "ticket" to events and meal functions.

Speaker Ready Room (Board Room C)
- The Speaker Ready Room will be open from 1 pm to 6:30 pm Sunday and from 7 am to 9 am Monday through Wednesday. Presenters can review their presentations on a conference computer prior to their sessions.

Special Needs
- Check with the Registration Desk if special needs are required.

Sunday Reception and Keynote Speaker
- The Kanopy Dance Company will present a 10-minute performance at 6:15 pm in the Ball Room. Conferees will then proceed to the opening session and keynote address by Jared Diamond in the arena, which is located in the lower level. Seating for conferees will be reserved with general public seating open and in back of reserved conference seating. Therefore, it will not be necessary to leave the reception early to obtain good seating.

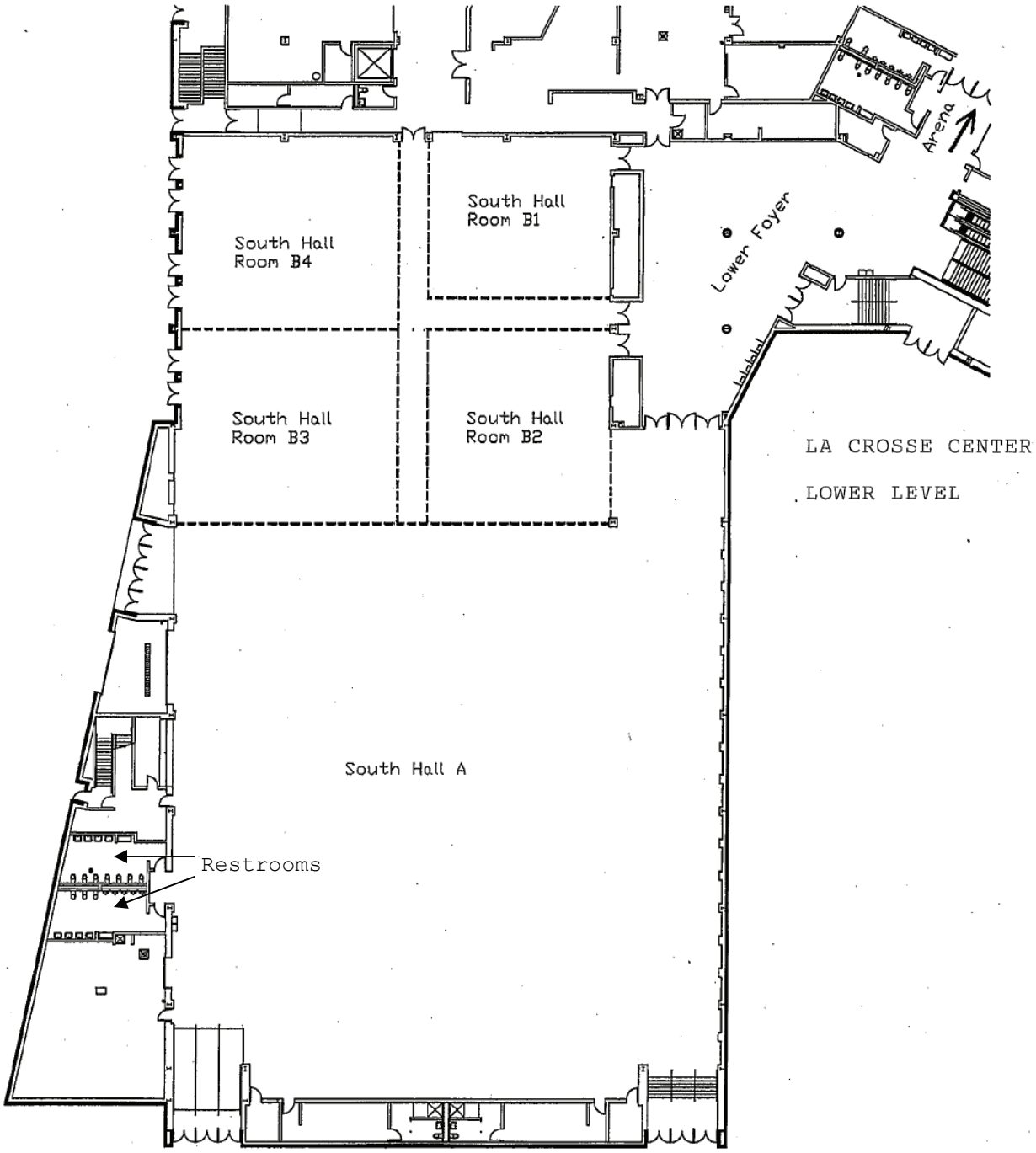
Tour/Field Trip Pickup/Drop Off

- Pick up and drop off for the Friday and Saturday pre-conference and Thursday post-conference tours will be at the Radisson Hotel parking lot. Pick up and drop off for all other tours and field trips will be in front of the La Crosse Center. Please report at least 15 minutes prior to the departure time.

Artist Awards

- Conferees will have an opportunity to vote for the "People's Choice Award" during the Poster and Exhibit session on Monday.
  There will be a drawing for two or more pieces of artists' work at the luncheon on Wednesday; conferees must be present to win.

Maps


South Hall
Room B4
South Hall
Room B1
Lower Foyer
Arena
South Hall
Room B3
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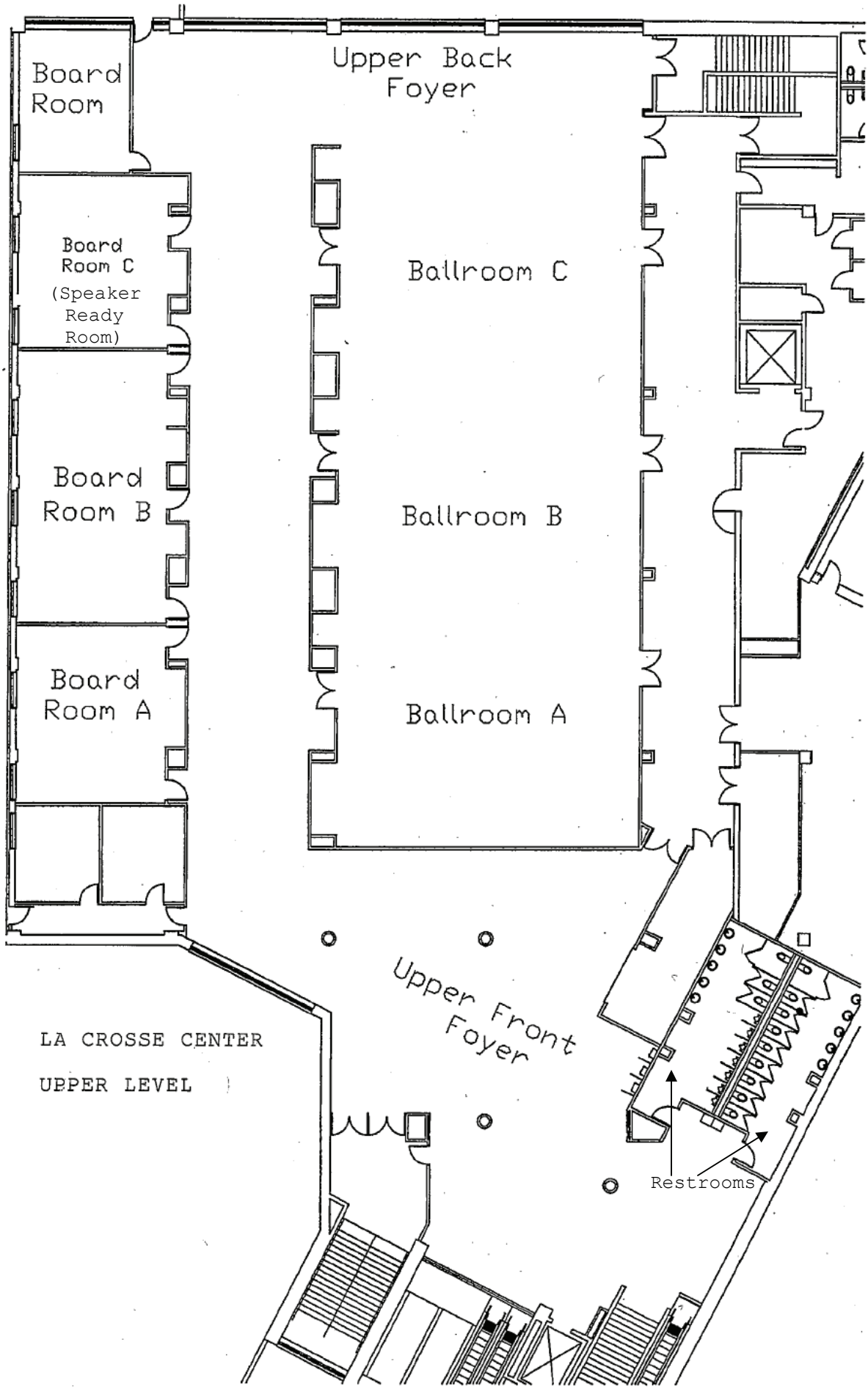
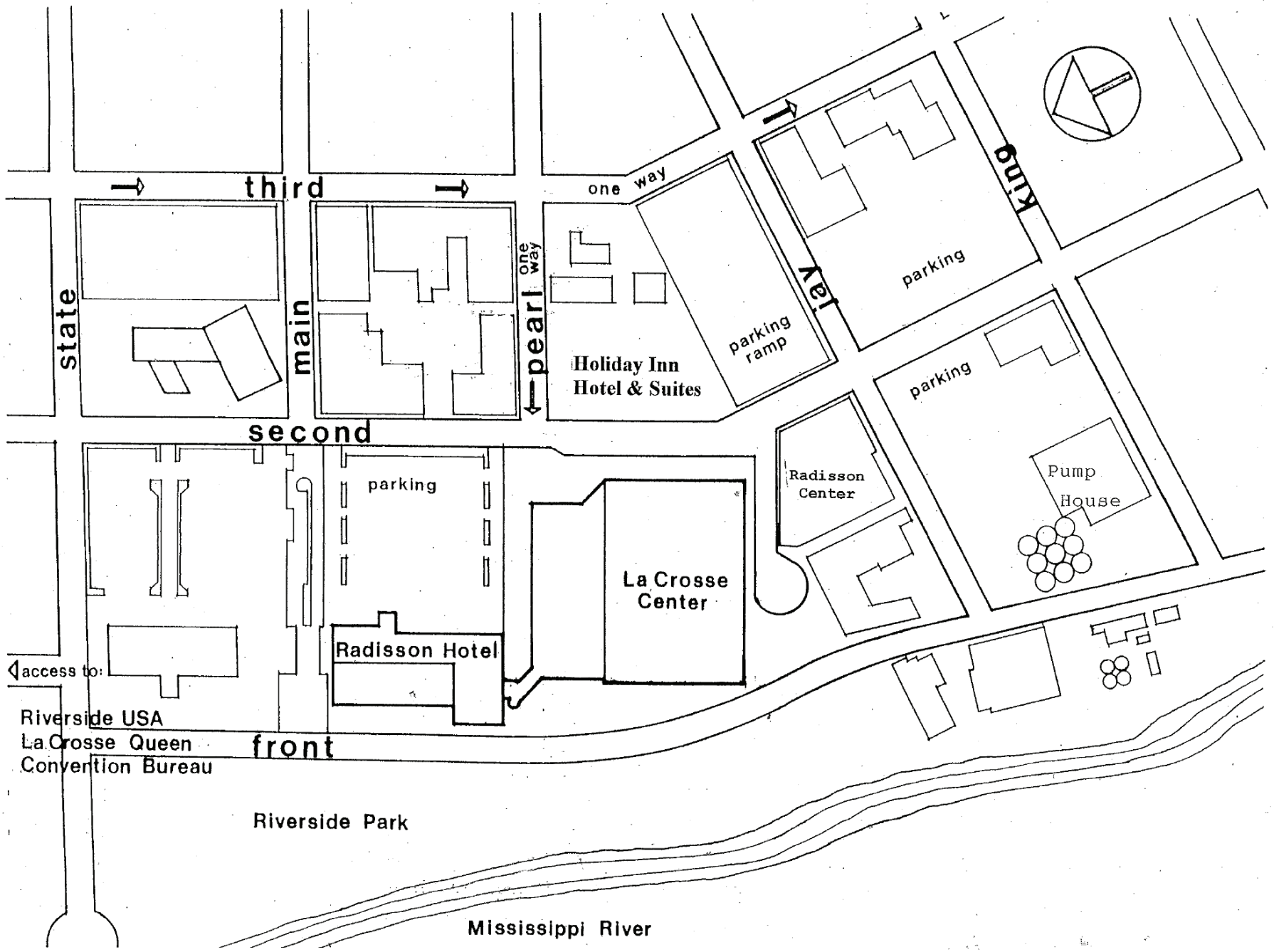
LA CROSSE CENTER
LOWER LEVEL
South Hall A
Restrooms


Board Room
Upper Back Foyer
Board Room C (Speaker Ready Room)
Ballroom C
Board Room B
Ballroom B
Board Room A
Ballroom A
Upper Front Foyer
LA CROSSE CENTER
UPPER LEVEL
Restrooms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Hotel & Suites
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Radisson
Center
parking
Pump
House
La Crosse
Center
Radisson Hotel
access to:
Riverside USA
La Crosse Queen
Convention Bureau
front
Riverside Park
Mississippi River

Pre-Conference Tour Information/Schedules are located at www.rivers2006.com

INTERNATIONAL CONFERENCE ON RIVERS AND CIVILIZATION

Program Overview

Sunday, June 25

Registration, Pre-conference Tours, Opening Reception, and Keynote Address

TIME		
8:00 a.m.		
8:30 a.m.		**TOUR** ***Indian Mounds, Rock Art, and the Fur Trade:*** ***A View from Trempealeau Mountain, Perrot State Park*** Van/bus pick up at the La Crosse Center at 8:30 a.m.; return at ~noon Limited to 10 to 45 participants A snack and water will be provided Tour guided by the UW-L Mississippi Valley Archeology Center
9:00 a.m.		
11:00	**Set up Exhibits & Posters** 12 noon - 5:15 p.m. **Registration open** **Main Lobby** 12:00 noon - 6:30 pm	
~noon		
12:45 p.m.		**TOUR** ***Large River Monitoring*** Van/bus pick up at the La Crosse Center at 12:45 p.m. and will return at ~ 4 p.m. Limited to 12-20 participants A snack and water will be provided Tour guided by personnel from the Wisconsin, Minnesota, and Iowa Departments of Natural Resources, Long Term Resource Monitoring Program, and U.S Geological Survey
2:15 p.m.		
~4:00 p.m.		
~4:45 p.m.		
5:15 p.m.		**Opening Reception** 5:15-6:45 pm w/heavy hors d'oeuvres and cash bar **Ballroom** **~6:15 pm: Performance Kanopy Dance Company (PF 1)** *Along Those Shores, Astir with Life and Motion..Heavily was [the River] Breathing"--An Invocation Through Dance*
6:30 p.m.		
7:00 p.m.		**Opening Ceremony** **Keynote Address** 7:00 pm - 9:00 pm South Hall A Jared Diamond (University of California at Los Angeles) *Why the World Runs on Water* Open to Public (tickets required)

INTERNATIONAL CONFERENCE ON RIVERS AND CIVILIZATION

Program Overview

MONDAY, June 26

Full-Day Session with Poster and Exhibit Session and Evening Concert

TIME					
	Registration Desk Open Main Lobby 7:00 a.m. - 6:30 p.m.	**Posters & Exhibits** Set up: South Hall 7 a.m.-1 p.m.			
7:00 am-8:00 am	**Continental Breakfast - 7:00 am - 8:00 am** **Upper Level Foyer**				
8:00 am-8:30 am	**Welcome/opening remarks Ball Room** **Elizabeth Hitch, Chancellor, University of Wisconsin - La Crosse** **U.S. Representative Ron Kind and Jerry Enzler, National Mississippi River Museum & Aquarium**				
8:30 am-10:00 am	**Oral Session 1 (Plenary) Ball Room** David Dudgeon (University of Hong Kong, China): *Conservation of Riverine Biodiversity in the Human-Dominated Landscapes of Monsoonal Asia* Moderator: Roger Haro Donna Mergler (University of Quebec at Montreal, Canada): *An Ecosystem Approach to Mercury and Health in the Amazon Basin* Moderator: James Wiener				
10:00 am-10:30 am	**Break with Refreshments** **Upper Level Foyer**				
10:30 am-12:15 pm	**Oral Session 2 (Plenary) Ball Room** *Historical Development of World Rivers(The German Historical Institute)* Mark Cioc (University of California-Santa Cruz) Meredith McKittrick (Georgetown University) Donald Worster (University of Kansas) Dorothy Zeisler-Vralsted (University of Eastern Washington) Moderator: Christof Mauch				
12:15 pm-1:45 pm	**Lunch with Featured Speaker: 12:15 pm - 1:45 pm - Arena** Oral Session 3 (Plenary) Douglas Brinkley (Tulane University) *The Great Deluge: Hurricane Katrina, New Orleans, and the Mississippi Gulf Coast* Moderator: Teri Hawks Goodman				
1:45 pm-3:15 pm	**Oral Session 4 Special** South Hall B-3 *Civilizing the Mississippi: River Engineering & Its Consequences*--Part 1 Moderator: Robert Meade	**Oral Session 5 Special** South Hall B-2 *Environmental Education: Models & Partnerships for the Future*--Part 1 Moderator: Randy Hines	**Oral Session 6 Contributed** South Hall B-4 *Ecology, Conservation, and Biodiversity*--Part 1 Moderator: Melinda Knutson	**Oral Session 7 Contributed** South Hall B-1 *Human Interactions with Rivers at the Basin Scale*--Part 1 Moderator: Cynthia Berlin	**Oral Session 8 Special** Board Room B *Connecting Lives and Literature: Rivers, a Moving Sense of Place* Moderator: Jerry Enzler
3:15 pm-3:45 pm	**Break with Refreshments** **South Hall**				**3:45 pm- 5:30 pm Special Sessions in Pump House Regional Arts Center** Moderator: Beth Cherne
3:45 pm-5:30 pm	**Oral Session 9 Special** South Hall B-3 *Civilizing the Mississippi: River Engineering & Its Consequences*--Part 2 Moderator: Steve Gutreuter	**Oral Session 10 Special** South Hall B-2 *Environmental Education: Models & Partnerships for the Future*--Part 2 Moderator: Randy Hines	**Oral Session 11 Contributed** South Hall B-4 *Ecology, Conservation, and Biodiversity* - Part 2 Moderator: Steven Zigler	**Oral Session 12 Contributed** South Hall B-1 *Human Interactions with Rivers at the Basin Scale--Part 2* Moderator: Cynthia Berlin	**Performance/Presentation 2** *Choreographic Presentation on the Science of Water Flow* **Performance/Presentation 3** *Narrated Photographic Exhibit: Rivers of the Upper Midwest* **Performance/Presentation 4** *Narrated Painting Exhibit: Landscapes of Russian Rivers*
5:30 pm - 7:30 pm	**Poster and Exhibit Session 1--First Showing (Second Showing on Tuesday) - South Hall A** **with Reception (heavy hors d'oeuvres and cash bar)** (Conferees Only) **Poster and Exhibit Session includes:** Technical Posters Organizational/Agency/Sponsor Exhibits Museum Exhibits Photography Exhibits Art Exhibits				Open gallery w/refreshments **Then move to,** La Crosse Center for Poster and Exhibit Session with Reception **7:30-9:00 pm** **Performance/Presentation 5** *International Friendship Concert: Dubna Trio & La Crosse Musicians* (limited seating--first-come basis; sign up at conference registration desk)

INTERNATIONAL CONFERENCE ON RIVERS AND CIVILIZATION

Program Overview

TUESDAY, June 27

Full-Day Session with evening workshop and performance

TIME					
	Registration Desk Open Main Lobby 7:30 am - 4:30 pm				
7:00 am-8:00 am	**Continental Breakfast - 7:00 am - 8:00 am** **Upper Level Foyer**				
8:00 am-8:15 am	**Introductory remarks and conference updates - Ball Room**				
8:15 am-9:45 am	**Oral Session 13 (Plenary)** **Ball Room** Christer Nilsson (Umea University, Sweden): *Landscape Ecology of Large Rivers: Human Modifications and Management of Floodplains and Watersheds* Moderator: Barry Johnson Karlyn Eckman (University of Minnesota): *Assessing Human Vulnerability in Major River Systems* Moderator: Mark Sandheinrich				
9:45 am-10:15 am	**Break with Refreshments - 9:45 am - 10:15 am - South Hall**				
10:15 am-11:45 am	**Oral Session 14 Special** South Hall B-3 *Ecosystem Services Provided by Major Rivers: Concepts, Measures, & Applications* Part 1 Moderator: N. LeRoy Poff	**Oral Session 15 Special** South Hall B-1 *Historical & Contemporary Development and Use of the Upper Mississippi River* Moderator: Brian Aldrich	**Oral Session 16 Special** South Hall B-4 *Historical Ecology: Reconstructing the Past to Guide the Future*--Part 1 Moderator: Robert Fuerstenberger	**Oral Session 17 Contributed** Board Room B *Rivers as Borders: Transnational Perspectives* Moderator: Harun Rashid	**Oral Session 18 Contributed** South Hall B-2 *Hydrology, Climate, and Sediment Transport in Rivers* Moderator: Randy Hunt
11:45 am-1:15 pm	**Lunch with Featured Speaker - 11:45 am -1:15 pm - Arena** **Oral Session 19 (Plenary)** John Wiens (The Nature Conservancy) *Great Rivers as Great Integrators: Linking Land with Water, People with Conservation* Moderator: Vince Shay, The Nature Conservancy				
1:15 pm-3:00 pm	**Oral Session 20 Special** South Hall B-3 *Ecosystem Services Provided by Major Rivers: Concepts, Measures, & Applications* Part 2 Moderator: N. LeRoy Poff **Open to Public**	**Oral Session 21 Special** Board Room B *John Wesley Powell: and the Colorado River Dream* Moderator: Anders C. Dahlgren **Open to Public**	**Oral Session 22 Special** South Hall B-4 *Historical Ecology: Reconstructing the Past to Guide the Future*--Part 2 Moderator: Robert Fuerstenberger **Open to Public**	**Oral Session 23 Special** South Hall B-1 *Ecosystem Restoration on the Ume River (Sweden) and the Mississippi River (USA)* Moderator: Scott Yess **Open to Public**	**Oral Session 24 Contributed** South Hall B-2 *Customs, Ethics, Perceptions and Public Involvement in River Management*--Part 1 Moderator: Gretchen Benjamin **Open to Public**
3:00 pm-6:00 pm	**Poster & Exhibit Session 2** South Hall A (second/repeat showing) 3 - 6 p.m. (w/refresh. until 4 p.m.) **Session includes:** Technical Posters Sponsor Exhibits Organizational/Agency Exhibits Museum Exhibits Art and Photography Exhibits **Open to Public**	**Break with Refreshments - 3:00 pm - 3:30 pm - South Hall**			
		Oral Session 25 Special South Hall B-1 *Mississippi-Mekong Partnership* Moderator: Timothy Sullivan **Open to Public**	**Oral Session 26 Special** South Hall B-4 *Waters of Wisconsin: an Initiative for the Future of Wisconsin's Water* Moderator: Shaili Pfeiffer **Open to Public**	**Oral Session 27 Special** South Hall B-3 *Restoration of Historic River Fronts* Moderator: Jerry Enzler **Open to Public**	**Oral Session 28 Contributed** South Hall B-2 *Customs, Ethics, Perceptions and Public Involvement in River Management*--Part 2 Moderator: Charles Lee **Open to Public**
7:00 pm-8:45 pm	**Performance/Presentation 6** Ballroom *Anthropomorphism, Personification, and Environmentalism in Environmental Arts Workshop* B. Salamun	**Performance/Presentation 7** Board Room B *Native American Storytelling* Joe Campbell Moderator: Beth Cherne			

INTERNATIONAL CONFERENCE ON RIVERS AND CIVILIZATION

Program Overview

WEDNESDAY, June 28

Full-day session; conference adjourns at 5:30 p.m.

TIME					
	Registration Desk Open Main Lobby 7:30 a.m. - 12:00 noon				
7:00 am-8:00 am	**Continental Breakfast 7:00 am - 8:00 am** **Upper Level Foyer**				
8:00 am-8:15 am	**Introductory remarks and conference updates - Ball Room**				
8:15 am-9:45 am	**Oral Session 29 (Plenary)** **Ball Room** Fekri Hassan (University College, London, England): *The Nile and Civilization* Moderator: James Gallagher Robert Howarth (Cornell University, Ithaca, New York): *Human Alteration of the Nitrogen Cycle in Large Watersheds: Causes, Consequences, and Steps Towards Solution* Moderator: William Richardson				
9:45 am-10:15 am	**Break with Refreshments - 9:45 am - 10:15 am - South Hall**				
10:15 am-12 noon	**Oral Session 30 Special** South Hall B-2 *Archeological,* Anthropological, and *and Historical Perspectives* *of the Upper* *Mississippi Valley* Moderator: James Stoltman	**Oral Session 31 Special** South Hall B-3 *Navigation and the* *Environment: Planning for a* *Sustainable UMR System* *with ref. to the Middle Parana* *River of South America* Moderator: Daniel Wilcox	**Oral Session 32 Special** South Hall B-4 *Ecology, Trade, and* *Sustainable Agriculture* *in the Mississippi* *River Basin* Moderator: Mark Muller	**Oral Session 33 Contributed** Board Room B *Water Quality in* *Riverine Systems* Moderator: James Fischer	**Oral Session 34 Contributed** South Hall B-1 *Management, Restoration,* *and Analysis* *of Large Rivers* Moderator: Brian Ickes
12 noon-1:30 pm	**Lunch with Featured Speaker - 12:00 noon - 1:30 pm - Arena** **Oral Session 35 (Plenary)** Michael Tidwell: *Life after Katrina: Allowing the Mississippi River to "Flood" Again is the Only Way to Save New Orleans* Moderator: Susan Crutchfield				
1:30 pm-3:15 pm	**Oral Session 36 Special** South Hall B-3 *Lessons from the Deep* *History & Recent History* *of the Missouri, Illinois, and* *Mississippi Rivers*- Part 1 Moderators: Richard Sparks and Jane Buikstra	**Oral Session 37 Special** South Hall B-4 *Bioassessment &* *Monitoring of* *Non-Wadeable Streams* *and Rivers* - Part 1 Moderator: Joseph Flotemersch	**Oral Session 38 Special** South Hall B-1 *Illinois River Restoration:* *Concepts, Background, and* *Specific Examples* Moderator: Mike Demissie	**Oral Session 39 Contributed** South Hall B-2 *Cultural, Literary, and* *Historical Interpretations* *of Rivers* Moderator: Anita Evans	**Oral Session 40 Contributed** Board Room B *Water Quality: Ecological* *and Health Risks* Moderator: Kristofer Rolfhus
3:15 pm-3:45 pm	**Break with Refreshments - 3:15 pm - 3:45 pm - South Hall**				
3:45 pm-5:30 pm	**Oral Session 41 Special** South Hall B-3 *Lessons from the Deep* *History & Recent History* *of the Missouri, Illinois, and* *Mississippi Rivers*- Part 2 Moderators: Jane Buikstra and Richard Sparks	**Oral Session 42 Special** South Hall B-4 *Bioassessment &* *Monitoring of* *Non-Wadeable Streams* and Rivers - Part 2 Moderator: Joseph Flotemersch	**Oral Session 43 Contributed** South Hall B-1 *Rivers in Mythology, Religion* *and the Ancient World* Moderator: William Gresens		
5:30 p.m.	**CONFERENCE ADJOURNS (except for post-conference tour/field trip)**				

INTERNATIONAL CONFERENCE ON RIVERS AND CIVILIZATION

Program Overview

Thursday, June 29

Post-Conference Tour

TIME	
7:30 a.m.	**POST-CONFERENCE TOUR**
	Large River Management II: Navigation Pool 8, Upper Mississippi River
7:00 am-8:00 am	*Bus picks up participants from Radisson Hotel parking lot at 7:30 a.m. Travel to Stoddard Boat Landing in Stoddard, Wisconsin
8:00 am-8:30 am	10-25 participants plus 5 crew
8:30 am-10:00 am	Lunch, snacks, and water provided
	*Bus picks up participants at Genoa Fish Hatchery in Genoa, Wisconsin, at 2:30 p.m and returns to La Crosse with a narrated trip back to La Crosse. Arrival at Radisson Hotel in La Crosse at approximately 5 p.m.
10:00 am-10:30 am	Tour is guided by personnel from the Wisconsin Department of Natural Resources U.S. Fish and Wildlife Service U.S. Army Corps of Engineers
10:30 am-12:15 pm	

Sunday/Monday

Sunday, June 25, 2006

12-6:30 p.m. **Registration Desk Open**
Main Lobby

8:30 a.m.-12 p.m. **Tour: Indian Mounds, Rock Art, and the Fur Trade: A View from Trempealeau Mountain, Perrot State Park**
Van/bus pick up at the La Crosse Center
Snack and Water provided
Tour guided by the UW-L Mississippi Valley Archeology Center

12:45-4 p.m. **Tour: Large River Monitoring**
Van/bus pick up at the La Crosse Center
Snack and Water provided
Tour guided by personnel from the Wisconsin, Minnesota, and Iowa Departments of Natural Resources, Long Term Resource Monitoring Program, and U.S. Geological Survey

5:15-6:45 p.m. **Opening Reception**
Upper Level Foyer
Hors d'oeurves buffet

6:15 p.m. **Performance/Presentation Session 1 (PF 6)**
Ballroom
Kanopy Dance Company Performance
Along Those Shores, Astir with Life and Motion...Heavily was [the River] Breathing—An Invocation Through Dance

7-9 p.m. *Arena*

Welcome and Introductory Remarks
Including Introduction of Previous Conference Hosts
(Dubna University, Dubna, Russia and Assiut University, Assiut Egypt)

Cora Marrett, University of Wisconsin System

Keynote Address
Why the World Runs on Water

Jared Diamond
Pulitizer Prize Winning Author and Professor, University of California at Los Angeles

Monday, June 26, 2006

7 a.m.-6:30 p.m. **Registration Desk Open**
Main Lobby

7-8 a.m. **Continental Breakfast**
Upper Level Foyer

8-8:30 a.m. **Welcome and Opening Remarks**
Ballroom
Elizabeth Hitch, Chancellor, University of Wisconsin-La Crosse
U.S. Representative Ron Kind, La Crosse, Wisconsin
Jerry Enzler, National Mississippi River Museum & Aquarium

8:30-10 a.m. **Oral Session 1 (Plenary)**
Ballroom
Keynote Speaker: **David Dudgeon, University of Hong Kong, China**
Conservation of Riverine Biodiversity in the Human-Dominated Landscapes of Monsoonal Asia. ***(O-029)***
Moderator: Roger Haro, University of Wisconsin–La Crosse

Keynote Speaker: **Donna Mergler, University of Quebec at Montreal, Canada**
An Ecosystem Approach to Mercury and Health in the Amazon Basin. ***(O-092)***
Moderator: James Wiener, University of Wisconsin-La Crosse

10-10:30 a.m. **Break with Refreshments**
Upper Level Foyer

10:30 a.m.-12:15 p.m. **Oral Session 2 (Plenary)**
Ballroom
Mark Cioc, University of California-Santa Cruz
Meredith McKittrick, Georgetown University
Donald Worster, University of Kansas
Dorothy Zeisler-Vralstad, University of Eastern Washington
Historical Development of World Rivers (German Historical Institute) ***(O-016)***
Moderator: Christof Mauch, German Historical Institute

12:15-3:15 p.m. **Lunch with Featured Speaker: Oral Session 3 (Plenary)**
Arena
Featured Speaker: **Douglas Brinkley, Tulane University**
The Great Deluge: Hurricane Katrina, New Orleans, and the Mississippi Gulf Coast ***(O-016)***
Moderator: Teri Hawks Goodmann, National Mississippi River Museum & Aquarium

1:45-3:15 p.m. **Oral Session 4 (Special)**
South Hall B-3
Civilizing the Mississippi: River Engineering and Its Consequences-Part 1
Moderator: Robert Meade, U.S. Geological Survey

1:45 p.m. *Engineering the Mississippi: An Introductory Overview* ***(O-090)***
Meade, Rober H., U.S. Geologial Survey, Denver, Colorado, USA

2:15 p.m. *Fish Tales of the Past, Present, and Future of the Upper Mississippi River Ecosystem.* ***(O-049)***
Gutreuter Steve, U.S. Geological Survey, La Crosse, Wisconsin, USA

2:45 p.m. *An Empirical Multivariate Model of Flood Response to River-System Engineering.* ***(O-106a)***
Pinter, Nicholas, Abebe Andualem Jemberie, Jonathan W.F. Remo, Southern Illinois University, Carbondale, Illinois, USA, Reuben Heine, Augustana College, Rock Island, Illinois, USA

Part 2 Begins at 3:45 p.m.

1:45-3:15 p.m. Oral Session 5 (Special)

South Hall B-2
Environmental Education: Models and Partnerships for the Future-Part I
Moderator: Randy Hines, U.S. Geological Survey

1:45 p.m. *Call to Order.* Randy Hines, Moderator

1:50 p.m. *Environmental Education at U.S. Environmental Protection Agency.* ***(O-043)***
Gavin, Megan, U.S. Environmental Protection Agency, Chicago, Illinois, USA

2:10 p.m. *U.S. Geological Survey, Upper Midwest Environmental Sciences Center Communication Program as a Model for Environmental Education.* ***(O-054)***
Hines, Randy K., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

2:30 p.m. *National Mississippi River Museum and Aquarium.* ***(O-138)***
Wagner, Mark, The National Mississippi River Museum and Aquarium, Dubuque, Iowa, USA

2:50 p.m. *Taking Research on the Road: Modeling the Effects of Dam Removal on the Elwha River.* ***(O-019)***
Campbell, Karen M., National Center for Earth-surface Dynamics, Minneapolis, Minnesota, USA, Travis O. Sandland, Science Museum of Minnesota, St. Paul, Minnesota, USA

Part 2 Begins at 3:45 p.m.

1:45-3:15 p.m. Oral Session 6 (Special)

South Hall B-4
Ecology, Conservation, and Biodiversity-Part 1
Moderator: Melinda Knutson, U.S. Fish and Wildlife Service

1:45 p.m. *Call to Order.* Melinda Knutson, Moderator

1:50 p.m. *Predicting Global Losses of Freshwater Fish Resulting from River Channel Fragmentation and Flow Regulation.* ***(O-114)***
Reidy, Catherine A., Christer, Nilsson, Landscape Ecology Group, Department of Ecology and Environmental Science Umeå University, Umeå, Sweden

2:10 p.m. *Development of Landscape Models for Protection and Restoration of Freshwater Mussels in Large Rivers.* ***(O-099)***
Newton, Teresa J., Michelle R. Bartsch, Jennie S. Sauer, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Jeff J. Steuer, U.S. Geological Survey, Wisconsin Water Science Center, Middleton, Wisconsin, USA, Steve J. Zigler, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

2:30 p.m. *Longterm Changes in a Mussel Community in Pool 29, Upper Mississippi River.* ***(O-004)***
Anderson, Richard V., Michael A. Romano, Western Illinois University, Macomb, Illinois, USA

2:50 p.m. *Exploitation of Freshwater Snakes from Tonle Sap, Cambodia.* ***(O-065)***
Karns, Daryl R., Rivers Institute, Hanover College, Hanover, Indiana, USA Voris, Harold K., John C. Murphy, Field Museum of Natural History, Chicago, Illinois, USA

Part 2 Begins at 3:45 p.m.

1:45-3:15 p.m. Oral Session 7 (Contributed)

South Hall B-1
Human Interactions with Rivers at the Basin Scale-Part I
Moderator: Cynthia Berlin, University of Wisconsin – La Crosse

1:45 p.m. *Call to Order.* Cynthia Berlin, Moderator

1:50 p.m. *The Assessment of Human Influences on Riverine Ecosystem: The Case of the Niger River Basin of West Africa.* ***(O-091)***
Merem, Edmund C., Jackson State University, Jackson, Mississippi, USA

2:10 p.m. *The Metamorphosis of European Alpine Riverine Landscapes During the 19th Century: From Wild Braided Rivers to Fruitful Plains.* ***(O-045)***
Girel, Jacky M., University Joseph Fourier & C.N.R.S., Grenoble, France

2:30 p.m. *Watersheds as Units of Analysis and Planning for Local Sustainable Economic Development: Do They Make Any Sense?* ***(O-129)***
Taylor, Davis F., College of the Atlantic, Bar Harbor, Maine, USA, Eric R. Dodge, Rivers Institute at Hanover College, Hanover, Indiana, USA

2:50 p.m. *Harnessing River Power: Irrigation, Gender, Social Continuity, and Social Change in South Pare, Tanzania.* ***(O-109)***
Porter, Karen A., Hanover College, Hanover, Indiana, USA

Part 2 Begins at 3:45 p.m.

1:45-3:15 p.m. Oral Session 8 (Special)

Board Room B
Connecting Lives and Literature: Rivers, a Moving Sense of Place
Moderator: Jerry Enzler, National Mississippi River Museum & Aquarium

1:45 p.m. *Call to Order.* Jerry Enzler, Moderator

1:50 p.m. *Reading the River.* ***(O-033)***
Fischer, Katherine M., Clarke College, Dubuque, Iowa; Jane Varley, Muskingum College, New Concord, Ohio, USA

2:10 p.m. *Dreaming the Mississippi.* ***(O-032)***
Fischer, Katherine M., Clarke College, Dubuque, Iowa, USA

2:25 p.m. *Rivers Rising: The Mississippi and Beyond.* ***(O-136)***
Varley, Jane, Muskingum College, New Concord, Ohio, USA

3:15-3:45 p.m. Break with Refreshments

South Hall

3:45-5:30 p.m. Oral Session 9 (Special)

South Hall B-3
Civilizing the Mississippi: River Engineering and Its Consequences-Part 2
Moderator: Steve Gutreuter, U.S. Geological Survey

3:45 p.m. *Re-engineering the Missouri River: Integrating Sound Science into River Rehabilitation.* ***(O-041)***
Galat, David L., Robert B. Jacobson, U.S. Geological Survey, Columbia, Missouri, USA

4:15 p.m. *The Lower Mississippi as a Technological System: The Engineering Challenges.* ***(O-117)***
Reuss, Martin A., U.S. Army Corps of Engineers (retired), 2911 Seminole Rd., Woodbridge, Virginia, USA

4:45 p.m. *Panel Discussion with Speakers*

3:45-5:30 p.m. Oral Session 10 (Special)

South Hall B-2
Environmental Education: Models and Partnerships for the Future-Part 2
Moderator: Randy Hines, U.S. Geological Survey

3:45 p.m. *Rivers of Life.* ***(O-073)***
Peggy Knapp, Center for Global Environmental Education, Hamline University, St. Paul, Minnesota, USA

4:05 p.m. *The River Studies Center: Partnerships in Science Research and Education.* ***(O-119)***
Sandheinrich, Mark B., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

4:25 p.m. *University on the River: A Model for Interdisciplinary Undergraduate Education.* ***(O-055)***
Hokanson, Drake, Darrell Downs, Winona State University, Winona, Minnesota, USA

4:45 p.m. *The National Great Rivers Research and Education Center: A Confluence of Partners.* ***(O-103)***
Pascoe, Jessica A., National Great Rivers Research and Education Center, Godfrey, Illinois, USA

5:05 p.m. *Rivers Institute at Hanover College: A Liberal Arts Approach to Environmental Education.* ***(O-028)***
Dodge, Molly, Rivers Institute at Hanover College, Hanover, Indiana, USA

3:45-5:30 p.m. Oral Session 11 (Contributed)

South Hall B-4
Ecology, Conservation, and Biodiversity-Part 2
Moderator: Steven Zigler, U.S. Geological Survey

3:45 p.m. *Call to Order.* Steven Zigler, Moderator

3:50 p.m. *River Systems and the Origin of Biodiversity in Southeast Asia.* ***(O-137)***
Voris, Harold K., Field Museum of Natural History, Chicago, Illinois, USA, Daryl R. Karns, Rivers Institute, Hanover College, Hanover, Indiana, USA

4:10 p.m. *Spatial and Temporal Patterns of Species Richness in a Riparian Landscape.* ***(O-116)***
Renöfält, Birgitta, M., Christer Nilsson, Roland Jansson, Umeå University, Umeå, Sweden

4:30 p.m. *Conservation of Upper Mississippi River Floodplain Forests: Threats and Action.* ***(O-072)***
Kirsch, Eileen M., Yao Yin, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Randall R. Urich, U.S. Army Corps of Engineers, La Crescent, Minnesota, USA, Gary V. Swenson, U.S. Army Corps of Engineers, Le Claire, Iowa, USA, John B. Cannon, U.S. Army Corps of Engineers, West Alton, Illinois, USA

4:50 p.m. *An Evaluation of a Structural Method Versus a Non-Structural Method Applied to Restore Aquatic Vegetation in Pool 8 of the Upper Mississippi River.* ***(O-146)***
Yin, Yao, U.S. Geological Survey, La Crosse, Wisconsin, USA

5:10 p.m. *Quantitative Characteristics of Transformation of Biosphere to the Noobiosphere: Changes in the Hydrosphere.* ***(O-068)***
Khodakovsky, Igor L., Dubna University, Dubna, Moscow Region, Russia

3:45-5:30 p.m. Oral Session 12 (Contributed)

South Hall B-1
Human Interactions with Rivers at the Basin Scale-Part 2
Moderator: Cynthia Berlin, University of Wisconsin-La Crosse

3:45 p.m. *Call to Order.* Cynthia Berlin, Moderator

3:50 p.m. *Impacts of Channel Relocation at Road Crossings on Channel Morphology and Sediment Transport Processes in Southern Minnesota Rivers.* ***(O-082)***
Lenhart, Christian F., University of Minnesota, Water Resources Science Program, St. Paul, Minnesota, USA, Joseph A. Magner, University of Minnesota, Department of Forest Resources, and Minnesota Pollution Control Agency, St. Paul, Minnesota, USA, Kenneth N. Brooks, University of Minnesota, Department of Forest Resources, St. Paul, Minnesota, USA

4:10 p.m. *Our Missouri River - A Great River Once... A Great River Again?* ***(O-084)***
Maas, Marian, Nebraska Wildlife Federation, Bellevue, Nebraska, USA

4:30 p.m. *Using Geographic Information Systems to Describe Livelihood Status in River Basins.* ***(O-007)***
Arvin, Shelley, Philip Nunoo, Rivers Institute at Hanover College, Hanover, Indiana USA, Pete Worcester, Geology Department, Hanover College, Hanover, Indiana, USA, Dennis Wichelns, Rivers Institute at Hanover College, Hanover, Indiana, USA

4:50 p.m. *Implications of Amazon Basin Land Use/Land Cover Change for Aquatic Ecosystem Biogeography and Associated Riverine CO_2 Fluxes of Amazonia.* ***(O-058)***
Howard, Erica A., Center for Sustainability and the Global Environment, University of Wisconsin-Madison, Madison, Wisconsin, USA, Michael T. Coe, Woods Hole Research Center, Woods Hole, Massachusetts, USA, Jonathan A. Foley, Center for Sustainability and the Global Environment, University of Wisconsin-Madison, Madison, Wisconsin, USA, Marcos Heil Costa, Federal University of Vicosa, Vicosa, Minas Gerais, Brazil

5:10 p.m. *The Development of the Natural Resources on the Nile River Basin and Their Environmental Impact.* ***(O-121)***
Soliman, Hassan, Abdel Hamed, Assiut University, Assiut, Egypt

3:45-9 p.m. Performance/Presentation

3:45-5:30 p.m. *Choreographic Presentation on the Science of Water Flow:* ***Session 2 (PF 3)***
Pump House Regional Arts Center (119 King Street)
Presenter: **Gretchen Cohenour,** Department of Theatre and Dance, Winona State University, Winona, Minnesota, USA
Moderator: Beth Cherne, University of Wisconsin-La Crosse

3:45-5:30 p.m. *Narrated Photography Exhibit: Rivers of the Upper Midwest, A Survey of River Environs of the Region:* ***Session 3 (PF 5)***
Pump House Regional Arts Center (119 King Street)
Presenter: **Christopher Faust**, St. Paul, Minnesota, USA
Moderator: Beth Cherne, University of Wisconsin–La Crosse

3:45-5:30 p.m. *Narrated Painting Exhibit: Landscapes of Russian Rivers:* ***Session 4 (PF 2)***
Pump House Regional Arts Center (119 King Street)
Presenter: **Gevork Chubaryan**, New York, New York, USA
Moderator: Beth Cherne, University of Wisconsin–La Crosse

7:30-9 p.m. *International Friendship Concert: Dubna Trio and La Crosse Musicians*
Pump House Regional Arts Center (119 King Street)
Presenters: **Busya Lugovier,** Viterbo University, **Irina Oganessian**, Dubna (Russia) Music School, **Karina Oganesyan**, Moscow (Russia) Gnesin Academy of Music, **Damian Mead**, Viterbo University
Moderator: Beth Cherne, University of Wisconsin–La Crosse
(*Limited seating: first come bases. Inquire about ticket availability at conference registration desk.)*

5:30-7:30 p.m. **Poster and Exhibit Session 1**
South Hall A
Hors d'oeurves buffet and cash bar
(*Display of posters and most exhibits will be repeated on Tuesday, June 27, 3-6 p.m.)*

Themes

Cultural, Artistic, Literary, and Historical Interpretations of Rivers
Human Interactions with Rivers
Water Quality in River Systems
Management, Restoration, and Analysis of Large Rivers
Geology, Hydrology, Climate, and Sediment Transport in Rivers
Ecology, Conservation, and Biodiversity
Education
Artist, Museum, and Organization Exhibits

Tuesday

Tuesday, June 27, 2006

7 a.m.-4:30 p.m. **Registration Desk Open**
Main Lobby

7-8 a.m. **Continental Breakfast**
Upper Level Foyer

8-8:15 a.m. **Introductory Remarks and Conference Updates**
Ballroom

8:15-9:45 a.m. **Oral Session 13 (Plenary)**
Ballroom
Keynote Speaker: **Christer Nilsson**, Umeå University, Sweden
Landscape Ecology of Large Rivers: Human Modifications and Management of Floodplains and Watersheds ***(O-100)***
Moderator: Barry Johnson, U.S. Geological Survey

Keynote Speaker: **Karlyn Eckman**, University of Minnesota, USA
Assessing Human Vulnerability in Major River Systems ***(O-030)***
Moderator: Mark Sandheinrich, University of Wisconsin–La Crosse

9:45-10:15 a.m. **Break with Refreshments**
South Hall

10:15-11:45 a.m. **Oral Session 14 (Special)**
South Hall B-3
Ecosystem Services Provided by Major Rivers: Concepts, Measures, and Applications-Part 1
Moderator: N. LeRoy Poff, Colorado State University

10:15 a.m. *Call to Order.* N. LeRoy Poff, Moderator

10:20 a.m. *Global Consequences of Land Use: Connecting Issues, Connecting Scales.* ***(O-035)***
Foley, Jonathan, University of Wisconsin-Madison, Madison, Wisconsin, USA

10:45 a.m. *Eco-zoning and Evaluation on Eco-function of Yangtze River in China.* ***(O-042)***
Gao, Jixi, Chinese Research Academy of Environmental Sciences, Beijing, China, Xianghao Zhong, Chinese Academy of Sciences, Chengdu, China, De Su, Chinese Research Academy of Environmental Sciences, Beijing, China

11:10 a.m. *The "Water Provider Program": A Financial Compensation Project for Erosion and Sedimentation Abatement in Rural Watersheds.* ***(O-021)***
Chaves, Henrique ML, School of Technology, University of Brasilia, Brasilia, Brazil

Part 2 Begins at 1:15 p.m.

10:15-11:45 a.m. **Oral Session 15 (Special)**
South Hall B-1
Historical and Contemporary Development and Use of the Upper Mississippi River
Moderator: Brian Aldrich, Winona State University

10:15 a.m. *Call to Order.* Brian Aldrich, Moderator

10:20 a.m. *Development of the Mississippi River: 600 Million Years B.P. Through 1860 A.D.* ***(O-038)***
Fremling, Calvin R. (emeritus), Winona State University, Winona, Minnesota, USA

10:40 a.m. *The Origins of the Modern Mississippi.* ***(O-005)***
Anfinson, John O., National Park Service/MNRRA, St. Paul, Minnesota, USA

11 a.m. *A River that Works and a Working River.* ***(O-088)***
McGuiness, Daniel W., Upper Mississippi River Campaign, National Audubon Society, St. Paul, Minnesota, USA

11:20 a.m. *Tenuous Coexistence: Managing a National Wildlife Refuge on a Multiple-use River.* ***(O-060)***
Hultman, Donald G., U.S. Fish and Wildlife Service, Winona, Minnesota, USA

10:15-11:45 a.m. Oral Session 16 (Special)

South Hall B-4
Historical Ecology: Reconstructing the Past to Guide the Future-Part 1
Moderator: Robert Fuerstenberger, King County Department of Natural Resources and Parks

10:15 a.m. *Call to Order.* Robert Fuerstenberger, Moderator

10:20 a.m. *Historical Ecology and the Recovery of Endangered Salmon in Puget Sound, Washington, USA.* ***(O-040)***
Fuerstenberg, Robert R., King County Department of Natural Resources and Parks, Seattle, Washington, USA, Christopher P. Konrad, U.S. Geological Survey, Tacoma, Washington, USA, Terry Butler, Karen Bergeron, Gino Lucchetti, King County Department of Natural Resources and Parks, Seattle, Washington, USA

10:40 a.m. *Reconstructing the Late Holocene Geo-ecology of Puget Sound's Riverine Landscapes to Guide Their Restoration and Management.* ***(O-023)***
Collins, Brian D., David R. Montgomery, University of Washington, Seattle, Washington, USA

11 a.m. *Reconstructing Riverine Landscapes at 100 and 10,000 Year Time Scales.* ***(O-010)***
Beechie, Timothy J., George R. Pess, NOAA Fisheries, Seattle, Washington, USA

11:20 a.m. *Reconstructing Geomorphic Processes from Channel Form.* ***(O-075)***
Konrad, Christopher P., U.S. Geological Survey, Tacoma, Washington, USA

Part 2 Begins at 1:15 p.m.

10:15-11:45 a.m. Oral Session 17 (Contributed)

Board Room B
Rivers as Borders: Transnational Perspectives
Moderator: Harun Rashid, University of Wisconsin–La Crosse

10:15 a.m. *Call to Order.* Harun Rashid, Moderator

10:20 a.m. *The Blue and White Nile and Egyptian Claims: Revisiting the Use of Nile Waters and Colonial Agreements.* ***(O-003)***
Amutabi, Maurice N., Central Washington University, Ellensburg, Washington, USA

10:40 a.m. *Borders Remade as Arteries: The Place of the River in Chicano and Quebecois Poetry.* ***(O-022)***
Cocola, Jim, University of Virginia, Charlottesville, Virginia, USA

11 a.m. *The Tijuana River and the Problem of Border Environmentalism, 1940s-1970s.* ***(O-079)***
Lanpher, Daniel, Yale University, New Haven, Connecticut, USA

11:20 a.m. *Downstream Livelihoods Depend on Upstream in the Context of Bangladesh.* ***(O-001)***
Al-Amin, Mohammad, Progress, Dhaka, Banglades

10:15-11:45 a.m. Oral Session 18 (Contributed)

South Hall B-2
Hydrology, Climate, and Sediment Transport in Rivers
Moderator: Randy Hunt, U.S. Geological Survey

10:15 a.m. *Call to Order.* Randy Hunt, Moderator

10:20 a.m. *Retro Modeling of the Middle Mississippi River.* ***(O-115)***
Remo, Jonathan, W., Environmental Resource Policy Program, Southern Illinois University, Carbondale, Illinois, USA, Nicholas Pinter, Department of Geology, Southern Illinois University, Carbondale, Illinois, USA

10:40 a.m. *Modeling the History of the Great Rivers of the World.* ***(O-018)***
Bryson, Reid A., Katherine McEnaney, Anthony Ruter, University of Wisconsin-Madison, Madison, Wisconsin, USA

11 a.m. *Controls and Long-Term Geomorphic Effects of Slope-to-Channel Fluxes – A Case Study from the Rhine Basin (Central Germany).* ***(O-145)***
Wunderlich, Juergen, Peter Houben, Michael Schmidt, J. W. Goethe-University, Frankfurt am Main, Germany

11:20 a.m. *Rivers of Uzbekistan Under the Impact of Irrigated Agriculture.* ***(O-077)***
Kurbanov, Rukhulla B., Gulnara M. Rakhmatullayeva, State Research Center for Fish Development, Tashkent, Uzbekistan

11:45 a.m.-1:15 p.m. Lunch with Featured Speaker: Oral Session 19 (Plenary)

Arena
Featured Speaker: **John Wiens**, The Nature Conservancy
Great Rivers as Great Integrators: Linking Land with Water, People with Conservation ***(O-143)***
Moderator: Vince Shay, The Nature Conservancy

1:15-3 p.m. Oral Session 20 (Special)

South Hall B-3
Ecosystem Services Provided by Major Rivers: Concepts, Measures, and Applications-Part 2
Moderator: N. LeRoy Poff, Colorado State University

1:15 p.m. *Call to Order.* N. LeRoy Poff, Moderator

1:20 p.m. *Spatial Distribution of Ecosystem Services Within Large River Basins.* ***(O-140)***
West, Paul C., The Nature Conservancy and University of Wisconsin-Madison, Madison, Wisconsin, USA, Jonathan A. Foley, Chris Kucharik, Carol Barford, University of Wisconsin-Madison, Madison, Wisconsin, USA

1:45 p.m. *The Murray-Darling Basin's Living Murray Initiative: Ecosystem Services Management in Practice.* ***(O-120)***
Siebentritt, Mark A., Tony McLeod, Murray-Darling Basin Commission, Canberra, Australian Capital Territory, Australia

2:10 p.m. *Threats to Ecosystem Services: The Case of the Middle Zambezi and Lower Reaches of the Luangwa River Systems in Southern Africa.* ***(O-086)***
Mandima, Jimmiel J., African Wildlife Foundation, Kariba, Zimbabwe

2:35 p.m. *Valuing Ecosystem Services.* ***(O-107)*** Polasky, Stephen, University of Minnesota, St. Paul, Minnesota, USA

1:15-3 p.m. Oral Session 21 (Special)

Board Room B
John Wesley Powell and the Colorado River Dream
Moderator: Anders C. Dahlgren, Library Planning Associates, Inc.

1:15 p.m. *Call to Order.* Anders C. Dahlgren, Moderator

1:20 p.m. *John Wesley Powell and the Popular Press.* ***(O-132)***
Thomas, Marcia L., University of Wisconsin-Baraboo/Sauk County, Baraboo, Wisconsin, USA

1:50 p.m. *John Wesley Powell's Cartography of the Colorado River System.* ***(O-112)***
Quartaroli, Richard D., Northern Arizona University, Flagstaff, Arizona, USA

1:50 p.m. *Selected Prose of John Wesley Powell.* ***(O-111)***
Powell, John Wesley, Arlington National Cemetery, Arlington, Virginia, USA

2:20 p.m. *John Wesley Powell: A Dream Unrealized for the Colorado River.* ***(O-139)***
Wegner, David L., Ecosystem Management International, Inc., Durango, Colorado, USA

1:15-3 p.m. Oral Session 22 (Special)

South Hall B-4
Historical Ecology: Reconstructing the Past to Guide the Future-Part 2
Moderator: Robert Fuerstenberger, King County Department of Natural Resources and Parks

1:15 p.m. *Call to Order.* Robert Fuerstenberger, Moderator

1:20 p.m. *Reconstructing a Semi-arid Riverine Landscape with Historical Surveys, Stratigraphic Evidence, and Process Studies.* ***(O-108)***
Pollock, Michael M., Timothy J. Beechie, NOAA Fisheries, Seattle, Washington, USA

1:40 p.m. *Reconstructing River History as a Guide to Restoring Riverine Wetlands in the Rio Grande Basin.* ***(O-020)***
Cassin, Jan L., Parametrix, Inc., Seattle, Washington, USA

2 p.m. *Glacial Floods to Reservoirs - Historical Changes in the Columbia River.* ***(O-105)***
Petersen, Jim, U.S. Geological Survey Western Fisheries Research Center, Vancouver, Washington, USA

2:30 p.m. *Panel Discussion* with Christopher P. Konrad, U.S. Geological Survey

1:15-3 p.m. Oral Session 23 (Special)

South Hall B-1
Ecosystem Restoration on the Ume River (Sweden) and the Mississippi River (USA)
Moderator: Scott Yess, U.S. Fish and Wildlife Service

1:15 p.m. *Call to Order.* Scott Yess, Moderator

1:20 p.m. *Effects of River Restoration on Biodiversity in Riparian Plant Communities.* ***(O-052)***
Helfield, James M., Western Washington University, Bellingham, Washington, USA, Samantha J. Capon, Monash University, Clayton, Victoria, Australia, Christer Nilsson, Jansson Roland, Umeå University, Umeå, Sweden, Daniel Palm, Swedish University of Agricultural Sciences, Umeå, Sweden

1:40 p.m. *Conservation—the Other Economy* ***(O-025a)***
Delaney, Robert L., U.S. Geological Survey, U.S. Fish and Wildlife Service, and Lower Mississippi River Conservation Committee, Vicksburg, Mississippi, USA, Angela Moore, Ron Nassar, Lower Mississippi River Conservation Committee, Vicksburg, Mississippi, USA

2 p.m. *Environmental Guidelines for Dike Notching.* ***(O-070)*** Killgore, Jack, Jan Hoover, Steve Ellis, James Gutshall, Sandra Brewer, U. S. Army Corps of Engineers Mississippi Valley Division, Vicksburg, Mississippi, USA

2:20 p.m. *Ecosystem Restoration: Projects, Lessons Learned, Criteria.* ***(O-053)***
Hendrickson, Jon, S., Donald L. Powell, U.S. Army Corps of Engineers, St. Paul, Minnesota, USA

2:40 p.m. *A Glimpse at Environmental Responses to 20 Years of Upper Mississippi River Habitat Restoration Through Environmental Management Program.* ***(O-062)***
Janvrin, Jeffrey A., Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

1:15-3 p.m. Oral Session 24 (Contributed)

South Hall B-2
Customs, Ethics, Perceptions and Public Involvement in River Management–Part 1
Moderator: Gretchen Benjamin, Wisconsin Department of Natural Resources

1:15 p.m. *Call to Order.* Gretchen Benjamin, Moderator

1:20 p.m. *The Dangers of Marginalizing Women in the Management of Water Sources: Some Lessons from Tanzania.* ***(O-128)***
Swai, Elinami V., Penn State University, State College, Pennsylvania, USA

1:40 p.m. *Can There Be a Water Ethic?: Aldo Leopold and the Bluing of Ethics.* ***(O-097)***
Nelson, Michael P., University of Idaho, Moscow, Idaho, USA

2 p.m. *A River with a Regional Identity: The Isar in Bavaria, 1880-1930.* ***(O-148)***
Zeller, Thomas, University of Maryland/German Historical Institute, College Park, Maryland, USA

2:20 p.m. *Yellow River Initiative, Iowa, USA: Setting the Stage for Watershed Resource Sustainability. (****O-122)***
Sowl, John H., Natural Resources Stewardship and Science, National Park Service, Omaha, Nebraska, USA, Jessica A. Bolwahn, Denise L. Boudreau, Effigy Mounds National Monument, Harpers Ferry, National Park Service, Iowa, USA, Arthur S. Hawkins, Upper Mississippi River National Wildlife and Fish Refuge, U.S. Fish and Wildlife Service, Winona, Minnesota, USA, Rodney D. Rovang, Effigy Mounds National Monument, National Park Service, Harpers Ferry, Iowa, USA

2:40 p.m. *The Selenge River: Source of the Sacred Waters of Lake Baikal.* ***(O-017)***
Brummond, Janice K., University of Michigan, Ann Arbor, Michigan, USA

Part 2 Begins at 3:30 p.m.

3-3:30 p.m. Break with Refreshments

South Hall

3:30-5:15 p.m. Oral Session 25 (Special)

South Hall B-1
Sullivan, Timothy, Mississippi River Institute for Global Cooperation, Red Wing, Minnesota, USA, Jim Anderson, Water Resources Center, University of Minnesota, Saint Paul, Minnesota, USA
The Mississippi-Mekong Partnership: A Model of Global Cooperation ***(O-127)***
Moderator: Timothy Sullivan, Mississippi River Institute for Global Cooperation

3:30-5:15 p.m. Oral Session 26 (Special)

South Hall B-4
Waters Of Wisconsin: An Initiative for the Future of Wisconsin's Water
Moderator: Shaili Pfeiffer, Wisconsin Department of Natural Resources

3:30 p.m. *Call to Order.* Shaili Pfeiffer, Moderator

3:35 p.m. *Waters of Wisconsin - An Initiative for the Future of Wisconsin's Waters.* ***(O-125)***
Strigel, Michael, J., Wisconsin Academy of Sciences, Arts and Letters, Madison, Wisconsin, USA

3:55 p.m. *Three Years Later – The Impact of Waters of Wisconsin.* ***(O-002)***
Ambs, Todd, Shaili Pfeiffer, Wisconsin Department of Natural Resources, Madison, Wisconsin, USA

4:15 p.m. *New Directions in Wisconsin Water Policy: The Impacts of Waters of Wisconsin.* ***(O-037)***
Frank, Nancy, University of Wisconsin - Milwaukee, Milwaukee, Wisconsin, USA

4:35 p.m. *Discussion*

3:30-5:15 p.m. Oral Session 27 (Special)

South Hall B-3
Restoration of Historic River Fronts
Moderator: Jerry Enzler, National Mississippi River Museum & Aquarium

3:30 p.m. *Call to Order.* Jerry Enzler, Moderator

3:35 p.m. *America's River Development at the Port of Dubuque.* ***(O-031)***
Enzler, Jerry A., Teri Hawks Goodmann, National Mississippi River Museum & Aquarium, Dubuque, Iowa, USA

4:05 p.m. *La Crosse's Revitalization and Riverfront Restoration.* ***(O-071)***
Kirch, Lawrence J., City of La Crosse, La Crosse, Wisconsin, USA

4:35 p.m. *Discussion*

3:30-5:15 p.m. Oral Session 28 (Contributed)

South Hall B-2
Customs, Ethics, Perceptions and Public Involvement in River Management–Part 2
Moderator: Charles Lee, University of Wisconsin–La Crosse

3:30 p.m. *Call to Order.* Charles Lee, Moderator

3:35 p.m. *Protecting and Healing Rivers One Watershed At A Time: Secular and Religious Collaborative Programs.* ***(O-144)***
Wilding, Joyce M., Sewanee University of The South, Sewanee, Tennessee, USA

3:55 p.m. *Working in Concert, Working in Concert - Partnerships and Public Involvement from the Perspective of a Mississippi River Practitioner.* ***(O-011)***
Benjamin, Gretchen L., Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

4:15 p.m. *National Trends in Water Trails.* ***(O-135)***
Tornes, Angela, M., National Park Service, Milwaukee, Wisconsin, USA

4:35 p.m. *Floodplain Residents' Choices for Flood Alleviation in Bangladesh and Canada.* ***(O-133)***
Rashid, Harun, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Wolfgang Haider, Simon Fraser University, Burnaby, British Columbia, Canada

4:55 p.m. *Participation of Community and Institutions in River Ecosystem Restoration.* ***(O-076)***
Kulkarni Upendra Dattatraya, SGGS Institute of Engineering and Technology, Nanded, Maharashtra, India

3-3:30 p.m. Break with Refreshments

South Hall

3-6 p.m. Poster and Exhibit Session 2

South Hall A

Themes

Cultural, Artistic, Literary, and Historical Interpretations of Rivers
Human Interactions with Rivers
Water Quality in River Systems
Management, Restoration, and Analysis of Large Rivers
Geology, Hydrology, Climate, and Sediment Transport in Rivers
Ecology, Conservation, and Biodiversity
Education
Artist and Museum Exhibits

7-8:45 p.m. Performance/Presentation

7-8:45 p.m. *Anthropomorphism, Personification and Environmentalism in Environmental Arts: A Viewing and Doing Seminar.* ***Session 6 (PF 7)***
Ballroom
Presenter: **Salamun, Betty A.,** DanceCircus, Milwaukee, Wisconsin, USA
Moderator: Dorothy Zeisler-Vralstad, Eastern Washington University

7-8:45 p.m. *Native American Storytelling****. Session 7 (PF 1)***
Board Room B
Presenter: **Joe Campbell**, Dakota Elder and Cultural Educator, Welch, Minnesota, USA
Moderator: Beth Cherne, University of Wisconsin–La Crosse

Wednesday, June 28, 2006

7 a.m.-12 p.m. **Registration Desk Open**
Main Lobby

7-8 a.m. **Continental Breakfast**
Foyer

8-8:15 a.m. **Introductory Remarks and Conference Updates**
Ballroom

8:15-9:45 a.m. **Oral Session 29 (Plenary)**
Ballroom
Keynote Speaker: **Fekri Hassan**, University College, London, England
*The Nile and Civilization **(O-051)***
Moderator: James Gallagher, University of Wisconsin–La Crosse
Keynote Speaker: **Robert Howarth**, Cornell University, Ithaca, New York, USA
*Human Alternation of the Nitrogen Cycle in Large Watersheds: Causes, Consequences, and Steps Toward Resolution **(O-059)***
Moderator: William Richardson, U.S. Geological Survey

9:45-10:15 a.m. **Break with Refreshments**
South Hall

10:15 a.m.-12 p.m. **Oral Session 30 (Special)**
South Hall B-2
Archeological, Anthropological, and Historical Perspectives of the Upper Mississippi Valley
Moderator: James Stoltman, University of Wisconsin - Madison

10:15 a.m. *Call to Order.* James Stoltman, Moderator

10:20 a.m. *The First Peoples of the Upper Mississippi River Valley. **(O-015)***
Boszhardt, Robert "Ernie", Mississippi Valley Archaeology Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

10:35 a.m. *The Woodland Tradition: Mounds, Pottery Containers, and the Spread of Plant Cultivation in the Upper Mississippi River Valley. **(O-131**)*
Theler, James L., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

10:50 a.m. *The Mississippi Flyway: A St. Louis Perspective on Cultural Interactions between AD 1000 and 1400. **(O-067)***
Kelly, John E., Lucretia S. Kelly, Washington University, St. Louis, Missouri, USA

11:05 a.m. *The Prehistoric Archeological Record of the Upper Mississippi River Valley: When the Past Meets the Present. **(O-012)***
Benn, David W., Bear Creek Archeology, Inc., Cresco, Iowa, USA

11:20 a.m. *Managing the Resource: Problems and Prospects for Archaeological Site Conservation Along the Upper Mississippi River. **(O-104)***
Perkl, Bradley E., U.S. Army Corps of Engineers, St. Paul District, St. Paul, Minnesota, USA

11:35 a.m. *Summary.* James Stoltman, Moderator

10:15 a.m.-12 p.m. Oral Session 31 (Special)

South Hall B-3
Navigation and the Environment: Planning for a Sustainable Upper Mississippi River System with Reference to the Middle Parana River of South America
Moderator: Daniel Wilcox, U.S. Army Corps of Engineers

10:15 a.m. *Call to Order.* Daniel Wilcox, Moderator

10:20 a.m. *Integrated Water Resources Planning for the Upper Mississippi River-Illinois Waterway: A Summary of National Research Council Studies.* ***(O-061)***
Jacobs, Jeffrey W., National Research Council, Washington, D.C., USA

10:45 a.m. *Navigation and the Environment: Recommendations for a Sustainable Upper Mississippi River-Illinois Waterway Navigation System.* ***(O-008)***
Barr, Kenneth A., Corps of Engineers, Rock Island, Illinois, USA

11:10 a.m. *Navigation and the Environment: Ecological Models Used to Assess Risks Posed by Commer cial Navigation to Selected Resources in the Upper Mississippi and Illinois Rivers.* ***(O-009)***
Bartell, Steven E., E2 Consulting Engineers, Inc., Maryville, Tennessee, USA

11:30 a.m. *Integrating Information Across Continents for Improved Ecosystem Management: The Case of the Paraná and Mississippi Systems.* ***(O-098)***
Nestler, John M., Army Engineer Research and Development Center, Vicksburg, Mississippi, USA, Claudio R. M. Baigún, IIB-INTECH, Chascomus, Argentina, Noberto O. Oldani, Instituto de Desarrollo Tecnológico para la Industria Química (INTEC-CERIDE), Santa Fe, Argentina, Carlos Vionnet, Universidad National del Littoral, Santa Fe, Argentina, Larry J. Weber, IIHR Hydroscience and Engineering, University of Iowa, Iowa City, Iowa, USA

10:15 a.m.-12 p.m. Oral Session 32 (Special)

South Hall B-4
Ecology, Trade, and Sustainable Agriculture in the Mississippi River Basin
Moderator: Mark Muller, Institute for Agriculture and Trade Policy

10:15 a.m. *Call to Order.* Mark Muller, Moderator

10:25 a.m. *Introduction to the Mississippi River Basin: From Land to Sea.* ***(O-093)***
Morse, Steve, University of Minnesota, St. Paul, Minnesota, USA, Dennis R. Keeney, Institute for Agriculture and Trade Policy, Minneapolis, Minnesota, USA, Douglas Daigle, , Mississippi River Basin Alliance, New Orleans, Louisiana, USA, R. Eugene Turner, Whitney Broussard, Louisiana State University, Baton Rouge, Louisiana, USA

10:45 a.m. *Upper Midwest U.S. Agriculture: Consequences of Technology and Policy.* ***(O-066)***
Keeney, Dennis, Mark Muller, Institute for Agriculture and Trade Policy, Minneapolis, Minnesota, USA

11:05 a.m. *Developing Perennial-based Agricultural Systems: the Green Lands Blue Waters Model.* ***(O-064)***
Jordan, Nicholas R., University of Minnesota, St. Paul, Minnesota, USA, Steven Manson, Kristen C. Nelson, University of Minnesota, Minneapolis, Minnesota, USA, Steve Morse, University of Minnesota, St. Paul, Minnesota, USA, Jeri Neal, Iowa State University, Ames, Iowa, USA, Don Wyse, University of Minnesota, St. Paul, Minnesota, USA

11:25 a.m. *Finding the Win-Win Solutions: Incorporating Sustainable Agricultural Approaches.* ***(O-094)***
Murray, Helene, University of Minnesota, St. Paul, Minnesota, USA, George Boody, Land Stew-ardship Project, White Bear Lake, Minnesota, USA

10:15 a.m.-12 p.m. Oral Session 33 (Contributed)

Board Room B
Water Quality in Riverine Systems
Moderator: James Fischer, Wisconsin Department of Natural Resources

10:15 a.m. *Call to Order.* James Fischer, Moderator

10:20 a.m. *Patterns of Nitrogen Cycling in the Upper Mississippi River (UMR) and Floodplain.* ***(O-118)***
Richardson, William B., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Eric A. Strauss, Fort Hays State University, Hays, Kansas, USA, Lynn A. Bartsch, Jennifer C. Cavanaugh, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

10:40 a.m. *Nutrients, Chlorophyll, and Suspended Sediment in the Upper Mississippi River: Temporal and Spatial Variability.* ***(O-057)***
Houser, Jeffrey N., Brian R Gray, Jim T. Rogala, U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

11 a.m. *In-stream Nitrogen Loss Due to Denitrification in the Mississippi River from Minneapolis to the Atchafalaya River Diversion.* ***(O-124)***
Strauss, Eric A., Fort Hays State University, Hays, Kansas, USA, William B. Richardson, Lynn A. Bartsch, Jennifer C. Cavanaugh, U.S. Geological Survey, La Crosse, Wisconsin, USA

11:20 a.m. *Innovative Approaches to Improving Water Quality in River Basins.* ***(O-095)***
Nakao, Megumi, University of Tulsa, Tulsa, Oklahoma, USA, Dennis Wichelns, Rivers Institute at Hanover College, Hanover, Indiana, USA

11:40 a.m. *The Riverine Ecosystem Synthesis: a Scaled Model of Biocomplexity in River Networks* ***(O-025b)***
Delong, M.D., Large River Studies Center, Winona State University, Winona, Minnesota, USA, J. H. Thorp, Kansas Biological Survey, University of Kansas, Lawrence, Kansas, USA, M. C. Thoms, Cooperative Research Centre, University of Canberra, Canberra Australia

10:15 a.m.-12 p.m. Oral Session 34 (Contributed)

Board Room 1
Management, Restoration, and Analysis of Large Rivers
Moderator: Brian Ickes, U.S. Geological Survey

10:15 a.m. *Call to Order.* Brian Ickes, Moderator

10:20 a.m. *River Restoration in the Upper Mississippi River Basin: Insights from Project Managers and Practitioners.* ***(O-101)***
O'Donnell, T. Kevin, University of Missouri-Columbia, Columbia, Missouri, USA, David L. Galat, U.S. Geological Survey Cooperative Research Units, University of Missouri-Columbia, Columbia, Missouri, USA

10:40 a.m. *Resource Monitoring on the Upper Mississippi River: Past, Present, and Future.* ***(O-063)***
Johnson, Barry L., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

11 a.m. *Urban Development of Nile Islands and Gulf: Suggested Strategies.* ***(O-085)***
Mahrous, Esam, El-Din, Kamal, Assiut University, Assiut, Egypt

11:20 a.m. *Application of the Concept of Ecosystem Health to Adaptive Management of the Upper Mississippi River.* ***(O-083)***
Lubinski, Kenneth S., The Nature Conservancy, Brownsville, Minnesota, USA, John Barko, U.S. Army Corps of Engineers, Vicksburg, Mississippi, USA, David Galat, U.S. Geological Survey, Columbia, Missouri, USA, John Nestler, U.S. Army Corps of Engineers, Vicksburg, Mississippi, USA, Charles Theiling, U.S. Army Corps of Engineers, Rock Island, Illinois, USA

11:40 a.m. *GIS for the Gulf: A Geographic Reference Database for Hurricane Affected Areas.* ***(O-047)***
Greenlee, David D., U.S. Geological Survey EROS, Sioux Falls, South Dakota, USA

12-1:30 p.m. Lunch with Featured Speaker: Oral Session 35 (Plenary)

Arena
Featured Speaker: **Michael Tidwell,** Author-Filmmaker
Life After Katrina: Allowing the Mississippi River to "Flood" Again Is the Only Way to Save New Orleans ***(O-134)***
Moderator: Susan Crutchfield, University of Wisconsin–La Crosse

1:30-3:15 p.m. Oral Session 36 (Special)

South Hall B-3
Lessons from the Deep History and Recent History of the Missouri, Illinois, and Mississippi Rivers-Part 1
Moderators: Richard Sparks, National Great Rivers Research and Education Center
Jane Buikstra, Center for American Archeology and Arizona State University

1:30 p.m. *Call to Order and Introductions.* Richard Sparks and Jane Buikstra, Moderators

1:45 p.m. *Long-term Human Interactions with the Environment in the Illinois River Valley.* ***(O-126)***
Styles, Bonnie, Illinois State Museum, Springfield, Illinois, USA, Jane Buikstra, Arizona State University, Tempe, Arizona, USA

2:15 p.m. *EuroAmerican Settlement, Increased Sediment Yield to the Illinois River, and a Geomorphic Remediation Solution.* ***(O-050)***
Hajic, Edwin R., Pathfinder CRM LLC, Santa Fe, New Mexico, USA

2:45 p.m. *Floods, Sedimentation, and Floodplain Development on the Upper Mississippi River During the Past 6000 Years.* ***(O-074)***
Knox, James C., University of Wisconsin-Madison, Madison, Wisconsin, USA

Part 2 Begins at 3:45 p.m.

1:30-3:15 p.m. Oral Session 37 (Special)

South Hall B-4
Bioassessment and Monitoring of Non-Wadeable Streams and Rivers-Part 1
Moderator: Joseph Flotemersch, U.S. Environmental Protection Agency

1:30 p.m. *Call to Order.* Joseph Flotemersch, Moderator

1:40 p.m. *The Role of Bioassessment and Monitoring in Overall Basin Management.* ***(O-056)***
Hooper, Bruce, Southern Illinois University, Carbondale, Illinois, USA, Joseph E. Flotemersch, U.S. Environmental Protection Agency, Cincinnati, Ohio, USA

2 p.m. *A Reference Condition Approach for the Great Rivers of the Central Basin: The Ohio, Missouri and Upper Mississippi Rivers.* ***(O-006)***
Angradi, Ted, David Bolgrien, Terri Jicha, Brian Hill, Debra,Taylor, Environmental Protection Agency, Duluth, Minnesota, USA

2:20 p.m. *Development of a Large River Bioassessment Protocol (LR-BP) for Macroinvertebrates: Pilot Results from Midwestern Rivers in the United States.* ***(O-034)***
Flotemersch, Joseph E., Karen A. Blocksom, Brent Johnson, U.S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, Ohio, USA

2:40 p.m. *Department of Environmental Quality's Non-wadeable Stream Bioassessment Methods Development Project.* ***(O-133)***
Thompson, Charles M., Mike C. Beiser, Mississippi Department of Environmental Quality, Pearl, Mississippi, USA

3 p.m. *Discussion*

Part 2 Begins at 3:45 p.m.

1:30-3:15 p.m. Oral Session 38 (Special)

South Hall B-1
Illinois River Restoration: Concepts, Background, and Specific Examples
Moderator: Mike Demissie, Illinois State Water Survey

1:30 p.m. *Call to Order.* Mike Demissie, Moderator

1:35 p.m. *Hydraulic Consideration in the Building of Artificial Islands.* ***(O-013)***
Bhowmik, Nani G., Center for Watershed Science, Illinois State Water Survey, Champaign, Illinois, USA

1:55 p.m. *Restoration of the Emiquon Floodplain Site along the Illinois River.* ***(O-014)***
Blodgett, K. Douglas, The Nature Conservancy, Lewistown, Illinois, USA, James R. Herkert, The Nature Conservancy, Peoria, Illinois, USA

2:15 p.m. *Beneficial Use of Illinois River Sediment as Topsoil.* ***(O-087)***
Marlin, John C., Waste Management and Research Center, Illinois Department of Natural Resources, Champaign, Illinois, USA., Robert G. Darmody, Department of Natural Resources and Environmental Science, University of Illinois, Urbana, Illinois, USA

2:35 p.m. *Watershed Assessment Framework for Rapid Project Identification and Restoration of the Illinois River System.* ***(O-141)***
White, William P., Illinois Department of Natural Resources--State Water Survey, Peoria, Illinois, USA

2:55 p.m. *Sedimentation Problems and Sediment Budget of the Illinois River.* ***(O-026)***
Demissie, Misganaw, Center for Watershed Science, Illinois State Water Survey, Champaign, Illinois, USA

1:30-3:15 p.m. Oral Session 39 (Contributed)

South Hall B-2
Cultural, Literary, and Historical Interpretations of Rivers
Moderator: Anita Evans University of Wisconsin–La Crosse

1:30 p.m. *Call to Order.* Anita Evans, Moderator

1:35 p.m. *The Rivers at the Heart of (the Valley) of the World.* ***(O-046)***
Goggans, Jan E., University of California, Merced, Merced, California, USA

1:55 p.m. *Mississippi Movement: Marylee Hardenbergh's Site-Specific Dances for the Mississippi River.* ***(O-081)***
LeFevre, Camille, Independent Dance Critic and Scholar, St. Paul, Minnesota, USA

2:15 p.m. *Unconformity and Unfathomability: Literary Potamology.* ***(O-089)***
McMillin, T. S., Oberlin College, Oberlin, Ohio, USA

2:35 p.m. *The Upper Mississippi River in History and Memory: Living Midstream.* ***(O-080)***
Lee, Charles R., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

2:55 p.m. *Rivers Embraced by the Japanese People–Some Examples Expressed in Japanese Literature and Arts.* ***(O-096)***
Nakato, Tatsuaki, Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS), Muscatine, Iowa, USA

1:30-3:15 p.m. Oral Session 40 (Contributed)

Board Room B
Water Quality: Ecological and Health Risks
Moderator: Kristofer Rolfhus, University of Wisconsin-La Crosse

1:30 p.m. *Call to Order.* Kristofer Rolfhus, Moderator

1:35 p.m. *A Framework for Near-Term Reduction of Human Exposure to Methylmercury During Restoration of the San Francisco Bay-Delta Ecosystem.* ***(O-142)***
Wiener, James, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Jay Davis, San Francisco Estuary Institute, Oakland, California, USA, Robert Brodberg, California Office of Environmental Health Hazard Assessment, Sacramento, California, USA, Alyce Ujihara, California Department of Health Services, Richmond, California, USA

1:55 p.m. *INTAFERE – Integrated Analysis of Mobile Organic Foreign Substances in Rivers: New Approaches for Coping with Risk and Uncertainty.* ***(O-123)***
Stiess, Immanuel, Institute for Social-Ecological Research, ISOE, Frankfurt/M, Germany, Christiane Doell, J.W. Goethe-University, Frankfurt/M, Germany

2.15 p.m. *INTAFERE – Integrated Analysis of Mobile Organic Foreign Substances in Rivers: Analytical and Eco-Toxicological Results.* ***(O-027)***
Di Benedetto, Patrizia, Kristin Quednow, J. W. Goethe University, Frankfurt/M, Germany

2:35 p.m. *Methylmercury Relationships Between Sediments and Resident Benthic Macroinvertebrates in Chequamegon Bay (Wisconsin), Lake Superior.* ***(O-102a)***
Ogorek, Jacob, M., Roger Haro, Kristofer Rolfhus, James Wiener, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

2:55 p.m. *Water Quality Issues and Status in Nepal* ***(O-07a)***
Bajracharya, Keshari, His Majesty's Government, Ministry of Environment Science and Technology, Department of Hydrology and Meteorology, Baber Mahal, Kathmandu, Nepal

3:15-3:45 p.m. Break with Refreshments

South Hall

3:45-5:30 p.m. Oral Session 41 (Special)

South Hall B-3
Lessons from the Deep History and Recent History of the Missouri, Illinois, and Mississippi Rivers-Part 2
Moderators: Jane Buikstra, Center for American Archeology and Arizona State University Richard Sparks, National Great Rivers Research and Education Center

3:45 p.m. *Climate Change, Flooding, and American Indian History in the Mississippi Valley.* ***(O-069)***
Kidder, Tristram R., Washington University-St. Louis, St. Louis, Missouri, USA

4:15 p.m. *200+ Years of Geomorphic, Land-cover, and Land-use Change on the Middle Mississippi River: Implications for Flow Dynamics and Flood Risk.* ***(O-106b)***
Pinter, Nicholas, Jonathan W. F. Remo, Southern Illinois University, Carbondale, Illinois, USA

4:45 p.m. *Concluding Remarks.* Jane Buikstra and Richard Sparks, Moderators

3:45-5:30 p.m. Oral Session 42 (Special)

South Hall B-4
Bioassessment and Monitoring of Non-Wadeable Streams and Rivers—Part 2
Moderator: Joseph Flotemersch, U.S. Environmental Protection Agency

3:45 p.m. *Comparison of Aquatic Macroinvertebrate Biodiversity Among Habitat Units in the Lower Missouri River Floodplain: Implications for Biological Assessment and Monitoring.* ***(O-110)***
Poulton, Barry C., U.S. Geological Survey, Columbia, Missouri, USA

4:05 p.m. *From Data to Information: Development of Integrative Habitat Indices for Great River Ecosystems.* ***(O-130)***
Taylor, Debra L., Theodore R. Angradi, David W. Bolgrien, Brian H. Hill, Terri M. Jicha, U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, Minnesota, USA

4:25 p.m. *Discussion*

3:45-5:30 p.m. Oral Session 43 (Contributed)

South Hall B-1
Rivers in Mythology, Religion and the Ancient World
Moderator: WillIam Gresens, University of Wisconsin–La Crosse

3:45 p.m. *Call to Order.* William Gresens, Moderator

3:50 p.m. *Urbanized River Network Plain Area.* ***(O-147)***
Yuan, Wen, Kang Yang, East China Normal University, Shanghai, China

4:10 p.m. *The Flood History and Its Water Culture Along the Gan River in Poyang Lake Basin in China.* ***(O-039)***
Fu, Chun, Qi Liu, University of Nanchang, Jiangxi Province, P. R. China

4:30 p.m. *"By the Banks of the Boann"--River as Muse and Healer in Irish Myth.* ***(O-024)***
Conaway, Jessica D., Minnesota State University-Mankato, Mankato, Minnesota, USA

4:50 p.m. *Re-appropriating Rivers: The Creation of Place in Strabo's Geography.* ***(O-048)***
Gresens, Nicholas J., Indiana University-Bloomington, Bloomington, Indiana, USA

Posters

Poster Sessions

Poster Theme 1: Cultural, Artistic, Literary, and Historical Interpretations of Rivers

Humanities Computing and the Geographical Imagination: The Mark Twain's Mississippi Project. (P-65) VandeCreek, Drew E., Northern Illinois University Libraries, DeKalb, Illinois, USA

Inter Relationship Between River and Culture in India. (P-56) Sadgir, Parag A., Government College of Engineering, Aurangabad, (M.S.) India, Pradeep A. Bhalge, Irrigation Department, Aurangabad (M.S.) India, Ashok W. Ithape, Sangamner, India

"Deep River, My Home Is Over Jordan": Abolitionism and the Underground Railroad in the Ohio River Valley. (P-24a) Gammon Purvis, Michelle D., Rivers Institute at Hanover College, Hanover, Indiana, USA

Plein Air Depiction of Rivers: The Great River Paint Out. (P-03) Bajuyo, Catalina H., DeAndra Good, Rivers Institute at Hanover College, Hanover, Indiana, USA

River Strymon, Macedonia, Greece. (P-21) Emanouilidou, Maria, Dimitra Tsakiri, George Apsilidis, Serres UNESCO Club, Serres, Greece

Influence of Major Rivers on Religious and Spiritual Developments in India. (P-43) Nair, Shadananan K., Centre for Earth Research and Environment Management, Kerala, India

Poster Theme 2: Human Interactions with Rivers

Recent Ecological Condition of the Upper Volga River Basin Area. (P-54) Romanovskaya, Maria A., Moscow State University, Moscow, Russia

Dam Nations: The Missouri River and the Yangtze. (P-28) Hartman, Kerry E., Fort Berthold Community College, New Town, North Dakota, USA, Diane H. Rickerl, South Dakota State University, Brookings, South Dakota, USA

Project No. 459: The Dammed Osage and the U.S. Hydroelectric Industry. (P-35) Little, Gillian L., University of Missouri-Kansas City, Kansas City, Missouri, USA

Discussion on Irrigation and Drainage Environment Protection Project. (P-66) You, Jinsheng, Hydrology Observation Center of Tianjin, Tianjin, Tianjin, China

I Can Survive a Flood, But Not FEMA: Low-Income Rivertown Residents Are Forced to Move. (P-47) Paddock, Todd W., Winona State University, Winona, Minnesota, USA

Harnessing River Power: Irrigation, Gender, Social Continuity, and Social Change in South Pare, Tanzania. (P-49) Porter, Karen A., Hanover College, Hanover, Indiana, USA

Need to Restore the Historical River Burigonga. (P-22) Farouque, Chowdhury Mohammad, Institute for Environment and Development Studies, Dhaka, Bangladesh

Poster Theme 3: Water Quality in River Systems

Foreign-ownership, Firm-size and Toxic Releases: The Perception and Reality of Pollution in the Menominee River. (P-40) Miller, Carol D., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

Hydraulic Connectivity of Backwater Areas to Flowing Channels Influences Nitrogen Dynamics Within Upper Mississippi River. (P-06) Bartsch, Lynn A., William B. Richardson, Jennifer C. Cavanaugh, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Eric A. Strauss, Fort Hays State University, Hays, Kansas, USA

Causes of Variations in Water Quality and Aquatic Ecology in Rivers of the Upper Mississippi River Basin, Minnesota and Wisconsin. (P-61) Stark, James R., U.S. Geological Survey, Mounds View, Minnesota, USA

Nitrogen Cycling in Sediment During Water Level Drawdown on the Upper Mississippi River. (P-15) Cavanaugh, Jennifer C., William B. Richardson, Lynn A. Bartsch, U. S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Strauss, Eric A., Fort Hays State University, Hays, Kansas, USA

Mercury and Trace Metals in Water and Fish of the Wabash River, Indiana: Preliminary Trends. (P-44) Neumann, Klaus, Ball State University, Muncie, Indiana, USA, Jean-Claude Bonzongo, University of Florida, Gainesville, Florida, USA

Methylmercury Relationships Between Sediments and Resident Benthic Macroinvertebrates in Chequamegon Bay (Wisconsin), Lake Superior. (P-46) Ogorek, Jacob, M.; Roger Haro, Kristofer Rolfhus, James Wiener, River Studies Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

Effects of Pool Drawdown and Plant Growth on Nitrogen Cycling in the Upper Mississippi River. (P-45) Northwick, Reid, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, William B. Richardson, Lynn Bartsch, Jennifer Cavanaugh, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Haro, Roger, River Studies Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

River Health and the System of Diagnostics of Water Quality on the Basis of Parallel Analytics for Verhnevolzhsky Region. (P-24b) Gladyshev, Pavel, Boris Zuev, Svetlana Morzhuhina, International University of Nature, Society and Man "Dubna", Dubna, Moskow Region

The Estimation of Volga River Quality in the Upper Volga Basin. (P46a) Osmachko, Marina, The "Dubna" International University for Nature, Society, and Man, Dubna, Moskow Region, Russia, Morzhukhina, Svetlana, The "Dubna" International University for Nature, Society, and Man, Dubna, Moskow Region, Russia, Rogovaya, Irina,The "Dubna" International University for Nature, Society, and Man, Dubna, Moskow Region, Russia

Poster Theme 4: Management, Restoration, and Analysis of Large Rivers

Agricultural Tradeoffs of Ecosystem Services in the Mississippi Basin. (P-41) Monfreda, Chad; Jon Foley, University of Wisconsin-Madison, Madison, Wisconsin, USA

Utilizing Geographic Information Science For Bathymetric Mapping and Dredging Assessment in a Small Urban Lake in Southeastern Minnesota USA. (P-42) Mueller, Robert, F., Ball State University, Muncie, Indiana, USA, David R. McConville, Saint Mary's University, Winona, Minnesota, USA

Global Restoration and Preservation of Lakes: A Comparative Analysis of Caspian and Chad Lake Basins. (P-17) Dadje, Paktano, Pascal International Relations Institute of Cameroon, University of Yaounde II, Yaounde, Cameroon

Shoreline and Water Quality Impacts from Recreational Boating on the Upper Mississippi River - A Compilation of Findings from Agency Reports. (P-31) Johnson, Scot B., Minnesota Department of Natural Resources, Division of Waters, Lake City, Minnesota, USA, Jack Enblom, Minnesota Department of Natural Resources, Division of Ecological Services, St. Paul, Minnesota, USA

The 2001 Mississippi River Flood: Assessing Flooding in La Crosse, Wisconsin. (P-08) Berlin, Cynthia, James Handley, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

Midwest Driftless Area Restoration Effort. (P-37) Mauldin, Louise, M., U.S. Fish and Wildlife Service, LaCrosse, Wisconsin, USA

Process as Product: Seeking Common Ground for Floodplain Functionality and Development. (P-39) Metcalf, Sara, Department of Geography, University of Illinois Urbana-Champaign, Illinois, USA, Todd BenDor, Department of Urban and Regional Planning, University of Illinois Urbana-Champaign, Illinois, USA, Emily Wheeler, Program in Ecology and Evolutionary Biology, University of Illinois Urbana-Champaign, Illinois, USA, Ken Lubinski, U.S. Geological Survey, La Crosse, Wisconsin, USA, Bruce Hannon, Department of Geography, University of Illinois Urbana-Champaign, Illinois, USA

Illinois River Basin Ecosystem Restoration. (P-27) Hagerty, Karen H., Brad E. Thompson, Corps of Engineers, Rock Island District, Rock Island, Illinois, USA

Large River Rehabilitation within an Adaptive Management Framework: Setting Goals and Objectives for Successful Ecological Restoration. (P-23) Galat, David L., U.S. Geological Survey, Cooperative Research Units, University of Missouri, Columbia, Missouri, USA, Emily S. Bernhardt, Duke University, Department of Biology, Durham, North Carolina, USA, Kenneth S. Lubinski, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, LaCrosse Wisconsin, USA, Margaret A. Palmer, University of Maryland Center for Environmental Science, Solomons, Maryland, USA, Charles H. Theiling, U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois, USA

GIS for the Gulf: A Geographic Reference Database for Hurricane Affected Areas. (P-25) Greenlee, David D., U.S. Geological Survey EROS, Sioux Falls, South Dakota, USA

Changes in Aquatic Vegetation Between 1975, 1991, and 2004 near Stoddard, Wisconsin, Pool 8, Upper Mississippi River System. (P-34) Langrehr, Heidi A., Jeanne T. Dukerschein, Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

Exploratory Analysis of Index of Biotic Integrity Scores Calculated from Datasets Obtained by Three Different Day Electrofishing Protocols. (P-05) Bartels, Andrew D., Jeanne T. Dukerschein, Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA, Brian Ickes, U.S. Geological Survey, La Crosse, Wisconsin, USA

Poster Theme 5: Geology, Hydrology, Climate, and Sediment Transport in Rivers

Assessing Soil Loss by Water Erosion in Jamni River Basin, Bundelkhand Region, India Adopting Universal Soil Loss Equation (USLE0 Using GIS). (P-59) Singh, Ram, V.S. Phadke, University of Mumbai, India

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Evaluation of a Catch and Release Regulation for Largemouth Bass in Brown's Lake, Pool 13, Upper Mississippi River. (P-12) Bowler, Melvin C., Iowa Department of Natural Resources, Bellevue, Iowa, USA

Transported Organic Matter in a Floodplain River: Evidence of Hydrological Controls. (P-18) Delong, Michael D., Winona State University, Winona, Minnesota, USA

Food Web Dynamics of Large Floodplain Rivers: Assessment Through Stable Isotope Analysis. (P-60) Slattery, Kelly, Michael Delong, Winona State University, Winona, Minnesota, USA

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Fishery Resources of the Yukon River. (P-01) Adams, F. Jeffrey, U.S. Fish and Wildlife Service, Fairbanks, Alaska, USA, Timothy J. Patronski, U.S. Fish and Wildlilfe Service, Minneapolis, Minnesota, USA

Freshwater Phytoplankton Diversity of Rivers in Edo State, Nigeria. (P-32) Kadiri, Medina, University of Benn, Benn City, Edo, Nigeria

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Yukon River Educational Exchange Program. (P-33) Klein, Jill, Darcy King, Yukon River Drainage Fisheries Association, Anchorage, Alaska, USA, Timothy J. Patronski, U.S. Fish and Wildlilfe Service, Minneapolis, Minnesota, USA

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School-on-the-River Program. (P-14) Buswell, Debra, Jeff Hansen, Longfellow Middle School, La Crosse School District, La Crosse, Wisconsin, USA

Exhibits

Exhibits

Big River Magazine, Exploring the Upper Mississippi River from the Twin Cities to the Quad Cities (E-01) Reggie McLeod (Exhibitor), Big River Magazine, Winona, Minnesota, USA

The Minnesota Marine Art Museum: A New Art Museum Along the Banks of the Mississippi River (E-02) Danielle Benden (Exhibitor), Minnesota Marine Art Museum, Winona, Minnesota, USA

Mississippi Valley Archeology Center, Exploring Upper Mississippi Valley Archeology (E-03) Joseph Tiffany (Exhibitor), University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

Mississippi River Sculpture Park (E-04) Florence Bird (Exhibitor), Mississippi River Sculpture Park, Prairie du Chien, Wisconsin, USA

Blufflands Alliance – A Unique Partnership for Land Conservation in the Driftless Region (E-05) James Falvey (Exhibitor), Mississippi Valley Conservancy, La Crosse, Wisconsin, USA

SteamBoat A'Coming: Photographic History of Steamboats on the Upper Mississippi River (E-06) Paul Beck (Exhibitor), Murphy Library Special Collections, University of Wisconsin - La Crosse, La Crosse, Wisconsin, USA

The National Great Rivers Research and Education Center, Partnering to Recover and Sustain the Great Rivers of the Upper Midwest (E-07) Jessica Pascoe (Exhibitor), The National Great Rivers Research and Education Center, Champaigne, Illinois, USA

Film Series (River of Dreams, John Fitch Invents the Steamboat, The 1st Steamboat on the Ohio & Mississippi, The Golden Age of Steamboating, Barging Ahead) (E-08) National Mississippi River Museum & Aquarium, Dubuque, Iowa USA

Lewis and Clark's Excellent Adventure (E-09) National Mississippi River Museum & Aquarium, Dubuque, Iowa USA

Rivers of Choice (E-10) National Mississippi River Museum & Aquarium, Dubuque, Iowa USA

River on the Road: Modeling Dam Removal on the Elwha River (E-11) Karen Campbell (Exhibitor), National Center for Earth-surface Dynamics, St. Anthony Falls Laboratory, Minneapolis, Minnesota, USA

The Nature Conservancy-Managing Water for People and Nature (E-12) Nicole Silk (Exhibitor), The Nature Conservancy, Boulder, Colorado, USA

The Nature Conservancy-Working Together, We Can Protect the World's Great Rivers (E-13) Peter Bryant (Exhibitor), The Nature Conservancy, Peoria, Illinois, USA

Office of International Education: The View from the Bluff is Global (E-14) Jay Lokken (Exhibitor), University of Wisconsin, La Crosse, La Crosse, Wisconsin, USA

Rivers Institute at Hanover College: A Liberal Arts Approach to Environmental Education (E-15) Michelle Gammon Purvis (Exhibitor), Rivers Institute at Hanover College, Hanover, Indiana, USA

Highlighted Programs of the Rivers Institute at Hanover College (E-16) Molly Dodge (Exhibitor), Rivers Institute at Hanover College, Hanover, Indiana, USA

The Upper Mississippi River Conservation Committee Working for the Resource (E-17) Scott Yess (Exhibitor), Upper Mississippi River Conservation, Onalaska, Wisconsin, USA

U.S. Army Corps of Engineers (E-18) Kurt Brownell (Exhibitor), U.S. Army Corps of Engineers, La Crescent, Minnesota, USA

U.S. Army Corps of Engineers (E-19) Dan Wilcox (Exhibitor), U.S. Army Corps of Engineers, St. Paul, Minnesota, USA

Upper Mississippi River National Wildlife and Fish Refuge (E-20) Cindy Samples (Exhibitor), U.S. Fish and Wildlife Service Winona, Minnesota, USA

U.S. Fish and Wildlife Service Big Rivers Fisheries Program (E-21) Jeff Finley and Jennifer Johnson (Exhibitors), U.S. Fish and Wildlife Service Columbia, Missouri, USA

U.S. Fish and Wildlife Service Big Rivers Fisheries Program (E-22) Mark Steingraeber (Exhibitor), U.S. Fish and Wildlife Service, Onalaska, Wisconsin, USA

U.S. Geological Survey Upper Midwest Environmental Sciences Center (E-23) Randy Hines (Exhibitor), U.S. Geological Survey, La Crosse, Wisconsin, USA

Upper Mississippi River System Environmental Management Program 20th Anniversary (E-24) Jennifer Sauer (Exhibitor), U.S. Geological Survey, La Crosse, Wisconsin, USA

Upper Mississippi River System Environmental Management Program 20th Anniversary (E-25) Jeanne T. Dukerschein (Exhibitor), Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

Upper Mississippi River System Environmental Management Program 20th Anniversary (E-26) Kraig Hoff (Exhibitor) Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

Winona State University Center for Mississippi River Studies (E-27) Drake Hokanson (Exhibitor) Winona State University, Winona, Minnesota, USA

Wisconsin Humanities Council Community Through Conversation (E-28) Dena Wortzel (Exhibitor) Wisconsin Humanities Council, Madison, Wisconsin, USA

Mississippi River Aquarium with Common Species of Fish (E-20) Dave Vetrano (Exhibitor), Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

Artist Exhibits

Billy Curmano (Video, Mixed Media) (A-01)
Marion Egan (Watercolor Paintings) (A-02)
Martha Greenwald (Paintings) (A-03)
Joan Gundersen (Paintings) (A-04)
Robert J. Hurt (Photography) (A-05)
Marilyn Klinkner (Pottery) (A-06)
Sara Lubinski (Paintings) (A-07)
Phyllis Martino (Watercolor Paintings) (A-08)
Eric Miller (Ink Drawings and Paintings) (A-09)
Michael Schwenker (Photography) (A-10)
Linda Steine (Paintings) (A-11)
Mary Louise Thompson (Pastels) (A-12)
Gene Tully (Steel and Rock) (A-13)

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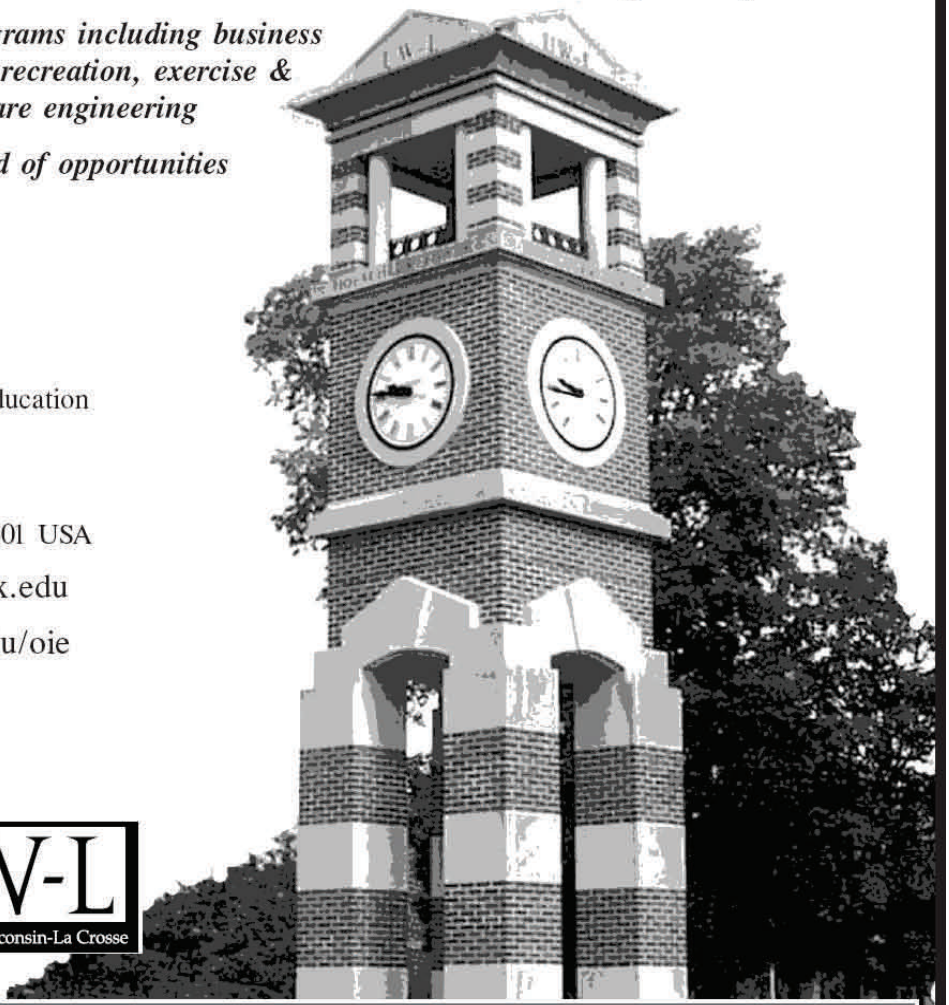

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Oral Presentations

Al-Amin, Mohammad, Progress, Dhaka, Bangladesh

O-001 Downstream Livelihoods Depend on Upstream in the Context of Bangladesh. *(Oral Session 17)*

Abstract: Bangladesh and India are neighboring countries and all the water sources of Bangladesh Rivers are from India. These two countries have a long conflict between the sharing of water, and recently India is planning to divert the 53-river course, which is the lifeline for Bangladesh. This paper will highlight the upcoming problem for Bangladesh if India implements this plan. India plans to link major rivers flowing from the Himalayas and divert them south to drought-prone areas will be the cause of a 10% to 20% reduction in the water flow to the country and could dry out great areas for much of the year. More than 80% of Bangladesh's farmers grow rice and depend on water that has flowed through India. What will happen to the environment of Bangladesh after this plan? (1) Bangladesh WILL witness rise in sea level, (2) 11% of the population will be displaced by the effect on the Bangladesh coast, (3) Complete inundation of 17.5% of the total land area, (4) A decline of 13% in the GDP owing to losses to agriculture and hence a further fall in the per-capita income, (5) Affected will be the major port of Mongla, some 85 cities and towns, more than 800 kms of roads and 4,200 kms of coastal embankment, and (6) The extinction of the sunder bans, one of the world's largest mangrove forests, covering 5,770 sq kms. To abate the crisis, Bangladesh would need to embank 715 km of coastal island perimeters, 370 km of coastline and 7600 km of riverbanks. Paying for this cost inevitably means further indebtedness.

Ambs, Todd, Wisconsin Department of Natural Resources, Madison, Wisconsin, USA, Pfeiffer, Shaili, Wisconsin Department of Natural Resources, Madison, Wisconsin, USA

O-002 Three years later – The Impact of *Waters of Wisconsin*. *(Oral Session 26)*

Abstract: *Waters of Wisconsin* was a landmark initiative articulating a comprehensive approach for water resources and ecosystem management and protection in Wisconsin. *Waters of Wisconsin* was structured around several key themes – science-based decision-making, principles of sustainability, and long term planning. Recommendations from the report fall into four categories: water policy, education, monitoring, and sustainability. A key question in the intervening years since the presentation of the report to Governor Doyle in 2003 and the present is: "What has been accomplished since the publishing of the *Waters of Wisconsin* Report?" While the development of findings and recommendations can be a systematic, orderly process, carrying out the recommendations often takes a more time consuming and circuitous route. Several steps have needed to be taken before a water policy taskforce could be formed to develop a comprehensive water policy for Wisconsin. In fact, many aspects of the recommendations are being addressed in a less comprehensive fashion. Wisconsin enacted new Groundwater Legislation in 2004 that makes the linkage between groundwater and surface water. Wisconsin's Governor was one of the signers of the Great Lakes Water Quantity Agreements in 2005. The Wisconsin Department of Natural Resources has developed the first statewide water monitoring strategy for Wisconsin – a key to addressing the need for better information to make management decisions and is working with partners to expand volunteer monitoring efforts in the state. Wisconsin's Governor has also recently called for a state water conservation plan. My experience with *Waters of Wisconsin* and as the Administrator for the Wisconsin Department of Natural Resources underscores the persistent effort needed to develop a comprehensive approach to water policy such as was envisioned in *Waters of Wisconsin*.

Amutabi, Maurice N., Central Washington University, Ellensburg, Washington, USA

O-003 The Blue and White Nile and Egyptian Claims: Revisiting the Use of Nile Waters and Colonial Agreements. *(Oral Session 17)*

Abstract: In 1990, Ismail Serageldin, then Vice-President of the World Bank, made the famous prediction that the twenty-first century wars will be fought over water. Indeed the era of 'hydro politics' or 'Blue Wars' or global 'water conflicts,' is already here. Wars over water in the Middle East and other parts of the world are more real now than in 1990 when Ismail Serageldin made his claims. Water is an important resource in development in the world. The last few years have seen great concerns on an impending water crisis in the world. Frightening and sensational works have appeared in the popular press presenting gloomy images about the declining levels of fresh water and implications for world development. This avalanche of research work and interest in water as it relates to development tells us a lot about the centrality of water in the world. In this essay, I interrogate the controversy surrounding the use of the Nile waters. The disagreement is between Egypt and the Nile riparian states of Ethiopia, Sudan, Uganda, Kenya and Tanzania. The hullabaloo has mainly stemmed from the colonial agreements that have guided the use of these waters for over 100 years now. It is the waters of Lake Victoria that supply the White Nile; and the waters of River Tana in Ethiopia

supply the Blue Nile. All the riparian states want the agreements re-negotiated, so that Egypt can compensate them for the water, or share it in its use equitably. In this paper, I place the sources of the waters of the Nile within the framework of diminishing water sources. I interrogate three types of controversies surrounding the Nile: the use of the water in the respective countries over the past, the environmental implications for control of the catchments; and the controversies inherent in the colonial agreements. My analysis will focus on the Nile waters as national heritages of the states in which the Nile flows and why Egypt needs to approach the issue with caution. I will demonstrate that Sudan, Ethiopia, Kenya, Tanzania and Uganda have genuine concerns for calling for the revision of the colonial agreements on Nile waters. These countries have their eyes focused on the use of the Nile waters (Lake Victoria and Lake Tana) for irrigation purposes, currently not allowed under the said agreements. My interpretation is informed by postcolonial and postmodern writings, which recognize the exploitative and controversial nature of the colonial state in Africa, which did not recognize and acknowledge the role of the Native "Other" and denied it voice and agency. Finally, I will affirm the vital role and potential of negotiation and dialogue as a way forward in resolving the controversies.

Anderson, Richard V., Western Illinois University, Macomb, Illinois, USA, Romano, Michael A., Western Illinois University, Macomb, Illinois, USA

O-004 Long Term Changes in a Mussel Community in Pool 29, Upper Mississippi River. *(Oral Session 6)*

Abstract: A mussel community located in the shallow channel border habitat of Pool 19, upper Mississippi River, has been quantitatively sampled annually for over 25 years. During this period, major events have occurred in this reach of the river including a major drought, the 1993 flood, development of high-population densities of invasive species (Asiatic clams and zebra mussels), and a regional mussel die-off. Changes in the mussel community, using density and diversity, were evaluated relative to these events. Total mussel density has remained comparatively stable over the period of the study; however, community composition has changed significantly as a result of some of the events. Over the 25-year period, 31 species of mussels have been found in the community. Three of those species were not collected prior to the 1993 flood but were abundant at the site the year following the flood. These species are more frequently found in small streams or lentic environments and may have been introduced with flood waters. Zebra mussels have reduced the abundance of some species, particularly those that are small in adult size and located near the substrate surface such as the fawnsfoot, deertoe, and threehorn wartyback. Abundance of heavy-shelled species and those that burrow more deeply into substrates has been less affected by the zebra mussels. With the recent development of aquatic macrophytes at the site, abundance of thin-shelled species such as the fragile papershell and giant floater has increased. A similar increase in these species was also associated with a severe drought in the late 1980s. The data suggest that mussel communtities do respond to major physical and biotic events in the riverine environment, but the duration of those changes may be short and the community returns to a stable persistent composition typical of mussel communities in this river reach.

Anfinson, John O., National Park Service/MNRRA, St. Paul, Minnesota, USA

O-005 The Origins of the Modern Mississippi. *(Oral Session 15)*

Abstract: Navigation improvements, floodplain levees and a refuge have largely defined the upper Mississippi River's physical and ecological character. Beginning in 1866, the U.S. Army Corps of Engineers began intensively reshaping the river by dredging, channel constriction and finally locks and dams. Farmers started capturing the upper river's floodplain during the middle and late nineteenth century, but the federal government did not seriously join them until the early twentieth century. In 1924, just when it seemed that farmers would claim all of the upper river's floodplain, the Izaak Walton League convinced Congress to establish a 261-mile long fish and wildlife refuge. The overall landscape created by each element was in place by 1940. This presentation will show how the physical and ecological character of the Upper Mississippi River today reflect this history.

Angradi, Ted, Environmental Protection Agency, Duluth, Minnesota, USA, Bolgrien, David, Environmental Protection Agency, Duluth, Minnesota, USA, Jicha, Terri, Environmental Protection Agency, Duluth, Minnesota, USA, Hill, Brian, EPA, Duluth, Minnesota, USA, Taylor, Debra, Environmental Protection Agency, Duluth, Minnesota, USA

O-006 A Reference Condition Approach for the Great Rivers of the Central Basin: The Ohio, Missouri and Upper Mississippi Rivers. *(Oral Session 37)*

Abstract: Empirical bioassessment of rivers is based on the comparison of conditions of sampled sites to conditions at sites in the same or comparable resource considered to be in "reference" condition. In the Environmental Monitoring and Assessment Program for Great River Ecosystems (EMAP-GRE) we use "least

disturbed condition" (LDC) as our definition of reference. Our underlying assumption is that although none of the Great Rivers of the Central Basin is in pristine condition, and there are no other comparable rivers, there is variation in condition along each river that provides the scope for bioassessment. We use a 3-phased approach to obtaining our set of internal least disturbed sites on each river. We use a GIS model to find locations on each river with a high probability of being in LDC condition. We use a natural gradient approach to filter out the best (and worst) sites from all the sampled sites. Finally, we will verify our approach to assigning LDC status to sites using metrics based on biotic assemblages (e.g., fish, macroinvertebrates). Our GIS models allow us to score every potential sample location on each river based on the proximity to upriver and local human disturbances including tributaries, dams, NPDES permits, urban areas, river crossings, and floodplain land use. Tributary influence on the main stem is weighted by watershed land use. Model outputs are used to define LDC candidate reaches that are then randomly sampled using a probability design. Model-suggested and all other sites that are actually sampled are filtered by scoring each site based on multiple (>12) abiotic metrics relative to a natural gradient for each metric (river mile as a surrogate for watershed area). Abiotic filtering metrics include water chemistry (e.g., nutrients, metals, chloride), habitat (woody debris, sediment toxicity, riparian vegetation) and landscape metrics (scores from the GIS proximity model). Comparing biotic metrics between filtered LDC sites and the entire population of probability sites will provide a test of the efficiency of our approach. This abstract does not necessarily reflect Environmental Protection Agency Policy.

Arvin, Shelley, Rivers Institute at Hanover College, Hanover, Indiana, USA, Nunoo, Philip, Rivers Institute at Hanover College, Hanover, Indiana USA, Worcester, Pete, Geology Department, Hanover College, Hanover, Indiana, USA, Wichelns, Dennis, Rivers Institute at Hanover College, Hanover, Indiana, USA

O-007 Using Geographic Information Systems to Describe Livelihood Status in River Basins. *(Oral Session 12)*

Abstract: Many of the world's poor live in river basins. Information describing how livelihood status varies throughout a river basin can be helpful in designing intervention strategies to improve household incomes and enhance food security. Many state and national agencies compile information describing livelihood status by district, state, or province. Some of those data are used by international organizations to develop indices of human welfare, such as the United Nations Human Development Index (HDI). The geographic distribution of a measure such as the HDI can be helpful in identifying opportunities for improving livelihoods in selected portions of a river basin and targeting intervention efforts. Data describing the HDI by political boundaries (districts, states, or provinces) can be analyzed using a geographic information system (GIS). The analysis is enhanced by examining also the underlying variables that are used to generate estimates of the HDI. Those variables include measures of life expectancy at birth, the adult literacy rate, the gross enrollment rate, and GDP per person. Visual inspection of a GIS plot and tabular analysis of the HDI and underlying variables can reveal helpful correlations that vary with location within a river basin. Our goal in this paper is to demonstrate the usefulness of GIS in depicting empirical information describing livelihood status in river basins. We focus on the quality and sources of information required for the analysis and the challenges involved in defining the political units that comprise a river basin. We describe the procedure using data for the Narmada River Basin in India. The graphical display of the HDI and underlying variables is helpful in understanding some of the issues that cause livelihood status to vary within the Basin. Combining that effort with tabular analysis enables us to describe how livelihoods vary with key measures of geography, demographics, and welfare.

Bajracharya, Keshari, His Majesty's Government, Ministry of Environment Science and Technology, Department of Hydrology and Meteorology, Baber Mahal, Kathmandu, Nepal

O-07a Water Quality Issues and Status in Nepal. *(Oral Session 40)*

Abstract: Extensive Surface Water pollution in Nepal is currently regarded as the most serious environmental issue in Nepal aside from the deforestation issue. Although Nepal is rich in water resources, the majority of the people are yet to share the benefits in terms of improved water quality. Rivers are not only of immense religious significance that serve as the cradle of human existence, they are a pre-requisite for a better future as well. The rivers are being contaminated by various reasons including people's negligence. Discharge of domestic sewage dumping of solid waste and industrial effluents are the most visible causes of contamination along the urban area of the rivers. The drinking water supply in Kathmandu Valley and in most of the rural areas is usually inadequate in terms of overall coverage, quantity of water and, of course, poor water quality, which is below WHO Standards. Water supplies are intermittent with access to only a few houses each day. As an alternative to the piped water supply system, people used traditional water sources such as springs, ponds, stream open dug well and shallow tube well. But these sources are unprotected, and the quality of water is usually poor. Thus these inadequate water facilities consumed by the

poor and low coverage of improved sanitation facilities together not only cause health problems but also lead to another cause of the contamination of surface water. Water borne epidemics such as occasional cholera breakouts are therefore endemic. Since water quality problems have attained a prominent role for the growing population of both the urban and rural areas, the monitoring of water resources contamination is the primary basis for environmental protection. Only by knowing the condition of water quality is it possible to take the appropriate measures to protect these scarce resources.

Barr, Kenneth A., Corps of Engineers, Rock Island, Illinois, USA

O-008 Navigation and the Environment: Recommendations for a Sustainable Upper Mississippi River-Illinois Waterway Navigation System. *(Oral Session 31)*

Abstract: The Chief of Engineers, on 15 Dec 2004, recommended the first increment of a 50-year plan for a sustainable Upper Mississippi River System. The plan calls for adaptive management to meet both navigation and ecosystem needs. Helper boats, mooring cells, scheduling and seven new 1200-foot locks are recommended to increase efficiency of inland waterway transportation. The adaptive implementation of ecosystem restoration including fish passage at 4 dams, water level management to better replicate a natural hydrograph, 35,000 acres of floodplain restoration, island building and backwater/side channel restoration is recommended to sustain a healthy large river ecosystem. A robust modeling and monitoring component is recommended to support science-based adaptive management. The importance of integrated collaborative planning is highlighted.

Bartell, Steven E., E2 Consulting Engineers, Inc., Maryville, Tennessee 37801

O-009 Navigation and the Environment: Ecological Models used to Assess Risks Posed by Commercial Navigation to Selected Resources in the Upper Mississippi and Illinois Rivers. *(Oral Session 31)*

Abstract: An ecological risk assessment was undertaken to assist in the evaluation of the alternative navigation improvement plans produced by the Upper Mississippi and Illinois Rivers (UMRS) Navigation Feasibility Study. Ecological models were used to estimate incremental risks posed by projected increases in commercial navigation on the UMRS. The projected increases in navigation are based on alternative plans for improving the UMRS navigation infrastructure. Commercial vessels entrain water through propellers, increase suspended sediments, generate waves, alter current velocities, and can physically scour sediments. The potential impacts of these physical forces on larval fish mortality, submerged aquatic vegetation (SAV) growth, unionid mussel growth, and fish spawning habitat defined the ecological endpoints of concern in the risk assessment. A model was developed to estimate larval fish entrainment mortality for 30 species of UMRS fish. Larval fish mortalities were extrapolated to future reductions in numbers of recruits and adults, as well as reductions in fish biomass. A bioenergetics model was adapted to simulate the effects of increased suspended sediment concentrations on SAV growth and vegetative reproduction. Another bioenergetics model was developed to assess the impacts of increased suspended sediments on mussel growth and reproduction. Existing models were adapted to forecast changes in the quality of fish spawning habitat for representative spawning guilds. These individual models were implemented in both deterministic and probabilistic frameworks to estimate risks posed by alternative scenarios of projected changes in navigation on the UMRS. The assessment addressed approximately 1,100 miles on the Upper Mississippi and Illinois Rivers over a 50-y project period. The presentation will briefly introduce the ecological models, provide selected examples of model results, identify model strengths and limitations, and describe the contribution of the models to mitigation planning and ecosystem restoration.

Beechie, Timothy J., NOAA Fisheries, Seattle, Washington, USA, George R. Pess, NOAA Fisheries, Seattle, Washington, USA

O-010 Reconstructing Riverine Landscapes at 100 and 10,000 Year Time Scales. *(Oral Session 16)*

Abstract: Historical reconstruction of pre-settlement landscapes and geomorphic processes in two river basins at two time scales (~10,000 years and ~100 years) highlight long-term processes that constrain the potential of the modern-day riverscape, as well as an understanding of how land uses have altered today's habitats for Pacific Salmon. Immediately after retreat of the continental ice sheet from Puget Sound (~14,000 YBP), the Skagit and Stillaguamish Rivers incised several hundred meters into valley-filling glacial sediments, creating a series of terraces that bound a wide floodplain. Voluminous lahars from Glacier Peak (~5,000 YBP) created an extensive low-gradient delta on the Skagit River, which then developed abundant habitats in wetlands and distributary channels. This post-glacial history demonstrates that salmonids experienced severe natural disturbances in the past, but that both environments and salmon recovered. Today, the geomorphic template created by this history constrains riverine habitat potential in both basins, with most salmon habitat located in low-gradient streams and rivers confined to valley floors. Since the mid-1800s,

land uses have greatly altered habitats available to salmon, and diking and ditching of floodplain and delta streams has obliterated more than 50% of coho salmon rearing habitat in both basins. Forestry practices have had relatively little effect on habitat abundance, despite its prevalence in both basins. Removal of salmon habitats in floodplains and deltas may not rival the magnitude of rare natural disturbances, but differs from natural disturbances in that it eliminates recovery mechanisms that allow salmon habitats to recover and salmon populations to rebound.

Benjamin, Gretchen L., Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

O-011 Working in Concert, Working in Concert - Partnerships and Public Involvement from the Perspective of a Mississippi River Practitioner. *(Oral Session 28)*

Abstract: For more than thirty years, formal and informal partnerships have been in place to solve problems regarding Mississippi River management. Before any books were written on the subject, federal and state government agencies collaborated to identify solutions to navigation channel dredging and disposal, minimizing affect on or enhancing river habitat, creating recreational opportunities for the public and promoting good legislation for the Mississippi River. These relationships were volatile at first, but as the partnership matured, the dialogue became more open and solutions became easier and faster, significantly changing the workload of agency staff. For instance, today dredging and disposal practices follow a routine protocol approved by the partnership, and staff time is spent on environmental restoration projects such as the Pool 8 or Pool 5 drawdown. These partnerships have also evolved to bring the public into the decision making process for river management. One successful example of this process was the public involvement component of the Pool 8 drawdown. Managers and scientist wanted to reduce water levels to promote aquatic plant growth, but high recreation use on the Mississippi River meant the public would have to accept a greater challenge to navigating on the river. To accept this change, managers made sure that the public was involved with every step and decision to implement the drawdown. The two-year effort included many meetings, newsletters, newspaper articles, TV and radio appearances, and website information. In the end, the public saw the habitat results and other than one operational error during the drawdown, it went fairly smoothly. This success was evident when the partnership went back to the public to obtain approval to repeat the drawdown for a second year to gain further benefits for aquatic vegetation. The public approved, and the aquatic plants responded favorably with greater density and robustness.

Benn, David W., Bear Creek Archeology, Inc., Cresco, Iowa, USA

O-012 The Prehistoric Archeological Record of the Upper Mississippi River Valley: When the Past Meets the Present. *(Oral Session 30)*

Abstract: The evidence for deeply buried Woodland and Archaic sites (ca. 5000 years old) in the floodplain is reviewed. Landform analysis of the valley floor tells us approximately how many prehistoric sites of each cultural period are preserved. Changes in the river environment since the insertion of locks and dams 60 years ago are causing rapid erosion of the archeological record. The principle adverse effect is bank erosion, which is closely related to evolution of floodplain forest communities and hydrological habitats.

Bhowmik, Nani G., Center for Watershed Science, Illinois State Water Survey, Champaign, Illinois, USA

O-013 Hydraulic Consideration in the Building of Artificial Islands. *(Oral Session 38)*

Abstract: Over the last 100 plus years, the Illinois River has undergone a tremendous amount of physical and ecological changes. These changes include land use alterations, tributary stream channelization, river bank erosion, watershed erosion, construction of locks and dams on the main stem of the river and others. On the other hand, various entities also engaged in the implementation of best management practices on the watershed including treatment of sewages that used to be discharged to the river and others. Still tremendous amounts of restoration activities need to be implemented in the very near future. Presently the state, federal and non-governmental entities are working together to restore some of the “functions” of the river. One option being considered now is the building of artificial islands by utilizing the sediment that has already been deposited with the river environment. Recently a hydraulic investigation was conducted to determine the sizes, shapes, orientation and heights of these proposed islands within the Peoria Lake, a bottomland lake along the Illinois River. This investigation which included mathematical hydrodynamic modeling has shown that several artificial islands could be built with dredged sediment within the river. Results from this study will form the basis of this talk. Presently the state of Illinois and the U.S. Army Corps of Engineers are working together to build such artificial islands in the very near future.

Blodgett, K. Douglas, The Nature Conservancy, Lewistown, Illinois, USA, Herkert, James R., The Nature Conservancy, Peoria, Illinois, USA

O-014 Restoration of the Emiquon Floodplain Site along the Illinois River. *(Oral Session 38)*

Abstract: A key ecological attribute of a large-floodplain river ecosystem is the dynamic relationship between the river and its floodplain. Along reaches of the Upper Mississippi River System, USA, greater than one half the river's natural floodplain has been isolated by earthen levees and drained, primarily for agricultural production. This has significantly altered ecological processes and the habitats that once supported both abundant and diverse natural plant and animal communities. Working with partners, The Nature Conservancy identified the restoration and management of functional floodplain as a primary strategy for conserving the biological diversity of the Upper Mississippi. The Conservancy's 2900-hectare (7100-acre) Emiquon Project is a model, landscape-scale, floodplain restoration project along the Illinois River, a major tributary of the Mississippi. This area of phenomenal biological abundance supported over 600 generations of Native Americans, and it has been used for intensive agricultural production since the early 1920s when it was isolated from the river by levees and drained. To help develop a science-based restoration and management plan for the site, the Conservancy formed the Emiquon Science Advisory Council, a group of over forty scientists and managers with a broad range of applicable expertise and experiences. At the Council's recommendation, the Conservancy engaged scientists to create spatially explicit computer simulation models (physical, biological, and economic) that are being used to develop and evaluate various restoration and management scenarios for the site. Restoration is currently scheduled to begin in the fall of 2006; as it proceeds, the models will be verified, refined as necessary, and used to provide feedback for adaptive management. Additionally, we anticipate these models and methodologies will be used to promote and guide future floodplain restoration and management efforts of the Conservancy and partners in the Upper Mississippi and beyond.

Boszhardt, Robert "Ernie", Mississippi Valley Archaeology Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

O-015 The First Peoples of the Upper Mississippi River Valley. *(Oral Session 30)*

Abstract: People entered the Upper Mississippi River Valley at the end of the Pleistocene, approximately 12,000 years ago. During this period of extreme climate, humans maintained a cultural adaptation of nomadic hunting bands known as Paleoindian. Included in their subsistence were various forms of megafauna such as mammoth and mastodon. By the onset of the Holocene 10,000 years ago, the environment had changed dramatically, and people adapted to new lifeways known as the Archaic cultural tradition. The 8,000 year span of the Archaic witnessed several innovations and developed regional territories. The Archaic culminated with increased sedentism and the development of elaborate mortuary patterns, which included long distance exchange of exotic objects. This paper will introduce the earliest archaeological cultures of the Upper Midwest.

Brinkley, Douglas, Tulane University (Abstract not available at time of posting)

O-016 The Great Deluge: Hurricane Katrina, New Orleans, and the Mississippi Gulf Coast. *(Oral Session 3)*

Abstract: (Abstract not available at time of printing)

Brummond, Janice K., University of Michigan, Ann Arbor, Michigan, USA

O-017 The Selenge River: Source of the Sacred Waters of Lake Baikal. *(Oral Session 24)*

Abstract: In the heart of southern Siberia and Central Mongolia are the streams and tributaries that form the mighty Selenge River – the major supplier of water to Lake Baikal, the world's largest, oldest and deepest lake. Most visitors only glimpse the river winding alongside the Trans-Siberian railroad route to Beijing, but local people consider the Selenge as critical to their cultural and natural heritage as the Mississippi River is to most Americans. Contributing over half of the waters discharging into Lake Baikal, the Selenge River flows north over 1000 kilometers from Mongolia's Khangai Mountains into the Buryat region of Eastern Siberia. The total watershed area is 448,000 square kilometers or the size of France and Germany combined. Central to the cultural identity of all Mongol peoples, this sparsely populated and physically harsh region is a historic center of shamanism, Buddhism, Russian Orthodox 'old believers', and Siberian exiles. Ecologically, the Selenge basin is home to a variety of endemic and endangered species, and its delta is an internationally significant wetland site. The Selenge River system, and consequently Lake Baikal, is under threat not only from urban pollution, deforestation, and minerals development, but also transboundary problems of scientific data collection, institutional engagement, and legal enforcement of environmental standards. Accelerating social changes are also contributing to putting these traditionally sacred waters at risk. This paper correlates biophysical data about the Selenge River system with socioanthropological data from local peoples' perspectives to help determine appropriate watershed protection strategies. Localized efforts to promote tourism and preserve nomadic traditions should be balanced with reinforced international programs such as the Ramsar Convention and World Heritage Site

designation to protect both cultural and natural resources in the Selenge River Basin and Lake Baikal.

Bryson, Reid A., University of Wisconsin-Madison, Madison, Wisconsin, USA, McEnaney, Katherine, University of Wisconsin-Madison, Madison, Wisconsin, USA, Ruter, Anthony, University of Wisconsin-Madison, Madison, Wisconsin, USA

O-018 Modeling the History of the Great Rivers of the World. *(Oral Session 18)*

Abstract: The great rivers of the world have been central to the course of history. One cannot discuss the origins of Western Civilization without considering the Tigris and Euprates, the Nile, and the Danube. South Asian history evokes the names of Indus and Ganges, and for East Asia the Yangtze and the Hwang Ho. It is now possible to study the history of flow of these rivers and more with the aid of a robust, high resolution climate model. This paper will present the current state of modeling of some of the great rivers using the Archaeoclimatic model.

Campbell, Karen M., National Center for Earth-surface Dynamics, Minneapolis, Minnesota, USA, Sandland, Travis O., Science Museum of Minnesota, St. Paul, Minnesota, USA

O-019 Taking Research on the Road: Modeling the Effects of Dam Removal on the Elwha River. *(Oral Session 5)*

Abstract: The Science Museum of Minnesota's (SMM) Earthscapes River Restoration classes introduce students to the issues surrounding dam removal, provide context within which to explore data and concepts from National Center for Earth-surface Dynamics (NCED) research, and give students the opportunity to actively participate in ongoing research on river systems. The topics of dam removal and river restoration provide excellent case studies from which to gain an interdisciplinary understanding of the ecological and physical processes that define and shape rivers and river networks. The geomorphic response of rivers to dam removal is extreme and provides a highly dynamic example of a river's natural tendency to move toward quasiequilibrium. Furthermore, the intense social, political, and economic questions and tensions raised by dam removal provide an engaging backdrop against which to explore a current scientific problem. This poster will include our table-top teaching model. The model is based on NCED research conducted to inform plans for the removal of the Glines Canyon Dam on Washington's Elwha River. Attendees will have a chance to experiment with this classroom-scale model and to learn about how this model and other collaborations between a museum and a national laboratory are bringing the latest scientific understanding of rivers to students and the public around the country.

Cassin, Jan L., Parametrix, Inc., Seattle, Washington, USA

O-020 Reconstructing River History as a Guide to Restoring Riverine Wetlands in the Rio Grande Basin. *(Oral Session 22)*

Abstract: Riparian wetlands are rare and valuable habitats in the arid southwestern United States, and maintaining or restoring these habitats is a high priority. Dam removal and restoration of more natural hydrologic regimes are frequently proposed to restore river and associated riparian systems. However, it is often difficult to determine if existing riparian wetlands will be sustainable following restoration or river flows, or if they are artifacts of river regulation and dam construction. The use of archival and process studies to characterize the historical ecology of rivers and riverine wetlands is a potentially powerful tool for evaluating the sustainability of these wetlands and guiding river protection and restoration. Major sources of historical information on pre-European-settlement ecology in the United States are the General Land Office (GLO) cadastral surveys and survey notes, which can be used to reconstruct historical landscapes and vegetation types. In the southwestern U.S., where Spanish and Mexican settlement pre-dates the GLO surveys, significant alterations to land use and river hydrology may have occurred prior to these surveys. In these cases, reconstructing historical ecology as a guide to river restoration requires the use of other archival sources, such as Spanish land grant records, the journals or accounts of Spanish expeditions, journals and histories of Mexican settlers, community irrigation records and water rights, and the oral traditions and histories of Native American pueblos. Use of these sources in combination with process studies of seasonal groundwater elevations and hydrologic regimes related to the distribution of riparian vegetation has been used to guide restoration of several riparian wetlands within the Rio Grande Basin. However, to gain an accurate picture of pre-settlement conditions, use of these records must be carefully evaluated in light of other historical changes, for example, grazing history, cyles of wet and dry years, and periods of extreme drought.

Chaves, Henrique ML, School of Technology, University of Brasilia, Brasilia, Brazil

O-021 The "Water Provider Program": A Financial Compensation Project for Erosion and Sedimentation Abatement in Rural Watersheds. *(Oral Session 14)*

Abstract: In spite of the relative success of soil and water conservation programs in Brazil in the last 20 years, they have not explicitly considered their off-site benefits or utilized any compensation instruments. One of the consequences of these shortcomings is that non-point type problems, such as river sedimentation and pollution, are still persistent in many regions of the country. Considering this fact and the new trends in agri-environmental programs, a soil conservation and reclamation project was developed, aimed at strategic water supply sources, where the financial incentives for the participant farmers are proportional to the off-site benefits provided, relative to the sedimentation abatement. Since the latter is not a trivial process, it was emulated by a simplified version of the Universal Soil Loss Equation-USLE, at the farm level. Thus, the financial incentives for the participants were estimated as a function of the erosion and sedimentation abatement provided, as well as the cost of the adoption of the practice. The simplicity and robustness of the proposed method, as well as the ease of the certification process in the field, allow for its decentralized implementation by watershed committees, associations and cooperatives. The theoretical and practical aspects of this project, entitled "Water Provider Program," will be discussed.

Cocola, Jim, University of Virginia, Charlottesville, Virginia, USA

O-022 Borders Remade as Arteries: The Place of the River in Chicano and Quebecois Poetry *(Oral Session 17)*

Abstract: In this paper, I take up a comparison of two poets contemplating river borders: Gatien Lapointe, a Quebecois poet addressing the St. Lawrence River border in *Ode au Saint-Laurent* (1961), and Jimmy Santiago Baca, a Chicano poet meditating on the Rio Grande border in *Winter Poems Along the Rio Grande* (2004). Just as both poets focus on a contested river border in order to speak to larger questions of cultural identity and political resistance, so too do both poets devote their lyric attention to riparian environments *qua* riparian environments, unsettling the more abstract geopolitical valences imposed upon these border spaces and unearthing the phenomenological qualities of the places that these borders presume to divide. Relating the poetics and the politics of these two works to each other, to the broader poetic constellations that surround them, and to the larger discourses of cultural geography and ecocriticism, I argue that in taking up river as border and border as river, Lapointe and Baca restore an environmental significance to the border which shifts the social imaginary away from national concerns and toward concerns of local and transnational import, as per recent calls within the field of American Studies issued by scholars including Walter D. Mignolo, Amy Kaplan, John Carlos Rowe and Jose David Salvidar.

Collins, Brian D., University of Washington, Seattle, Washington, USA, Montgomery, David R., University of Washington, Seattle, Washington, USA

O-023 Reconstructing the Late Holocene Geo-ecology of Puget Sound's Riverine Landscapes to Guide Their Restoration and Management. *(Oral Session 16)*

Abstract: Because Euro-American settlement in the Puget Lowland of Washington state homogenized and simplified river landscapes, we used archival, field, and digital terrain studies to develop a process-oriented, spatially explicit understanding of pre-settlement landscape as a coupled physical, ecological, and human system at multiple spatial (channel-width to region, or $10^1 – 10^5$ m) and temporal (decadal to interglacial cycle, or $10^1 – 10^5$ yr) scales. Holocene interaction of rivers draining the Cascade Range with a lowland shaped by scour and fill by the Cordilleran ice sheet created two contrasting river valley types. Rivers in both types have persisted in disequilibrium since deglaciation; in broad, low-gradient troughs eroded by subglacial runoff ("Pleistocene glacial valleys"), rivers generally aggrade, as other rivers incise narrower, steeper post-glacial river valleys ("Holocene fluvial valleys") through the glacial fill to local base level. These settings generated contrasting riverine morphologies, dynamics, and ecosystems. Rivers in glacial valleys were sinuous and migrated slowly; infrequent meander cutoffs created oxbow lakes within a narrow meander belt elevated by post-glacial fluvial sedimentation several meters above a valley bottom of extensive wetlands. Steeper rivers in Holocene valleys generally had multiple channels, islands, and sloughs, frequent channel-switching avulsions mediated by wood jams, and occupied a larger portion of their valley bottom. Often river restoration and management programs either implicitly or explicitly assume pre-settlement equilibrium and uniform conditions regionally, but neither is true of the Puget Lowland. For example, restoration emphases in adjacent rivers, or along the same river, can be on different processes—-river-floodplain forest connection in Holocene valleys or on river-floodplain hydrologic connection in Pleistocene glacial valleys—-and on different habitats. Puget Lowland rivers show the utility of using multiple approaches for developing an understanding of regional and historical geomorphic context, "seeing through" the modern, homogenized landscape to provide conceptual and site-specific guidance for its restoration and management.

Conaway, Jessica D., Minnesota State University-Mankato, Mankato, Minnesota, USA

O-024 "By the Banks of the Boann"--River as Muse and Healer in Irish Myth. *(Oral Session 43)*

Abstract: Rivers connect people to the land and each other and to the stories of their ancestry. For the ancient Irish, rivers were necessary for survival and travel, but they also played a significant role in the mythical imagination. The place names of rivers, lakes and plains are central to the unfolding of the three *Cycles of Myth*, that begin with ancient battles over the right to live on the isle of Ireland. These date back to well before the time of Christ. The *Dindsenchas* are another series of tales that describe the mythological associations of Ireland's sacred landscapes. These stories circulated as oral tradition until they were written down by Irish Christian monks, beginning in the sixth century. Sacred geography, as it is described in the mythology of the ancient Irish, reflects a people's keen sensitivity for the nuances of the landscape, and a sense of reverence for nature's forces. Sources of rivers, and storied places on their banks, offered refuge that inspired the mind and healed the body and soul of the visitor. These places have kept their sacred identity through social changes wrought by invasions and introduction of Christianity. Today, rivers and springs in Ireland are pilgrimage sites for those seeking spiritual inspiration and healing. The ancient stories and their associated rituals are entwined with the character of the Irish people and their landscape. Where a tree and a rock are perfectly juxtaposed on a river bank, you could find a poet seeking his Muse, "...for the poets deemed that on the brink of water was always a place of revelation...."

Delaney, Robert L., U.S. Geological Survey, U.S. Fish and Wildlife Service, and Lower Mississippi River Conservation Committee, Vicksburg, Mississippi, USA, Moore, Angela, Lower Mississippi River Conservation Committee, Vicksburg, Mississippi, USA, Nassar, Ron, Lower Mississippi River Conservation Committee, Vicksburg, Mississippi, USA

O-025a Conservation - the Other Economy. *(Oral Session 23)*

Abstract: Because Federal programs at their best only serve as catalysts and tools for action, regional economic development efforts by the government in 1988 and 2000 have been largely unsuccessful in bringing prosperity to the Lower Mississippi Valley (Delta). The 113 county/parish area remains one of the most economically distressed regions of United States where poverty levels significantly exceed the national average and per capita income is approximately half the national average. However the Delta's nationally recognized historical, cultural, and natural resource assets, especially those associated with the Lower Mississippi River (LMR) offer the promise of sustainable economic development. The region's unique cultural perspective and the literature, art, architecture, food, folk life, and traditions that comprise its rich history are intensely felt and vividly remembered by visitors. Tourism that sustains or enhances the geographical character of the place being visited and is prompted by a desire to experience these local attributes has recently been designated as "geotourism." Studies conducted by the Travel Industry Association of America identified 55 million travelers as potential geotourists - those attracted by a destination's unique characteristics. Tourists surveyed expressed interests in value, multiple things to do when visiting an area, and a desire to visit locations that are not heavily populated. Although such features are abundant in the Delta and the number of tourists traversing the region will greatly increase with the construction of Interstate 69, they are relatively undeveloped and inaccessible; nor is the region "tourist-friendly" in terms of providing the amenities desired by travelers. Tourism, fishing, and wildlife-associated recreation in the six-state area currently account for an annual input of $24.6 billion into the regional economy. A 2004 economic profile of the 113 county/parish-corridor surrounding the LMR reported that tourism was the largest non-manufacturing sector in the regional economy, contributing some $13 billion annually and supporting more than 180,000 jobs. The LMR, with its associated communities and their distinctive culture, represents a largely untapped economic resource. The Lower Mississippi River Conservation Committee has formulated a landscape-scale plan to facilitate natural resource-based economic development focused on the LMR's 2.7 million-acre leveed floodplain. The organization's "Restoring America's Greatest River" plan has the potential to revitalize the regional economy by enhancing tourism, improving the quality of life, and protecting and restoring the natural resources and the environment. Providing assistance to the six Delta states in formulating/implementing an economic development program based on restoration and sustainable use of the LMR's unique natural resources promises long-term benefits to the region while simultaneously ensuring restoration of the LMR-related natural resources.

Delong, M.D., Large River Studies Center, Winona State University, Winona, Minnesota, USA, Thorp, J.H., Kansas Biological Survey, University of Kansas, Lawrence, Kansas, USA, Thoms, M. C., Cooperative Research Centre, University of Canberra, Canberra Australia

0-025b The Riverine Ecosystem Synthesis: a Scaled Model of Biocomplexity in River Networks. *(Oral Session 33)*

Abstract: We propose an integrated, heuristic model of lotic biocomplexity, the riverine ecosystem synthesis

(RES) that encompasses spatiotemporal scales from headwaters to large rivers and from main channels to floodplains. Our purpose is to provide a framework for understanding both broad, often discontinuous patterns along longitudinal and lateral dimensions of river networks and local ecological patterns across various temporal and smaller spatial scales. This synthesis represents a conceptual marriage of ecogeomorphology with a terrestrial landscape model describing hierarchical patch dynamics. Contrasting with a common view of rivers as continuous, non-repeating longitudinal gradients in physical condition, our synthesis portrays rivers as downstream arrays of large hydrogeomorphic patches, or "functional process zones", formed by catchment geomorphology and climate. Community structure and ecosystem function vary predictably within different types of functional process zones. In contrast to the gradient perspective, functional process zones can be repeated along the longitudinal dimension of a river network. This conceptual synthesis blends our perspectives on biocomplexity with aspects of aquatic models proposed from 1980 – 2004. Our presentation briefly reviews major components of the RES and discusses its application in both basic and applied studies.

Demissie, Misganaw, Center for Watershed Science, Illinois State Water Survey, Champaign, Illinois, USA

O-026 Sedimentation Problems and Sediment Budget of the Illinois River. *(Oral Session 38)*

Abstract: Many major streams in Illinois drain into the Illinois River, which drains nearly half of the state. The Illinois Waterway with its system of locks and dams links Chicago and the Great Lakes to the Mississippi River, and thereby to the Gulf of Mexico. This linkage has significant transportation and commercial values for the state and the nation. In addition, with its numerous backwater lakes, wetlands, and floodplain forests, the Illinois River valley provides a significant habitat for fisheries, waterfowl, and other birds, and animals, making it an important ecological resource. Problems associated with erosion and sedimentation of the Illinois River valley have been recognized as the primary environmental problem of this river. The main sources of sediment to the Illinois River valley are watershed erosion, streambank erosion, and bluff erosion. In order to quantify the sedimentation problems, sediment yields from tributary streams of the Illinois River were calculated based on the available suspended sediment load data. Sediment rating curves that relate daily sediment load and daily water discharge were developed for each sediment monitoring station based on existing data. Sediment rating curves then were used to calculate annual sediment yields from all tributary streams for which sediment load data were available. These rating curves with some modifications were then utilized to estimate the sediment loads of all the tributaries. On average, it was estimated that 12.1 million tons of sediment were delivered to the Illinois River valley annually during the period 1981-2000, and the average annual outflow of sediment from the Illinois River at Valley City was 5.4 million tons. This resulted in an estimated average annual deposition of 6.7 million tons of sediment delivered from tributary streams to the Illinois River valley. This paper will highlight the sedimentation problems of this basin and how the sediment budget developed could now be utilized in the future to gage the improvements on the basin as far as the sediment delivery is concerned.

Di Benedetto, Patrizia, J. W. Goethe University, Frankfurt/M, Germany, Quednow, Kristin, J. W. Goethe University, Frankfurt/M, Germany

O-027 INTAFERE – Integrated Analysis of Mobile Organic Foreign Substances in Rivers: Analytical and Eco-Toxicological Results. *(Oral Session 40)*

Abstract: Worldwide there are more than 100,000 chemicals in constant use. However, only a small fraction of them are extensively investigated concerning human and eco-toxicological impacts. This knowledge deficit applies in particular for mobile organic foreign substances (MOF). Due to their high water solubility, MOF are generally extremely mobile in rivers. Although they are often persistent and biologically highly active even at trace levels, the hazard from MOF exposure for single organisms and aquatic ecosystems is insufficiently characterized. The interdisciplinary research project INTAFERE investigates the particular hazard of MOF for nature and society from an integrative perspective. In this paper we focus on the environmental aspects of MOF in rivers. The societal dimension is addressed in a complementary paper by C. Döll and I. Stiess. The area under investigation is the Hessian Ried – a region of major importance for the water supply of the Rhine-Main urban agglomeration. We report on measurements of partly high concentrations of selected MOF in this area and on results of comprehensive tests on their eco-toxicological effects. Bisphenol A as well as 4-Nonylphenol and 4-tert-Octylphenol demonstrate estrogen activity using the yeast estrogen screen. These results were also confirmed in a chronic whole organism test with aquatic snails. Furthermore the acute toxicity of both substances (concentration range: 0.05 - 150 mg/l), as well as of the synthetic musk compound AHTN (0.01 - 50 mg/l) and the organic chlorophosphate TDCPP (0.01 - 30 mg/l) could be shown using the California blackworm *Lumbriculus variegatus* (96 h exposure) and the larvae of *Chironomus riparius* (24 h exposure) in triplicate. Sediment toxicity could be demonstrated for

Bisphenol A and 4-Nonylphenol (0.4 - 250 mg/kg dw) in a 28-day test with *L. variegatus* using spiked sediment. A significantly reduced reproduction was revealed in the highest concentration of both chemicals.

Dodge, Molly, Rivers Institute at Hanover College, Hanover, Indiana, USA

O-028 Rivers Institute at Hanover College: A Liberal Arts Approach to Environmental Education. *(Oral Session 10)*

Abstract: The Rivers Institute enhances understanding of the culture, economics, and science of river systems around the world. We achieve our goals through three primary activities: education, convening, and consulting. Each activity provides educational opportunities for Hanover College faculty, staff, and students, K-12 teachers and students, academicians, technical specialists, public agencies, representatives of commerce, industry, non-profit organizations and the general public. The Rivers Institute creates educational opportunities by:

1. Enhancing the academic program at Hanover College. Our Resident Fellows are developing river-related courses. Our Director of Science Programs is developing an undergraduate environmental science program.
2. Providing grants to Hanover students, staff, and faculty that support river-related scholarly projects. The Rivers Institute encourages grant recipients to present the results of their research at professional workshops and conferences.
3. Developing collaborative relationships with K-12 teachers and students to create and incorporate environmental and water based curriculum, conducting special programs and field trips that expose children to the cultural, economic, and scientific aspects of rivers, and hosting special events that promote environmental knowledge and awareness.
4. Developing a web-based learning center that complements the scope and nature of our programs. The center provides brief reports on important topics and guides individuals to high-quality, river-related internet sites.
5. Managing a collection of books and materials in support of Rivers Institute programs and related interests of Hanover College faculty and students.
6. Convening workshops and conferences that facilitate the sharing of knowledge and promote discussion of timely issues.
7. Consulting on projects that enhance knowledge and contribute to solving problems involving water resources. We include Hanover faculty, staff, and students in our consulting efforts.

The Rivers Institute seeks meaningful partnerships in all of its activities. We are eager to collaborate with individuals, schools, colleges and universities, research centers, nonprofit organizations, agencies, corporations, and consulting firms.

Dudgeon, David, The University of Hong Kong, Hong Kong SAR, China

O-029 Conservation of riverine biodiversity in the human-dominated landscapes of monsoonal Asia. *(Oral Session 1)*

Abstract: Freshwater biodiversity is under threat worldwide, but the intensity of threat in monsoonal Asia (the Oriental biogeographic region) is exceptional. Asia is the most densely populated region on Earth and five Asian countries account for around half of the world's annual population growth rate. Many rivers of that region are grossly polluted and significant portions of their drainage basins and floodplains have been deforested or otherwise degraded. Flow regulation has been practiced for centuries, and thousands of dams have been constructed so that most rivers are now dammed – often at several points along their course. Irrigation, hydropower and flood security are among the perceived benefits. Recent water engineering projects in Asia have been exceptionally aggressive, and include the world's largest and tallest dams (in China), and a water transfer scheme intended to link India's major rivers. Some of these projects (on the Mekong, for example) have important international ramifications that have yet to be played out fully. Over-exploitation has exacerbated the effects of habitat alterations on riverine biodiversity, with the result that fish stocks are over-exploited and a variety of vertebrate species are critically endangered. The pressure from large, impoverished human populations, increasingly concentrated in cities, has forced governments to prioritize economic development over environmental protection and conservation, and river scientists in Asia seem to have little influence on policy makers or the implementation of water development projects. Contamination of water and threats to human health have resulted in the introduction of legislation to control water pollution, but these laws are not explicitly intended to protect biodiversity or ecosystem functioning. Nonetheless, where legislation has been enforced it can be effective against point-source polluters, but has had negligible impact on the huge quantities of organic pollution arising from agriculture and domestic sources that contaminate rivers such as the Ganges and Yangtze. To date, human demands from agriculture and industry dominate water allocation policies; in-stream flow needs for ecosystem

functioning have yet to be addressed. Restoration of Asian rivers to their original state is impractical given the constraints prevailing in the region, and rehabilitation will be possible only if the relevant scientific information is communicated and applied with urgency. Opportunities do exist, and the 2003 introduction of an annual fishing moratorium along the Yangtze River, as well as breeding and restocking programmes for endangered fishes in the Yangtze and Mekong, offer the chance to leverage other initiatives that enhance river health, such as the establishment of aquatic nature reserves on the Yangtze. Preliminary data indicate that some elements of freshwater biodiversity persist in degraded rivers, thus providing a basis for rehabilitation. As a matter of urgency it will be important to identify which ecological features facilitate persistence and which increase vulnerability to human impacts, because this information will be essential for the formulation of successful rehabilitation schemes.

Eckman, Karlyn, University of Minnesota, Saint Paul, Minnesota, USA

O-030 Assessing Human Vulnerability in Major River Systems. *(Oral Session 13)*

Abstract: Through the Mekong-Mississippi Partnership (MMP), the author has recently led a team of experts in the preliminary steps of a study of human vulnerability and the dependence of people on aquatic resources in the Lower Mekong Basin (Cambodia, Thailand, Lao PDR and Vietnam). This included a major literature review on vulnerability and dependence in each LMB country, as well as a general review of available methods to assess the human dimensions of vulnerability, food insecurity and dependence on aquatic resources. In the coming months the team will review secondary data, design a study methodology, prepare training curricula in vulnerability assessment (VA), and carry out training of trainers from the four countries in VA. As the team was working on the preliminary steps in Southeast Asia, hurricanes caused major damage and death in the Mississippi delta of the United States. The human dimensions of the storms, as well as the lack of effective response, were evident halfway across the world. Our team noted strong similarities in the apparent vulnerabilities of people, and especially poorer and more marginalized communities, in both riparian systems. We further observed that Thailand had already acquired significant experience in emergency response to coastal and water-related disasters during the 2005 Tsunami. The objective of this presentation is to foster a new discussion about human vulnerability in major river systems, and the needs for methods and tools of planners and decision makers to reduce human vulnerability. The elements of this presentation are the following: (a) summarize the preliminary VA study findings and report on ongoing study efforts; (2) compare and contrast the major factors that lead to the vulnerability of people living in the Mississippi and Mekong river basins; (3) assess and compare the methods and techniques used to assess vulnerability in each context; and (4) summarize major gaps in decision-making tools based upon the lessons learned in the Mississippi and Mekong contexts.

Enzler, Jerry A., National Mississippi River Museum & Aquarium, Dubuque, Iowa, USA, Teri Hawks Goodmann, National Mississippi River Museum & Aquarium, Dubuque, Iowa, USA

O-031 America's River Development at the Port of Dubuque. *(Oral Session 27)*

Abstract: Dubuque, Iowa, has revitalized its community through a major million riverfront development. What started as a $10 million museum expansion and the city's desire to build a river walk grew into a $188 million project which resulted in the Smithsonian-Affiliated National Mississippi River Museum & Aquarium, the Grand River Conference Center, the Grand Harbor Resort and Water Park, the River Walk and several riverfront amenities. The presentation will describe the growth of the project, the collaborations and partnerships, and the scholarship that went into building the largest river museum on the Mississippi River. The presentation will examine the unique focus on both history and environment and present visuals of the state of the art exhibits that focus on the river as it is today and how attitudes toward the Mississippi in the past have resulted in the river we have today.

Fischer, Katherine M., Clarke College, Dubuque, Iowa, USA

O-032 Dreaming the Mississippi. *(Oral Session 8)*

Abstract: Despite monumental human efforts beginning in the 1830's to harness, divert, deepen, and dig out the Mississippi, the river refuses to be girdled in. Up until the invention of the snag boats in the 1830's, people who lived along the river modified their own rhythms and needs to those of the river. Boat builders before the 1830's even created vessels equipped with side spars that leap-frogged the body of the boat over sandbanks and shoal water. If this didn't work, they waited for higher water. They made way for the river. But then came snag boats searching inland waterways, hooking and hauling away tree trunks and debris that might tangle paddlewheels. Thus, the snag boat was the first to make the river make way. Like the origins of the Mississippi north of Lake Itasca where water barely bubbles out of rock, there flowed an ever-increasing rush of methods designed to slim down the river, dredge the bottom, fill the swamplands, and dam it. My friends and I have heaved bags heavy with sand as we passed along stories of Noah years. I live on the

floodplain with the floods of 1965, 1993, and 2001 still fresh in memory and in my living room and basement. I juxtapose those recollections alongside environmental concerns resulting from engineering the river (extending locks, building flood walls, dredging) alongside kids' excuses to teachers: "My homework fell out of the boat on the way to school!" Although our meager efforts represent among the least effective forms of controlling a river, my session will feature reflections upon more devastating measures and the complexities they entail.

Fischer, Katherine M., Clarke College, Dubuque, Iowa; Varley, Jane, Muskingum College, New Concord, Ohio, USA

O-033 Reading the River. *(Oral Session 8)*

Abstract: How are rivers portrayed in literature? What social, economic, and political messages do they carry within these texts? Jane Varley and Katherine Fischer will reference river texts by Mark Twain, Ann Zwinger, Wendell Berry, Rachel Carson, and others in examining how artistic texts advance justice and environmental concerns.

Flotemersch, Joseph E., U.S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, Ohio, USA, Blocksom, Karen A., U.S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, Ohio, USA, Johnson, Brent, U.S. Environmental Protection Agency, National Exposure Research Laboratory, Cincinnati, Ohio, USA

O-034 Development of a Large River Bioassessment Protocol (LR-BP) for Macroinvertebrates: Pilot Results from Midwestern Rivers in the United States. *(Oral Session 37)*

Abstract: We conducted a study using an experimental macroinvertebrate sampling method that was designed to overcome limitations of several field methods currently in use. Our objectives were to: (1) determine the appropriate number of sampling points needed; (2) determine an appropriate laboratory subsample size; and (3) examine how varying reach length affects sample results. For 6 reaches in each of two large rivers, we sampled macroinvertebrates on both banks at 12 transects separated by increasingly larger distances (maximum distance equal to 40 times the wetted width) using a multi-habitat, semi-quantitative technique. Results were compared based on values for nine benthic macroinvertebrate assemblage metrics. Monte Carlo simulations indicated that a representative sample of the assemblage was collected by sampling both banks at 6 transects. While a reach length of 500-m is suggested for general bioassessment activities, analysis of the effects of distance between transects showed that there is flexibility that can accommodate different data quality objectives (e.g., documenting the effectiveness of restoration activities). We recommend that the field method be coupled with a minimum fixed laboratory subsample size of 300 organisms for bioassessment purposes, with the recognition that a subsample size of 500 organisms may be needed to meet the objectives of more rigorous studies. It is likely this approach will over-sample sites of uniform composition, but the goal was to develop a robust sampling protocol that would perform well across sites of differing habitat composition and disturbance type. Performance characteristics of the method also will be discussed briefly.

Foley, Jonathan, University of Wisconsin-Madison, Madison, Wisconsin, USA

O-035 Global Consequences of Land Use: Connecting Issues, Connecting Scales. *(Oral Session 14)*

Abstract: Land use has generally been considered a local environmental issue, but it is becoming a force of global importance. Worldwide changes to forests, farmlands, waterways and air are being driven by the need to provide food, fiber, water and shelter to over six billion people. Global croplands, pastures, plantations and urban areas have expanded in recent decades, accompanied by large increases in energy, water and fertilizer consumption, plus significant losses of biodiversity. Such changes in land use have enabled humans to appropriate an increasing share of the planet's resources, but they also potentially undermine the capacity of ecosystems to sustain food production, maintain freshwater and forest resources, regulate climate and air quality, and ameliorate infectious diseases. We face the challenge of managing tradeoffs between immediate human needs and maintaining the capacity of the biosphere to provide goods and services in the long term. In this presentation, we will review recent trends in global land use and the implications for the sustainable use of the biosphere and the future of the larger Earth System. Furthermore, we will also present a possible means for connecting these scientific results to global decision-makers. While impressive gains have been made in understanding the earth as a "whole system," through sophisticated computer modeling techniques and satellite-based imagery, there is still a large "disconnect" between global, top-down views of changing environmental conditions, and the local, bottom-up perspective of how humans live in a changing environment. Here we will describe a new effort underway to build an "Earth Collaboratory" – an interface between global environmental scientists and local experts drawn from all over the world. Building on new Internet-based technologies, such as the "wiki" collaborative interface

(e.g., Wikipedia.org) and collaborative mapping tools (e.g., Google Earth), the Collaboratory will help bridge gaps between global and local, and between science and practice.

O-036 Withdrew

Frank, Nancy, University of Wisconsin - Milwaukee, Milwaukee, Wisconsin, USA

O-037 New Directions in Wisconsin Water Policy: The Impacts of Waters of Wisconsin. *(Oral Session 26)*

Abstract: The Waters of Wisconsin (WOW) initiative forged new directions for thinking about water policy in Wisconsin. It also forged new relationships and networks. Several years after our formal meetings have ended, how are the ideas and relationships that were formed then making a difference in how people are working on water policy issues today? This paper will draw on the experiences of the direct participants in the WOW initiative to explore how our work together, looking at the big picture, is (or is not) having an effect on how we approach our day-to-day work.

Fremling, Calvin R., (emeritus), Winona State Univeristy, Winona, Minnesota, USA

O-038 Development of the Mississippi River: 600 Million Years B.P. Through 1860 A.D. *(Oral Session 15)*

Abstract: The Mississippi River is the largest and longest river in North America. From its source in northern Minnesota, it wanders for 856 km as a young, often rocky stream within Minnesota. Below Minneapolis, it flows 2,826 km southward through a cross section of America's agricultural heartland as a much older, sediment-choked river along the borders of Minnesota and nine other states before it enters the Gulf of Mexico 144 km south of New Orleans. South of Minneapolis, successive flows of glacial melt water during the past 1.6 million years incised the river's massive valley through an ancient sedimentary rock plateau. At the mouth of the Ohio River, the Mississippi enters the Mississippi Embayment, a broad, deep, sediment-filled, northward extension of the Gulf of Mexico. After 14,000 B.P., Paleoindians rapidly expanded their range throughout North America, modifying the landscape and establishing trade networks via the Mississippi and its tributaries. Prairies and savannas dominated most of the Mississippi Basin, primarily due to climate, prairie fires and the grazing of elk and bison. Old world diseases, brought to North America by Europeans in the 1500s, devastated Indian populations. Spaniards established the existence of the Mississippi River, approaching it from the south and west in a quest for gold. The French approached the Mississippi Basin from the north and east, explored its length and established the fur trade. The English and their colonists came across the Allegheny Mountains, were active in the fur trade, and settled the basin. The fur trade changed the map of North America, and it left its imprint on the Mississippi River. Profits from the fur trade financed world-shaping wars involving Great Britain, France, and Spain. Between 1835 and 1915, virtually all of the usable white pine and Norway pine logs in northern Minnesota and Wisconsin were floated to sawmills. Poor farming practices beginning in the 1850s caused disastrous soil erosion that caused ongoing sedimentation problems in the Mississippi. The steamboat era on the Mississippi began in the 1820s and reached its zenith in the 1850s and 1860s, but railroads killed the steamboats. Efforts failed to revitalize the steamboat industry by channelizing the river during the 1878-1920 period. The modern river is partially impounded by 29 navigation locks and dams between St. Paul and St. Louis, ensuring a 2.7 m navigation channel for diesel-driven towboats whose barges transport diverse bulk cargoes like grain, fertilizer, molasses, coal, and petroleum products. Most of the locks and dams were constructed during the 1930s.

Fu, Chun, University of Nanchang, Jiangxi Province, P.R. China, Liu, Qi, University of Nanchang, Jiangxi Province, P.R. China

O-039 The Flood History and Its Water Culture Along the Gan River in Poyang Lake Basin in China. *(Oral Session 43)*

Abstract: It is well known that most of historic civilizations and cultures originated from famous and great rivers. It has been thousands of years that rivers were playing a great role in human history. In China, Yellow River and Yangtze River that are glorified as the Mother Rivers of the whole Chinese, fostered a continuous civilization and culture. In this culture, rivers are not always in a kindly mood. They always flood into houses and destroy everything they meet. So there are lots of story telling how Chinese fight against floods. Among those heroes, Yu, who is the most famous one, waved a war against floods five thousand years ago. Besides, there is great number of fairy tales telling the relationship and communication between people and water. Gan River is one of the branches of the Yangtze River. At the headstream of Gan River, there is a city, Ganzhou, with more than 2100 years of history. It is said that there was a giant tortoise underneath Ganzhou. Because the giant tortoise could float on water, the city had never been flooded till one day a wide

military counselor, Liu Bowen, nailed the tortoise's legs up into the earth and flooded this city to conquer it. Along the Gan River, another famous city, Nanchang, is located in Poyang Lake basin. On the northeast of Nanchang is the largest fresh-water lake of China, named Poyang Lake. Nanchang used to be called Hongdu that means the center of flooded area. We can imagine how many lakes and rivers surround this city. The residents of Nanchang were always afraid that the city would flow away with water. So they put a huge nail into the earth to fix the city. Nowadays, you can still see the bottom of the huge nail, Shengjin Tower, that has been standing beside the Gan River, safeguarding the city for more than 1000 years. Water affects life and culture continuously. Humans have never stopped taking advantage of water to make our culture better and to make our life better.

Fuerstenberg, Robert R., King County Department of Natural Resources and Parks, Seattle, Washington, USA, Konrad, Christopher., U.S. Geological Survey, Tacoma, Washington, USA, Butler, Terry., King County Department of Natural Resources and Parks, Seattle, Washington, USA, Bergeron, Karen., King County Department of Natural Resources and Parks, Seattle, Washington, USA, Lucchetti, Gino., King County Department of Natural Resources and Parks, Seattle, Washington, USA

O-040 Historical Ecology and the Recovery of Endangered Salmon in Pugert Sound, Washington, USA. *(Oral Session 16)*

Abstract: Over the last 150 years, alterations in the freshwater, estuarine, and marine habitats in Puget Sound, Washington, have been responsible for much, if not most, of the decline in the abundance and diversity of salmon populations to levels where Chinook salmon are now listed under the Endangered Species Act. Our basic task for salmon recovery is to preserve as much of the evolutionary potential of these populations as possible, to ensure their survival into the future. To that end, the recovery of Chinook salmon rests on our knowledge of an historic template when salmon populations were abundant, diverse, and well-distributed, presumably robust to environmental and demographic threats. With such a template, we can discern the ecological and demographic gap between the past and the present, and between the present and the recovered future. Historical reconstructions of riverine and estuarine environments, of salmon population attributes, and of socio-cultural events are necessary to understand this template, the rate and magnitude of change, and the ecological limits imposed by this change. The examples in this paper illustrate the usefulness of geomorphic and hydrologic reconstructions, population reconstructions, and historic social and cultural knbowledge to the development of an ecological template. This template necessarily informs our recovery goals, our objectives and management actions, and our confidence in achieving recovery of endangered salmon.

Galat, David L., U.S. Geological Survey, University of Missouri, Columbia, Missouri, USA, Jacobson, Robert B., U.S. Geological Survey,Columbia, Missouri, USA

O-041 Re-engineering the Missouri River: Integrating Sound Science into River Rehabilitation. *(Oral Session 9)*

Abstract: The 3,768 km long Missouri River, first observed by Lewis and Clark in 1804-06, was highly braided with numerous sandbars and islands, shifting channels, high turbidity, and flooded frequently. Today, the upper one third remains largely unregulated, the middle one third is impounded behind six mainstem reservoirs, and the lower one third is flow-regulated, channelized, and largely disconnected from its flood plain. Eleven fishes are imperiled and the least tern, piping plover, and pallid sturgeon are listed under the Endangered Species Act. Events catalyzing 21st century rehabilitation include authorization of a habitat mitigation program (1986); catastrophic flooding during the 1990s; a National Research Council Report on recovery prospects (2002); a U.S. Fish & Wildlife Service jeopardy Biological Opinion (BiOp, 2003) to the U.S. Army Corps of Engineers (Corps); and revision of the Corps reservoir water-control master manual (2004). Mitigation and BiOp compliance programs include restoration, creation, and acquisition of channel-flood-plain habitats, unbalanced reservoir regulation to benefit fishes and birds, propagation of listed birds and fishes, flow naturalization, and an adaptive management, science-based research and monitoring program. Science elements include a Habitat Assessment and Monitoring Program, a Pallid Sturgeon Monitoring and Assessment Program, an evaluation of Sturgeon Responses to Flow Modifications, and a Comprehensive Pallid Sturgeon Research Program. Progress is underway to empower a stakeholder-based oversight group, the Missouri River Recovery Implementation Committee (MRRIC), to coordinate rehabilitation programs. The ability of science to contribute to timely, cost-effective, and adaptive Missouri River rehabilitation will require an accountable, objective-driven and transparent process, a predictable funding stream, adequate independent review, and widespread public support.

Gao Jixi, Chinese Research Academy of Environmental Sciences, Beijing, China, Xianghao Zhong, Chinese Academy of Sciences, Chengdu, China, De Su, Chinese Research Academy of Environmental Sciences,

Beijing, China

O-042 Eco-zoning and Evaluation on Eco-function of Yangtze River in China. *(Oral Session 14)*

Abstract: The Yangtze River is the largest long river in China and the third largest in the world. The length of the Yangtze River is 6,300 kilometers, and total drainage area is 1.8 million Km^2. It is endowed with unique and abundant biological resources due to its varied relief and landscape. Natural ecosystems of the basin are among the most biodiversity rich areas in China and well-known world wide for its rich species, various habitats and enormous productivity. Guided by the theories of eco-economics, a primary eco-region division is carried in the upper reaches of the Yangtze River basin for the purpose of conservation and restoration of the ecosystem in the region. Seven types of eco-function regions are included in the basin. It is (1) eco-region of green and high efficient agricultural ecosystems in Chengdu Plain; (2) eco-region of high efficient agro-forestry ecosystems with functions of water and soil conservation in purple soil hilly areas of the Sichuan Basin; (3) eco-region of watershed shelter forests in the mountainous region around the Sichuan Basin; (4) eco-region of agro-forestry ecosystems with functions of water and soil conservation in the Yunnan-Guizhou plateau; (5) eco-region of natural forests and water conservancy forests with functions of water retention, sediment control and disaster prevention in the high mountains and deep valleys ;(6) eco-region of natural forests and grasslands in plateau mountains and river valleys; and (7) eco-region of grasslands in the plateau in the headwater area of the Yangtze River.

Gavin, Megan., U.S. Environmental Protection Agency, Chicago, Illinois, USA

O-043 Environmental Education at the Environmental Protection Agency (EPA). *(Oral Session 5)*

Abstract: EPA takes a high-level approach to environmental education, focused less on environmental education fieldwork, and more on supporting other organizations and on statewide capacity building. The presentation will provide an overview of the major components of EPA's program, using examples of successful partnerships EPA has been involved in. EPA has seven environmental education priorities: capacity building, education reform, community issues, health, teaching skills, career development and research. One way EPA supports these priorities is through the Environmental Education and Training Partnership, a 5-year cooperative agreement with a consortium headed by the University of Wisconsin-Stevens Point. This program delivers environmental education training and support to education professionals across the United States. Nationally, EPA's environmental education program awards between $2-$3 million to state and local governments, tribes, colleges and universities, school districts, non-profit organizations and non-commercial educational broadcasting entities to enhance the public's awareness, knowledge, and skills to help people make informed decisions about environmental issues. Through the President's Environmental Youth award program, EPA recognizes young people across America who demonstrate their commitment to the environment. EPA's Megan Gavin has been working in the environmental education program for the past six years, the past four have been as coordinator for the Midwest region of EPA.

German Historical Institute, Washington, D.C., USA

O-044 World Rivers in History. *(Oral Session 2)*

Abstract: Taking examples from four regions of the world—major rivers in Africa, Asia, Europe, and North America—the panelists will explore differing approaches to the history of rivers. The session is sponsored by the German Historical Institute (GHI) in Washington, D.C. International Environmental History and comparative history are two of the GHI's areas of focus. Presenters include Mark Cioc, University of California, Santa Cruz, USA; Meredith McKittrick, Georgetown University, USA; Donald Worster, University of Kansas, USA; and Dorothy Zeisler-Vralsted, Eastern Washington University, USA.

Girel, Jacky M., University Joseph Fourier & C.N.R.S., Grenoble, France

O-045 The Metamorphosis of European Alpine Riverine Landscapes During the 19th Century: From Wild Braided Rivers to Fruitful Plains. *(Oral Session 7)*

Abstract: In the Alps, at the end of the 18th century, major water courses such as the Rhine, Rhône, Danube and Po rivers and their main tributaries were still characterized by large braided-anastomosed floodplains in which the river had built a complex network of changing channels and islands since the Little Ice Age. This "natural" hydrosystem was used by human rural societies as commons producing essentially pastureland, fire wood, green manure and more rarely, gravel and sand. During high flow periods (from mid-April to mid-July), recurrent floods did not allow the development of agriculture and were responsible for marshy fevers. In Alpine valleys, the population development could only occur through the deforestation of adjacent hill slopes or by colonization of the floodplain. Hill slope deforestation was causing transfers of huge volumes of water and matter from the slopes to the valley which had major consequences on the floodplain such as an increase in flooding episodes and an instability of landforms. The potential use of floodplains as

productive farmland was therefore closely dependent on engineering developments. As a result, since the end of the 18th century, governments of Alpine countries encouraged colossal projects managed in order to constrain the water and matter flows of the rivers within a single thread channel. In this presentation, using the examples of Alpine rivers flowing in piedmont zones of France, Switzerland, Italy, Austria and Germany, I will show how the cumulated impacts of engineering developments aimed at (i) channelizing rivers for navigation and protection against flooding, (ii) reclaiming alluvial soils for agriculture, and (iii) draining the wetlands for malaria eradication, have dramatically changed wild "natural" braided floodplains into fruitful ploughed plains characterized by a new landscape pattern designed by man. At present, these rivers need to recover wider channel beds mainly in order to prevent the catastrophic impacts of future flooding episodes. As a consequence, many river-widening projects have been proposed, and it is hoped that many Alpine rivers will recover small parts of their old braided natural corridor and consequently their ecological integrity.

Goggans, Jan, E., University of California, Merced, Merced, California, USA

O-046 The Rivers at the Heart of (the Valley) of the World. *(Oral Session 39)*

Abstract: Walking along the faux pioneer sidewalks of Old Sacramento, Sacramento's architectural (and commercial) homage to its Gold Rush history, Joan Didion realizes that "the entire enchantment" under which she lived her life has, with the hollow sound of her footsteps, disappeared. The ghosts who kept Sacramento's history framed in nostalgia are gone for her, and, significantly, one thing she loses is the Sacramento River: "the rivers I had written to replace the rivers I had left." For Didion, the great Sacramento River figures into a complex ideological and linguistical scheme of gender, power, and history, all of which act as a fulcrum that turns California, and Californians. Years before her books *Play It As It Lays* and *Run, River* were published, another California writer, John Steinbeck, included in *The Grapes of Wrath*, his novel of migrant agricultural labor, a crucial scene on the Colorado River. Steinbeck's work realizes the physical significance of the water on which California's crops relied, and he saw its parallel with the workers themselves, men and women who were as manipulated and exploited as the river systems on whose banks they often camped. As would Didion, Steinbeck cast that metaphor in gendered terms, giving Ma Joad a speech that postulates the deep-seated connection between people and landscape that is at the heart of California's cultural landscape: "Man, he lives in jerks—baby born an' a man dies, an' that's a jerk—gets a farm an' loses his farm, an' that's a jerk. Woman, it's all one flow, like a stream, little eddies, little waterfalls, but the river, it goes right on." Both writers produced works whose significance relies to a large extent on their understanding and interpretation of California's complicated dependence on rivers it both manipulates and remains at the mercy of. In this presentation, I will look closely at the role of California's great rivers, the Sacramento and the Colorado, in the work of its two best known writers, authors whose works have shaped, and been shaped by, the "California Dream," and all that dream has signified to its inhabitants and its geography.

Greenlee, David D., U.S. Geological Survey EROS, Sioux Falls, South Dakota, USA

O-047 GIS for the Gulf: A Geographic Reference Database for Hurricane Affected Areas. *(Oral Session 34)*

Abstract: GIS for the Gulf (GFG)is a Geographic Information System (GIS) database for areas of Louisiana, Alabama, Mississippi and Texas that were affected by Hurricanes Katrina and Rita. GIS data were collected by USGS and contractors for as much of the area as possible, resulting in partial coverage for the priority areas. GFG is built on the GIS for the Nation Data Model, a set of 14 themes (and hundreds of sub-themes). The USGS provided transportation, boundaries, hydrography, and elevation from The National Map, using sources of nationally consistent data (e.g. National Hydrography Dataset, National Elevation Dataset). The GFG data model was further populated by subjecting partner data in native form to an Extract, Transform, and Load (ETL) procedure that is repeatable and that results in a single consistent data model.

Gresens, Nicholas J., Indiana University-Bloomington, Bloomington, Indiana, USA

O-048 Re-appropriating Rivers: The Creation of Place in Strabo's Geography.*(Oral Session 43)*

Abstract: Two thousand years ago an educated Greek, Strabo of Amaseia, wrote a geography of the inhabited world under the auspices of the first two Roman emperors. Unlike other geographers Strabo cared little for mathematical geography. Instead, Strabo created what has recently been described as a "place-based, cultural-historical model of the world." Within this cultural-historical geography, rivers play a prominent role. While rivers loom large in Greek traditional literature, this paper explores how Strabo re-appropriates rivers for his geography. The first part of this paper outlines how rivers help to create place. Katherine Clark (1999) states that place is created out of abstract space through human action; i.e., place is lived-in space, and this paper argues that space also becomes place through unique physical characteristics, like

rivers. Landmasses become regions when bounded by rivers; cities become distinct when placed on a river; a place becomes truly special because of its river, as with Egypt. Thus rivers still function much as they did in Greek myth—"The rivers were characters in the myths…as well as essential features of the scenery." This paper then examines the affects of this creation of place in his geography. Strabo intended to write a useful treatise for governing an (almost world-wide) empire effectively. Rivers serve as a stable backdrop for understanding world and regional history and the empire's broad diversity. At the same time Strabo is also writing a philosophical treatise, and rivers serve as an ideal model for the contemplation of stability and change in the world. This exploration of rivers in Strabo helps both to better understand how one ancient geography functioned and to reflect on how description of place affects our own understanding of an ever-changing world.

Gutreuter, Steve, U.S. Geological Survey, La Crosse, Wisconsin, USA

O-049 Fish Tales of the Past, Present, and Future of the Upper Mississippi River Ecosystem. *(Oral Session 4)*

Abstract: The Upper Mississippi River (UMR) has been extensively modified to enhance navigation, minimize flood damage and generate electrical power. The major modifications preceded the development of even a vague understanding of the ecological services provided by the UMR. Therefore ecological consequences of those modifications can only be inferred from meager records or retrodicted from current conditions. The low-head dams have restricted the ranges of some fishes. For example skipjack herring are now rare above Lock & Dam 19. However those dams also eliminated the need for extreme channel constriction, thereby leaving the river plan largely unchanged other than the addition of shallow impounded areas. Fish biodiversity has remained stable, and species that were likely abundant prior to modification are still abundant today. Commercial navigation has some adverse effects on certain fishes, including partial denial of habitat and mortality, but we do not seem to have lost many options. Therefore the important question is not "What has been lost?" but rather "How can ecological services, including fish production, be preserved and even enhanced as the navigation capacity of the UMR is expanded?" Ongoing restoration efforts have focused on habitat rehabilitation and enhancement. However habitat may not be limiting. For example, current scientific evidence indicates that winter habit does not presently limit the abundance of certain important fishes in much of the UMR. Science and management have not yet developed essential knowledge about the factors that limit important ecological services and how best to enhance them. Efficient river ecosystem management requires both a new process-oriented science that develops better capabilities to predict how the production of ecological services responds to alternative management tactics and river management that treats those tactics as experiments.

Hajic, Edwin R., Pathfinder CRM LLC, Santa Fe, New Mexico, USA

O-050 EuroAmerican Settlement, Increased Sediment Yield to the Illinois River, and a Geomorphic Remediation Solution. *(Oral Session 36)*

Abstract: The Illinois River, Illinois, is a major commercial waterway in the Upper Mississippi River basin that, following EuroAmerican settlement, has been hampered by increased sediment yields from tributaries. The increased sediment influx has been attributed to the impact of agricultural practices in the productive uplands of west-central Illinois. For at least the last 2000 years, broad Illinois Valley floodplains underwent remarkably little geomorphic change as tributaries debouched onto alluvial fans or coursed through intermittent backwater lakes in natural leveed channels before entering the Illinois River. However, channelization of the lowest tributary reaches directly across leveed floodplains to the river is a major under-recognized factor that leads to increased sediment yields. Channelization affectively shortened tributary courses and steepened gradients causing stream incision to be propagated upstream, thus increasing tributary bank destabilization and sediment yields. Alluvial fans, the natural storage facilities of tributary sediments, are bypassed as active depositional sites as sediment-laden floodwaters are conveyed directly to the Illinois River. Dechannelization of the tributaries, reoccupation of the longer courses through flood basins, and restoring the function of alluvial fans would realign the geomorphic trajectories of tributaries more towards what they were attempting to accomplish geomorphically prior to channelization. These downstream adjustments would trigger a healing process with a headward vector that would be propagated upstream into the watersheds. Tributaries would begin to backfill, banks would stabilize, and sediment yields would decrease.

Hassan, Fekri A., Institute of Archaeology, University College London, London, United Kingdom

O-051 The Nile and Civilization. *(Oral Session 29)*

Abstract: The Nile is Egypt's life line. Descending into Egypt from Equatorial Africa and Ethiopia, the Nile, from the Cataracts near Aswan in the South to the reaches of Cairo in the North, forms a narrow floodplain

snaking through a barren desert, the easternmost margin of the Sahara. Beyond Cairo and until it reaches the Mediterranean coast, the river flows in two branches. Many more branches existed a thousand years ago forming an extensive deltaic plain. Their disappearance is only one of the many changes in the course and flooding regime of the river. Climate change influencing the volume and timing of the summer floods that bring water and fertile mud to the banks of the Nile every year has been crucial in the evolution of both the natural and cultural landscapes of Egypt. Congregating along the margins of the Nile Valley, as droughts gripped the eastern Mediterranean, the inhabitants of the Nile were introduced to farming and herding 7000 years ago. Once they began to depend on farming for their livelihood, the Egyptians were inexorably linked to the vagaries of Nile floods. They responded to crises with ingenuity manifesting the resilience that has so far enabled humanity to survive under daunting conditions. The cultural responses to droughts are astounding. From collaborative strategies among communities to buffer against food shortages that led to the rise of a nation state, to the construction of extensive waterworks to combat water scarcity, the responses to variations in Nile floods reveal a remarkable case study of rivers and civilization.

Helfield, James M., Western Washington University, Bellingham, Washington, USA, Capon, Samantha J., Monash University, Clayton, Victoria, Australia, Nilsson, Christer, Umeå University, Umeå, Sweden, Jansson, Roland, Umeå University, Umeå, Sweden, Palm, Daniel, Swedish University of Agricultural Sciences, Umeå, Sweden

O-052 Effects of River Restoration on Biodiversity in Riparian Plant Communities. *(Oral Session 23)*

Abstract: Fluvial processes such as flooding and sediment deposition play a crucial role in structuring riparian plant communities. In rivers throughout the world, these processes have been altered by channelization and other anthropogenic stresses. Yet despite increasing awareness of the need to restore natural flow regimes for the preservation of riparian biodiversity, few studies have examined the effects of river restoration on riparian ecosystems. In this study, we examined the effects of restoration in the Ume River system, northern Sweden, where tributaries were channelized to facilitate timber floating in the 19th and early 20th centuries. We compared riparian plant communities adjacent to channelized stream reaches with those adjacent to reaches that had been restored 3 – 10 years prior to observation. Species richness and evenness were significantly enhanced at restored sites, as were flood frequencies. These findings suggest that river restoration and associated changes in fluvial disturbance regime may be effective in enhancing riparian biodiversity. Given that riparian ecosystems tend to support a disproportionate share of regional species pools, these findings have potentially broad implications for biodiversity conservation at regional or landscape scales.

Hendrickson, Jon, S., U.S. Army Corps of Engineers, St. Paul, Minnesota, USA, Powell, Donald L., U.S. Army Corps of Engineers, St. Paul, Minnesota, USA

O-053 Ecosystem Restoration: Projects, Lessons Learned, Criteria. *(Oral Session 23)*

Abstract: Ecosystem restoration on the Upper Mississippi has included actions such as island creation, water level management, secondary channel restoration, backwater dredging, and shoreline stabilization. Tributary restoration and fish passage may be added to the action list in the future. Experience and lessons learned from over 20 years of restoration, through the Environmental Management Program (EMP), are used to improve project criteria and designs. These criteria and designs will be optimized based on continued monitoring through programs like the Navigation and Ecosystem Sustainability Program (NESP) and the EMP. Integration of navigation system operation and maintenance with ecosystem restoration is required to optimize river management decisions and, in some cases, obtain dual benefits. For example, pool drawdowns, a popular ecosystem restoration action, require advance dredging in the navigation channel for commercial traffic. Beneficial use of this dredge material, such as island construction in backwater areas, could be done to improve habitat even more. Another example is tributary restoration, which could reduce the sediment load from the tributary to the Mississippi River, greatly reducing navigation channel dredging and improving water quality. Constraints imposed by commercial and recreational navigation needs, existing infrastructure, society's resistance to change, and funding limitations prevent restoring the river to natural conditions during typical planning horizons (50 - 100 years). However, many actions can be implemented to improve the condition of the ecosystem despite these constraints. These actions, in most cases, include a partial restoration of natural conditions.

Hines, Randy K., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

O-054 U.S. Geological Survey, Upper Midwest Environmental Sciences Center Communication Program as a Model for Environmental Education. *(Oral Session 5)*

Abstract: The U. S. Geological Survey (USGS), Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, is a federal research center that collects, monitors, analyzes, and provides scientific understanding about biological resource conditions, issues, and problems. The UMESC provides information and tools to decision makers at all levels of government--and citizens in all walks of life--in order to address pressing societal issues. On a local, regional and national scale, science communication and cooperation with partners and customers is a vital part of our mission. The UMESC strives to provide a variety of advanced educational opportunities for the public and our partners. During the summer, UMESC hosts a two-day Environmental Explorers Camp for fourth through sixth grade students to learn about the Mississippi River ecosystem. Students have the opportunity to volunteer, job shadow or participate in internships. Teachers have the option to bring their classes to visit UMESC for tours, invite scientists to classrooms as guest speakers or use existing databases for classroom instruction. Universities can benefit by forming partnerships with UMESC to provide opportunities for students to use the Center facilities, serve as interns in our research, and conduct graduate and post-doctorate programs. Hosting annual UMESC open houses for the general public, speaking to local citizen groups, and participating in environmental awareness events are also other parts of being a true civic partner.

Hokanson, Drake, Winona State University, Winona, Minnesota, USA, Downs, Darrell, Winona State University, Winona, Minnesota, USA

O-055 University on the River: A Model for Interdisciplinary Undergraduate Education. *(Oral Session 10)*

Abstract: Winona State University's new University on the River Program is designed to provide experiential learning for interdisciplinary undergraduate education. The Mississippi River offers a vast array of possible field experiences for students engaged in the sciences, mathematics, social sciences and the liberal arts. One dimension of this practical learning experience in the social sciences and mathematics falls within the realm of politics and public policy. To witness first-hand the complexities of the river environment and at the same time to study the opposing views on how government should manage the resource and to study the data collected on the river environment and its application to policy provides a rare learning experience. This experience takes the study of policy making design out of the board room where public decisions are usually made today and puts it in the field. In terms of the sciences, students will be given the opportunity to design, conduct, and analyze data from small experiments that they will carry out while on the river. The role statistics plays in scientific inquiry will be taken from classroom and textbook into the real world. Following two weeks of intensive classroom preparation, students will board WSU's River Explorer for one week of field research in water resource management including stops to study the physical dimensions of the river and site visits to communities of interest that possess alternative views on river management. In its essence, this new program is an experiment in engaging undergraduates in a relevant and an exciting course of study designed to strengthen their preparation for a more meaningful university experience.

Hooper, Bruce, Southern Illinois University, Carbondale, Illinois, USA, Flotemersch, Joseph E., U.S. Environmental Protection Agency, Cincinnati, Ohio, USA

O-056 The Role of Bioassessment and Monitoring in Overall Basin Management. *(Oral Session 37)*

Abstract: Integrated river basin management involves decision-making by many stakeholders and over often competing jurisdictions. There is increasing international endorsement of an integrated approach to river basin management, in which collaboration and an adaptive management process is used. Measuring the effectiveness of this approach is a challenge. The condition and trend in quality of the biophysical environment is often used as a measure of success of management. In this paper we review the role of bioassessment in overall integrated river basin management and provide a template of how it supports adaptive management. We also provide a template of indicators of performance of river basin management, in terms of organizational performance, and provide key benchmarks, as identified in the case of the Delaware River Basin. Finally we discuss how both sets of indicators, bioassessment and organizational performance, fit within an overall basin management strategy.

Houser, Jeffrey N., Gray, Brian R., Rogala, Jim T., U.S. Geological Survey Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

O-057 Nutrients, Chlorophyll, and Suspended Sediment in the Upper Mississippi River: Temporal and Spatial Variability. *(Oral Session 33)*

Abstract: Substantial variability in time and space is a defining characteristic of large, floodplain rivers. We investigated temporal and spatial variation in a group of limnological variables related to river primary production using data from the Upper Mississippi River (UMR) Long Term Resource Monitoring Program (LTRMP). We included nutrient, chlorophyll a, and suspended sediment concentrations from 5 study

reaches of the UMR measured quarterly from 1994 to 2005. The limnological data were derived from channel and off-channel areas within each study reach, and the 5 study reaches were distributed over a 1300 km stretch of the UMR from Redwing, Minnesota to Cairo, Illinois. We found that total phosphorus (TP) and total suspended solids (TSS) increased moving downriver among the study reaches. Total nitrogen (TN) and chlorophyll varied among study reaches but did not exhibit downstream increases. Chlorophyll and TP were generally higher in off-channel areas than in channel areas, indicating higher algal standing stock and potentially higher rates of production in off channel areas. TN was usually higher in the channel areas than in off channel areas, probably reflecting the relatively high rates of dinitrification that occur in off-channel areas. TN concentrations were generally highest in spring and lowest in fall. In the northern study reaches, highest TP concentrations generally occurred in summer and lowest concentrations in spring. In the southern study reaches, highest concentrations were seen in spring and lowest in winter. Seasonal patterns in chlorophyll varied among study reaches. These spatial and temporal patterns in limnological characteristics of the UMR provide important context for understanding the physical and biological processes that structure the UMR and similar large, floodplain rivers.

Howard, Erica A., Center for Sustainability and the Global Environment, University of Wisconsin-Madison, Madison, Wisconsin, USA, Coe, Michael T., Woods Hole Research Center, Woods Hole, Massachusetts, USA, Foley, Jonathan A., Center for Sustainability and the Global Environment, University of Wisconsin-Madison, Madison, Wisconsin, USA, Costa, Marcos Heil, Federal University of Vicosa, Vicosa, Minas Gerais, Brazil

O-058 Implications of Amazon Basin Land Use/Land Cover Change for Aquatic Ecosystem Biogeography and Associated Riverine CO_2 Fluxes of Amazonia. *(Oral Session 12)*

Abstract: Rivers integrate the ecology, biogeochemistry, and hydrology of entire basins; they materially connect uplands to lowlands and headwaters to ocean. This property led Degens et al. (1991) to call rivers "the arteries of continents," and the Amazon River certainly deserves this title. Twenty percent of the world's runoff flows through rivers of the Amazon Basin, which spans much of South America and covers 6.7 million square kilometers. This water supports a diverse array of aquatic ecosystems, plays a major role in the global climate system and carbon cycle, and provides health, life, and livelihood for the millions of people who live there. All of these seemingly disparate services are bound together by their mutual dependence on the dynamics of Amazonia's aquatic environment. While many Amazonian aquatic ecosystems have been carefully studied, we still do not have a systematic understanding of large-scale controls on the distribution of these ecosystems in space and time and their sensitivity to large-scale environmental changes. This knowledge gap hinders our ability to envision the tangible consequences – for ecosystems and for people – of regional climatic variation and land use from ongoing development in Amazonia. We use land surface models combined with remote sensing imagery, historical datasets and future land use scenarios to explore the implications of land cover change (1980-2030) for aquatic ecosystem biogeography and function - particularly water and carbon cycling. We apply a physically based numerical modeling system to simulate hydrological fluxes throughout the basin as a function of vegetation cover and time-transient climate. This modeling system includes an ecosystem land surface model (IBIS) and a Terrestrial Hydrology Model with Biogeochemistry with dynamic floodplain (THMB). We discuss our efforts to estimate aquatic ecosystem extent and CO_2 efflux from the Amazon River system for future scenarios of land use in the Amazon Basin.

Howarth, Robert. W., Cornell University, Ithaca, New York, USA

O-059 Human Alteration of the Nitrogen Cycle in Large Watersheds: Causes, Consequences, and Steps toward Solutions. *(Oral Session 29)*

Abstract: Nutrients are the largest pollution problem in the coastal waters of the United States, and increased inputs over the past several decades have resulted in the degradation of 2/3rds of the nation's coastal rivers and bays. Effects include hypoxia and anoxia, increased incidences of harmful algal blooms, degradation and alteration of habitat and food-web structure, and loss of biotic diversity. Although phosphorus can contribute to this degradation, the major culprit is nitrogen in most coastal marine ecosystems (in sharp contrast to freshwater lakes, where phosphorus pollution is of greater concern). Nitrogen is far more mobile in the environment than is phosphorus, and management practices that often were designed to control phosphorus pollution sometimes fail to recognize the greater mobility of nitrogen. Human activity has roughly doubled the creation of reactive, biologically available nitrogen on the land masses of the Earth. Regional variation in this increase is great, and some large rivers have seen little change, while in other rivers, nitrogen fluxes have increased by 10- to 15-fold or more. Much of this increase has occurred over the past few decades. Increased use of synthetic nitrogen fertilizer and increased intensity of meat production have led the change globally and in many regions (including the Mississippi River basin), but atmospheric deposition of nitrogen from fossil-fuel combustion also contributes globally and is the largest single source

of nitrogen pollution in some regions (such as much of the northeastern United States). Because of this regional variation in the sources of nitrogen pollution, management approaches need to be tailored to particular regions. Technical solutions for reducing nitrogen pollution from all sources exist, and generally at reasonable cost. However, effective implementation of solutions for non-point sources of nitrogen pollution has been spotty at best in most watersheds.

Hultman, Donald G., U.S. Fish and Wildlife Service, Winona, Minnesota, USA

O-060 Tenuous Coexistence: Managing a National Wildlife Refuge on a Multiple-use River. *(Oral Session 15)*

Abstract: Established by an Act of Congress in 1924, the 240,000-acre Upper Mississippi River National Wildlife and Fish Refuge has played a critical role in safeguarding a major portion of the ecological values of a large river floodplain. The Refuge, like the Mississippi River, has been witness to development and management cycles in its 80-year history, ranging from simple preservation, a period of enhanced productivity for some species, ecological decline, and the current period of active restoration through the Environmental Management Program and other collaborative efforts. A recent multi-year planning effort to produce a Comprehensive Conservation Plan for the Refuge has heightened awareness of the difficulties in managing a dominant-use area (refuge for wildlife) in the context of a multiple-use river system (commercial navigation and recreation). The presentation examines these cycles, the failures and successes of restoration, and the political and sociological landscape that influence management direction of this large and heavily-used national wildlife refuge.

Jacobs, Jeffrey W. ,National Research Council, Washington, D.C., USA

O-061 Integrated Water Resources Planning for the Upper Mississippi River-Illinois Waterway: A Summary of National Research Council Studies. *(Oral Session 31)*

Abstract: From 1993-2004, the U.S. Army Corps of Engineers conducted a feasibility study of the Upper Mississippi River-Illinois Waterway (UMR-IWW). Notable for its scope, duration, and cost, the study is one of the important investigations ever conducted by the Corps. To provide independent review and input into the navigation feasibility study process, the Department of Defense and the Corps requested the National Research Council (NRC) to convene two separate expert committees to review the feasibility study. Those committees issued four reports: the first committee issuing one report in 2001 and the second committee issuing three reports, two in 2004 and one in 2005. All these NRC reports reviewed various drafts of the Corps feasibility study. This presentation will review and summarize findings and recommendations from these four reports, with an emphasis on prospects for integrating ecological concerns and uses with commercial navigation. Topics to be discussed will include river science, trade-offs, adaptive management, and federal legislation regarding UMR-IWW management.

Janvrin, Jeffrey A., Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA

O-062 A Glimpse at Environmental Responses to 20 years of Upper Mississippi River Habitat restoration through Environmental Management Program. *(Oral Session 23)*

Abstract: Over 40 Habitat Rehabilitation and Enhancement Projects (HREPs) have been constructed in the Mississippi River floodplain as one element of the Upper Mississippi River System Environmental Management Program (UMRS-EMP). These projects are planned through interagency interdisciplinary teams. The planning team establishes goals and objectives for HREPs based on the project's location within the UMRS and habitat types targeted. For example, the majority of projects along Wisconsin's portion of the UMRS involves island construction and/or dredging to address the loss of islands and increased sedimentation due to impoundment of the UMRS floodplain. Other common HREP features include: moist soil units, flow introduction/reduction, side channel modifications, bank stabilization and vegetation. Island projects often focus on providing improved environmental conditions to promote the growth of aquatic vegetation and often incorporate design criteria to also restore fisheries habitat. Islands improve environmental conditions for aquatic plants by reducing wave resuspension of fine materials thereby improving light penetration in localized areas. Islands designed to restore backwater fisheries habitat incorporate design criteria to reduce or eliminate water velocities in the area sheltered by the islands. Other objectives for island projects may include predator-free waterfowl and turtle nesting habitat, promote scour of surrounding area, and disposal sites for material dredged from backwaters. Backwater dredging projects often focus on improving protected off-channel lacustrine habitat, which usually focuses on restoring or enhancing overwintering conditions for centrarchids. Spoil from the dredge cuts has been used to construct islands or provide topsoil for revegetation of historic channel maintenance disposal sites. The planning and design of the HREPs has evolved over time, with each consecutive project taking lessons learned from previous projects to improve design and ecosystem benefits. For example, recent projects have taken a

broader "habitat complex" approach rather than focusing on just a few target habitat types.

Johnson, Barry L., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

O-063 Resource Monitoring on the Upper Mississippi River: Past, Present, and Future. *(Oral Session 24)*

Abstract: In 1986, the United States Congress authorized the Environmental Management Program for the Upper Mississippi River, which recognized the River as both a nationally significant ecosystem and transportation waterway. This program consists of two main parts: habitat restoration actions, and the Long Term Resource Monitoring Program (LTRMP). The LTRMP has become one of the world's most comprehensive river monitoring programs. It is designed to provide the information managers need te better understand how the river functions and to track river health at large scales. The LTRMP is funded by the U.S. Army Corps of Engineers and conducted by the U.S. Geological Survey in partnership with the Corps and state agencies. Data are collected annually on water quality, vegetation, invertebrates, and fish, and at longer time intervals on land cover and bathymetry. All data are publicly available on the World Wide Web. Program scientists and partners have conducted a variety of data analyses to investigate patterns in resource indicators and to develop tools that help managers understand the river and make better management decisions. Recently, program scientists completed 10-year data summaries for the four main field components. A new program being considered by Congress, the Navigation and Environmental Sustainability Program (NESP), may offer opportunities for improving monitoring. A primary focus of NESP would be increasing the number of individual projects that are evaluated at small scales. But, there may also be opportunities to increase the spatial scale of the long term monitoring program. Both scales are needed to develop a better understanding of the river's response to local management actions and to determine the combined effect of multiple actions on the long term goal of maintaining both the ecological and social benefits the river provides.

Jordan, Nicholas R., University of Minnesota, St. Paul, Minnesota, USA, Manson, Steven, University of Minnesota, Minneapolis, Minnesota, USA, Nelson, Kristen C., University of Minnesota, Minneaoplis, Minnesota, USA, Morse, Steve, University of Minnesota, St. Paul, Minnesota, USA, Neal, Jeri, Iowa State University, Ames, Iowa, USA, Wyse, Don, University of Minnesota, St. Paul, Minnesota, USA

O-064 Developing Perennial-based Agricultural Systems: the Green Lands Blue Waters Model. *(Oral Session 32)*

Abstract: The combined effects of many relatively modest barriers are preventing widespread adoption of new agricultural production systems based on perennial plants and continuous living cover. The Green Lands Blue Waters Project is testing a novel approach to lowering barriers to adoption. This approach is based on a well-supported premise: perennial-based farming systems create a range of environmental amenities and services in addition to marketable commodities. This plurality of production creates opportunities for a diverse mix of social groups and agencies to capture value at many scales. Realizing these opportunities requires a highly interactive process engaging scientists, grower/client organizations, and the broader public sector (including public agencies). Partnerships among these parties enable multiple discourses that persuade social actors to take innovative steps to design, implement and support farming systems that create ecologically sound and economically viable perennial-based agricultural landscapes. We discuss the use of cross-sector partnerships for learning and collective action to manage risk and uncertainty in development of new agricultural systems. We present case studies of whole-systems approaches to building such partnerships in California, where growers are adapting to changing water quality regulations, and in Minnesota, where growers are searching for a "third crop" to augment corn and soybean production.

Karns, Daryl R., Rivers Institute, Hanover College, Hanover, Indiana, USA, Voris, Harold K., Field Museum of Natural History, Chicago, Illinois, USA, Murphy, John C., Field Museum of Natural History, Chicago, Illinois, USA

O-065 Exploitation of Freshwater Snakes from Tonle Sap, Cambodia. *(Oral Session 6)*

Abstract: Overexploitation of freshwater fish and turtles in Southeast Asia is a focus of current research and conservation efforts. The commercial harvest of freshwater snakes occurs with varying regional intensity in Southeast Asia and has received relatively little attention. Studies by biologists from the Field Museum of Natural History, Chicago, and the University of East Anglia, United Kingdom, have documented the recent development of a major snake harvest in Tonle Sap, Cambodia. Tonle Sap is part of the Lower Mekong drainage basin and consists of the Tonle Sap River and Tonle Sap Lake; the lake undergoes extensive seasonal changes in area due to flooding and is the largest freshwater lake in Southeast Asia. The Tonle Sap snake harvest consists primarily of five species of homalopsine water snake. Homalopsines are viviparous,

rear-fanged water snakes found throughout Southeast Asia. They can be extremely abundant in wetland, lake, and river environments. The extensive harvest of these snakes is reported to have begun in the late 1990s in response to declines in fish harvests. The primary economic incentive for the snake harvest is the local Siamese Crocodile farming industry which exports crocodilian skins. The snakes have become a primary food for the crocodiles due to the declining fish harvest and increasing fish prices. Some homalopsine snake species are also used by humans as a food delicacy (especially ova) and for their skins. During the peak snake harvest period in 1999 and 2000, it is estimated that 8500 water snakes were harvested and sold per day; the homalopsine, *Enhydris enhydris*, comprised approximately 80% of the catch. The Tonle Sap snake harvest appears to be the largest harvest of any snake assemblage in the world. The ecological, economic, and conservation implications of freshwater snake exploitation at Tonle Sap and elsewhere in the region will be discussed.

Keeney, Dennis, Institute for Agriculture and Trade Policy, Minneapolis, Minnesota, USA, Muller, Mark, Institute for Agriculture and Trade Policy, Minneapolis, MInnesota, USA

O-066 Upper Midwest U.S. Agriculture: Consequences of Technology and Policy. *(Oral Session 32)*

Abstract: Advances in farm machinery and plant breeding, coupled with changes in food, agriculture and energy policy, have driven the current corn-soybean cropping system that dominates the upper Midwest. Technological advances have reduced on farm labor costs, while genetics have increased yields. Corn yield increases have averaged about 105 kg/ha/yr (1.6 bu/acre/yr) for several decades. Markets have responded to this as an oversupply situation, resulting in commodity prices consistently below the cost of production. Domestic and international purchasers of grains and oilseeds benefit from lower prices, and their investment decisions strongly impact cropping systems. Federal farm programs have helped mitigate the adverse economic impacts of low farm prices, but encourage continued corn-soybean cropping systems. Low grain prices have also encouraged large-scale animal feeding operations at the expense of perennial-based grazing. Additionally, the system is driven by large expenditures in public and private research and extension, and indirect subsidies for storage and transportation. Addressing the environmental concerns facing the Mississippi River Basin will require policies that promote investment in perennial crops, new markets, and a revised federal research agenda.

Kelly, John E., Washington University, St. Louis, Missouri, USA, Kelly, Lucretia S., Washington University, St. Louis, Missouri, USA

O-067 The Mississippi Flyway: A St. Louis Perspective on Cultural Interactions between AD 1000 and 1400. *(Oral Session 30)*

Abstract: Central Siouan groups, such as the Chiwere-speaking Winnebago and Ioway and their southern Dhegiha cognates like the Osage, occupied much of the Mississippi river basin above the Ohio river at the time of European contact. This region of the Mississippi river has long served as a conduit of cultural interaction and exchange between ancient Central Siouan populations. At the onset of the second millennium AD, one of the most important communities to appear in the Mississippi river valley was the immense (5-6 square miles) Middle Mississippian mound center of Cahokia. Located on the rich alluvial Mississippi river floodplain just below its confluence with the Missouri and Illinois rivers, this ritual city rapidly emerged as a center becoming a focal point for cultural knowledge as well as its dissemination to populations throughout the Mississippi river drainage. Between AD 1000 and 1400 the nature of interaction changed as the history of ancient Indian societies in the upper Mississippi river valley waxed and waned in response to environmental and cultural factors. Because Cahokia was abandoned before European contact, there has been much speculation about which Indian group(s) are Cahokia's descendants. In 1960 the Dean of Eastern North American Archaeology, James B. Griffin, published a paper, "The Origins of the Winnebago," in which he posed that Cahokia Mississippian culture was probably ancestral to the Dhegiha Central Siouan societies while those societies to the north were Chiwere. More important, he presented one of the first overviews of Cahokia's impact on the development and interaction of American Indian societies in the Upper Mississippi river drainage. This presentation focuses on the context of the interaction between the large Mississippian center of Cahokia and its northern neighbors residing along the Mississippi river and its tributaries.

Khodakovsky, Igor L., Dubna University, Dubna, Moscow Region, Russia

O-068 Quantitative Characteristics of Transformation of Biosphere to the Noobiosphere: Changes in the Hydrosphere. *(Oral Session 11)*

Abstract: In the second half of the 20th century, due to the development of the industrial society, the scale of man's pressure intensity on ecosystems has essentially changed. The biosphere's new state named as "noobiosphere" by I.L. Khodakovsky in 1995, has appeared. It seems to me that quantitative characteristics

on transformation of biosphere to the noobiosphere (initial time of transformation, its intensity, duration and other indexes) should be intercommunicated with dynamics of population for our planet. Because the hydrosphere is a part of biosphere (by V.I. Vernadsky definition), the quantitative characteristics of the changes in the hydrosphere may reflect on the quantitative characteristics of the transformation of the biosphere to the noobiosphere. The largest changes in the hydrosphere took place on the continents during the 20th century and were connected with creation of big man-made storage reservoirs in the major river basins. The era of building large dams in the developed countries (USA, European Union) is drawing to a close that has physical, ecological and economic limits. During the 20th century, the increase of cumulative reservoir storage in the world (V, km3), connect with increasing of population of our planet on given time (N): V (km3) = A + B/N + C/N2, where A, B and C – empirical coefficients. The same relationship is observed for the different countries. Because in future N -> const, then V (km3) -> Vmax. The time interval, when 1/2Vmax had been achieved, came at the beginning of demographic transition (1960-1975). Half of the biosphere was turned into noobiosphere.

Kidder, Tristram R., Washington University-St. Louis, St. Louis, Missouri, USA

O-069 Climate Change, Flooding, and American Indian History in the Mississippi Valley. *(Oral Session 41)*

Abstract: Recent and historical flooding in the Mississippi River basin reminds us that this river is a dynamic entity that influences the lives of anyone living on its banks or in its floodplain. American Indians were no less susceptible to floods and subsequent changes in the river's environment. Recent research on climate and archaeology reveals that episodic flooding related to major climate alterations resulted in significant changes in social, economic, and political behavior among American Indian populations living in the river's watershed. In this paper I focus on flooding in the Lower Mississippi Valley south of Cairo, Illinois, ca. 1000-500 BC and ca. 1100-1200 A.D. Climate changes and flooding in these periods had different historical results at the local and regional scale but both episodes had lasting effects on the long-term history of American Indian populations in eastern North America.

Killgore, Jack, U.S. Army Corps of Engineers-Engineer Research and Development Center, Vicksburg, Mississippi, USA, Hoover, Jan, U.S. Army Corps of Engineers-Engineer Research and Development Center, Vicksburg, Mississippi, USA, Ellis, Steve, U.S. Army Corps of Engineers Mississippi Valley Division, Vicksburg, Mississippi, USA, Gutshall, James, U.S. Army Corps of Engineers Mississippi Valley Division, Vicksburg, Mississippi, USA, Brewer, Sandra, U.S. Army Corps of Engineers Mississippi Valley Division, Vicksburg, Mississippi, USA

O-070 Environmental Guidelines for Dike Notching. *(Oral Session 23)*

Abstract: Dikes create heterogeneous hydraulic and topographic conditions that attract numerous species of fish. The dike surfaces provide firm, stable substrates inhabited by macroinvertebrates eaten by fishes. Slack water in dike fields is exploited by larval and juvenile stages of fish and may also provide habitat for mussels and other important macroinvertebrates. Overall, dike pools support high biomass and diversity of fish, and for these reasons, dikes are often considered beneficial to aquatic communities in large river systems. State and federal resource agencies have recently advocated dike notching to enhance fishery habitat in large rivers, particularly to re-open side channels. Although numerous dikes have been notched, biological justification is lacking and benefits are only assumed. Engineering criteria for constructing dike notches are lacking, and most notches are created haphazardly without regard to ensuing habitat conditions that attract fish and fish food organisms. Therefore, the spatial and temporal utilization of fishes associated with dike notching, as well as the geometry and location of the notch, needs to be addressed to develop specific criteria for justifying and designing dike notches. We have begun to evaluate benefits of dike notching in the Mississippi River. Using multiple gears to collect fish (trotlines, gill nets, trawls), we are comparing spatial and temporal patterns of fish abundance between notched and un-notched dikes. In addition, we are describing habitat characteristics created by dike notching related to biotic responses of aquatic species. These data will be used to develop environmental guidelines for dike notching that considers the placement and geometry of the notch to maximize benefits for fishes and other aquatic organisms.

Kirch, Lawrence J., City of La Crosse, La Crosse, Wisconsin, USA

O-071 La Crosse's Revitalization and Riverfront Restoration. *(Oral Session 27)*

Abstract: The City of La Crosse incorporated in 1856. Now celebrating its sesquicentennial, the City is much different than it was 150 years ago, when it began as a fur trading post and then grew with the lumber industry. As steamboats began to ply the Mississippi River, La Crosse continued to grow and prosper into the golden age of the railroad. At that time, La Crosse was known as the "Gateway City" to the westward expansion of the country. The City has changed over the years, from a river-dependent community to one

that now relies on multiple modes of transportation. With these changes in transportation modes, the La Crosse waterfront has changed as well. Recent losses in manufacturing and the movement of retail trade to the Interstate 90 corridor have had a profound effect on the City's historic, commercial downtown as well as its waterfront. As riverfront land uses changed, so did the role of downtown in the regional economy. At one time, virtually all auto traffic had to traverse through downtown to cross the Mississippi River. Since the Interstate highway was built north of the City in the mid-1960s, much of this through-traffic was cut off from the downtown. As a result, downtown lost its luster as a regional hub. Beginning in the 1970s, the City began a concerted effort to revitalize its downtown and waterfront. This effort continues today as the City and its partner, Downtown Mainstreet Inc. (DMI), continue the revitalization process. In 2002, the City and DMI were awarded a Great American Mainstreet Award™ from the National Trust for Historic Preservation. This was awarded particularly for the efforts of the City and DMI over the past 14 years. This presentation will focus on La Crosse's downtown and riverfront revitalization program, which is centered on the reconnection of the City to the Mighty Mississippi.

Kirsch, Eileen M., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Yin, Yao, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Urich, Randall R., U.S. Army Corps of Engineers, La Crescent, Minnesota, USA, Swenson, Gary V., U.S. Army Corps of Engineers, Le Claire, Iowa, USA, Cannon, John B., U.S. Army Corps of Engineers, West Alton, Illinois, USA

O-072 Conservation of Upper Mississippi River Floodplain Forests: Threats and Action. *(Oral Session 11)*

Abstract: Floodplain forests of the Upper Mississippi River System (UMRS) have changed and are continuing to change as a result of flow alterations caused by locks and dams, levees, other structures in the river, flow management for commercial navigation, and floodplain development. Losses of floodplain forests due to these impacts have been dramatic system-wide. Hydrological changes continue to negatively impact forests in complex ways, decreasing species diversity and habitat structure, and invasive reed canary grass further threatens forest sustainability. Such changes are likely to have undesirable impacts on wildlife, ecosystem functions, and aesthetics of the river. We will describe the current evidence that leads us to be concerned about the sustainability of UMRS floodplain forests including information on the value of the floodplain forest to wildlife. We will discuss the collaborative efforts involving the Corps of Engineers, USGS, U.S. Fish and Wildlife Service, several state agencies, and university researchers to plan coordinated research and management focused on restoring and maintaining floodplain forest health.

Knapp, Peggy, Center for Global Environmental Education, Hamline University, St. Paul, Minnesota, USA

O-073 Rivers of Life. *(Oral Session 10)*

Abstract: Hamline University's Center for Global Environmental Education (CGEE) bases its work on four major program components. These four "pillars" allow CGEE to engage in a wide range of critical partnerships with agencies and educational entities to reach the broadest possible audience with its mission to "foster environmental literacy and stewardship." Embedded within these four elements is a central organizational focus on rivers. **Formal and non-formal educators**--Part of the Graduate School of Education, CGEE offers a Master's Degree in Education with a focus on Natural Science and Environmental Education (MAEd/NSEE). Students in the program come from both formal and non-formal education fields. A hallmark of the coursework offered is the annual Rivers Institute, bringing together teachers and content experts to study and celebrate rivers. **K-12 education programs**--GEE creates environmental education programs and curricula for direct use in K-12 classrooms. Examples include the River Exploration Trunk program for the Grand Excursion 2004, water conservation curricula, non-point source pollution education, ecological footprint and consumer choice education, and global climate change education. **Multimedia production**--CGEE has begun production of a series of educational, interactive river and watershed CD-ROMs. The "Waters to the Sea" series explores land use through time, and the effects of various land uses on water quality. Two in the series are complete, Rivers of the Upper Mississippi Watershed," and "The Chatahoochee, Rivers of the Southwest." Several others are currently in development, including watersheds in Texas, the Pacific Northwest, and the Northeast. **Public Education and Outreach**--Public education and outreach efforts seek to increase public awareness of river issues, and renew our natural affinity to flowing water. Programs include the annual Solstice River, a site-specific dance on the historic Stone Arch Bridge in Minneapolis, and The Metro Watershed Partners, a cooperative education effort involving 45 watershed-related organizations.

Knox, James C., University of Wisconsin-Madison, Madison, Wisconsin, USA

O-074 Floods, Sedimentation, and Floodplain Development on the Upper Mississippi River

During the Past 6000 Years. *(Oral Session 36)*

Abstract: The rate of vertical accretion sedimentation on the upper Mississippi River (UMR) floodplain between River Miles 604 and 664 on Wisconsin's southwestern border has averaged 0.09 cm per year over the last 6000 years and prior to the introduction of Euro-American agriculture about 150-200 years ago when sedimentation increased by an order of magnitude above natural rates. The estimate of long-term natural sedimentation is based on 40 radiocarbon dates associated with organic material buried in floodplain alluvium. Grain sizes and other sedimentological proxies of flood magnitudes indicate that past relatively modest changes of climate had very important influences on the variability and recurrence intervals of large floods. Although the largest magnitude floods occurred during times that were relatively cool and relatively moist, the most striking association between climate and flood characteristics was the strong tendency for increased hydrologic variability during climate episodes that were relatively warm and dry. For example, frequent relatively warm and relatively dry conditions between about 5000-3000 and 1000-600 years ago were associated with an anomalous high frequency of moderate to relatively large floods. These floods probably resulted from wide-spread and anomalously early spring rains falling on melting snow similar to the causal conditions for the 2001 UMR flood that was the second largest in nearly 130 years of instrumented observations. Data also support the idea that relatively large floods are especially favored during times of rapid climate transition. The trend toward increasing hydrologic variability and frequent large floods on the UMR in recent decades with global warming is relatively similar to the patterns previously noted for periods between 5000-3000 and 1000-600 years ago. Research was supported by the U.S. National Science Foundation (ATM-0112614) and by the Evjue-Bascom Foundation (BG-25).

Konrad, Christopher P., U.S. Geological Survey, Tacoma, Washington, USA

O-075 Reconstructing Geomorphic Processes from Channel Form. *(Oral Session 16)*

Abstract: River ecosystems comprise a wide variety of physical and biological components that are internally dynamic and externally interactive. Protection and restoration of river ecosystems depends on not only on the presence of various components of the system but also on functioning processes internal to the components and interacting among the components. Although ecological processes operating over short time-scales (e.g., streamflow, primary production) can be assessed from synoptic surveys, others that operate at the scale of decades to centuries require historical investigation. River and floodplain morphology provide an instructive example of the need for a historical perspective on physical processes that are integral to river ecosystems. The form and materials of river channels and floodplains provide the physical template for aquatic and riparian habitats. Although a river channel is generally a static feature of the landscape on any given day, its form and position change over decades, creating new aquatic and floodplain habitats as it moves. An assessment of a river ecosystem, then, must go beyond static descriptions of the channel (e.g., width and sinuousity) to measures of geomorphic processes that operate at time-scale of decades. Applications of historical investigation of river and floodplain morphology and sediment transport dynamics are illustrated for regulated rivers in western Washington with examples of re-constructing sediment transport rates for the Elwha River and patterns of channel migration for the Green River.

Kulkarni Upendra Dattatraya, SGGS Institute of Engineering and Technology, Nanded, Maharashtra, India

O-076 Participation of Community and Institutions in River Ecosystem Restoration. *(Oral Session 28)*

Abstract: Unplanned growth of urban population and unsustainable increase in irrigated agriculture have developed pressure on river ecosystems in India. This has resulted into over abstraction of water from rivers, pollution of rivers and siltation. For effective management of rivers, communities dependent on it for their livelihood should be necessarily involved. Academic and administrative institutions should work in coordination with each other for building the effective mechanisms for sustainable use of rivers and solving the problems of the communities. With this objective, a forum ' Shankarsagar Sarowar Samvardhini' has been established in Nanded for the management and restoration of the reservoir in the Godawari basin in Maharashtra. The Shankarsagar is a reservoir on River Godavari constructed by the Irrigation department, Government of Maharashtra supplying drinking water to Nanded city and irrigating 15630 ha of land in Nanded district by a gravity canal system. The irrigation department manages irrigation activity. All the stakeholders are actively involved in the activities of Shankarsagar Sarowar Samvardhini. There are 12 villages on the upstream of the barrage, which are dependent on it for their livelihood. Farming communities and fishermen societies are also involved in the discussions, and awareness programmes are conducted for them. Five voluntary organizations, 7 academic institutions and the irrigation department are the integral part of Shankarsagar Sarowar Samvardhini. Marathi Vidyan Parishad has been active at the ground level in river pollution abatement activities for four years with substantial success. National Service

Scheme of the University is associated with these activities that has involved youth in the conservation of river ecosystems. The Samvardhini is a thematic network activity of the India Water Partnership with Indian Association of Aquatic Biology as a driver agency. It has decided in its meeting to a follow two-pronged approach: (a) to conduct and share research in the related areas of river ecosystems and (b) to organize activities at ground level to create awareness in the community. The present paper discusses the activities of the Samvardhini with reference to stated objectives and working methodology and its impact on the river ecosystem. The action plan for the next five years is also presented.

Kurbanov, Rukhulla B., State Research Center for Fish Development, Tashkent, Uzbekistan, Rakhmatullayeva, Gulnara M., State Research Center for Fish Development, Tashkent, Uzbekistan

O-077 Rivers of Uzbekistan Under the Impact of Irrigated Agriculture. *(Oral Session 18)*

Abstract: Uzbekistan is a country with a predominantly dry desert climate situated in Central Asia. Development of agriculture in all countries of Central Asia led to maximizing the use of available water resources. There are 24 reservoirs at present, with a total surface of 170 600 ha in Uzbekistan. All reservoirs have been constructed for agriculture purposes. Some of them are the result of damming of rivers, but some were constructed far away in natural depressions and are supplied with water by a net of irrigation canals. Regulation of rivers has led to profound changes in the natural aquatic environment. This has had a major impact on the Aral Sea. Reduced discharge into the Aral Sea through the two major rivers, i.e. Syr-Darya and Amu-Darya, led to a gradual desiccation of the sea, to increased salinity (more then 80 pro mille) and to disappearance of fish. Dams have stopped fish migrations and reservoirs have flooded natural spawning and feeding grounds.

O-078 Withdrew

Lanpher, Daniel, Yale University, New Haven, Connecticut, USA

O-079 The Tijuana River and the Problem of Border Environmentalism, 1940s-1970s. *(Oral Session 17)*

Abstract: Drawing on archival sources from both the United States and Mexico, this paper uses the Tijuana River--an international stream flowing between Tijuana and San Diego--as a window on the conflict over land use in the California-Mexico border region following World War II. After a century of tension over flooding in the river basin, the United States and Mexico agreed in 1967 to channelize the river so that investors could develop the floodplain. Mexico fulfilled the agreement, transforming its section of the river into a concrete ditch. In the United States, however, the project was suspended after the Sierra Club and the Audubon Society, together with local homeowners and San Diego city officials, challenged developers. Bolstered by growing public support for green legislation, the environmentalists argued before Congress that preserving the river valley would not only protect endangered wetland habitats, but also create an international human sanctuary--a buffer zone between San Diego and Tijuana--where people from both sides of the border might interact and together escape the burdens of city life. Although Congress ultimately sided with the environmentalists, naming the American section of the valley a national wildlife reserve, the dream of an international sanctuary never materialized. Little was done to promote the idea further or to welcome Mexicans across the line. Instead, this paper argues, the preserved valley became yet another wall between nations, another symbol of American class privilege, and for historians, an invaluable frame for understanding the thorny transnational history of land use and environmental politics in greater California.

Lee, Charles R., University of Wisconsin-La Crosse, La Crosse, Wisconsin USA

O-080 The Upper Mississippi River in History and Memory: Living Midstream. *(Oral Session 39)*

Abstract: The ecological history of the upper Mississippi River since the construction of the locks and dams chronicles the transformation of the river from public commons to its institutionalization. This presentation, developed from an extensive collection of oral histories conducted by students and faculty associated with the University of Wisconsin-La Crosse Oral History Program, focuses on three themes of the modern river and its riparian communities: the ecology of loss, making a living, and the narrative of river culture. The presentation will include extended audio excerpts from oral history testimony. A standard account of the upper Mississippi River since the construction of the locks and dams in the 1930s goes something like this: for thirty or forty years after the locks and dams were built the river flowered, flooded backwaters produced an abundance that was almost unheard of, but then a long decline set in as those same backwaters silted in--a decline that continues to this day. While the general direction of the standard narrative is confirmed by our research, an ecological history is much more complex and accounts for the ease of access, the entrepreneurialism and the natural plenty of the early years in comparison to the dominance of industrial, commercial and bureaucratic forces today.

LeFevre, Camille, Independent Dance Critic and Scholar, St. Paul, Minnesota, USA

O-081 Mississippi Movement: Marylee Hardenbergh's Site-Specific Dances for the Mississippi River. *(Oral Session 39)*

Abstract: Since 1997, thousands of people have gathered on the historic Stone Arch Bridge over the Mississippi River in downtown Minneapolis to experience the vibrant site-specific dance, "Solstice River." Choreographed by Marylee Hardenbergh, the free event includes brightly clad dancers on boats and a jetty in the river, on the infrastructure of the lock-and-dam, and on the roofs and balconies of adjacent flour-milling ruins. At dusk, Hardenbergh unfurls a swath of blue fabric down the bridge and urges the audience to "hold the river" while children frolic underneath. Hardenbergh's goal is to transform audience perceptions of the river and its environs. She's succeeded. In a recent survey, 60 percent of respondents reported behavior changes related to their water and fertilizer use, and increased understanding of the river's ecosystem because of the performance and accompanying educational materials. In this presentation, LeFevre defines site-specific dance and how it reinvigorates sites for audiences; describes the effectiveness of Hardenbergh's dance-therapy-based choreographic technique; and, using power-point slides, illustrates how the dance connects viewers with the river. LeFevre also presents images and information on Hardenbergh's "One River Mississippi," premiering June 24, 2006. An expansion of "Solstice River," the ecosystem-long "One River" features simultaneous performances at six additional sites on the Mississippi: the Itasca headwaters, the Quad Cities, St. Louis, Memphis, New Orleans, and Venice, Louisiana (at the river's mouth). A powerful metaphor for the interconnectedness of communities along an iconic river at the nation's center, "One River" has acquired additional potency since the hurricane devastation along the Gulf Coast. While "Solstice River" is a stellar example of how dance inspired by and performed in a natural setting can inspire fresh perspectives on the environment, "One River Mississippi" promises to engage an entire nation in the civic, industrial and environmental issues interwoven along this majestic waterway.

Lenhart, Christian F., University of Minnesota, Water Resources Science Program, St. Paul, Minnesota, USA, Magner, Joseph A., University of Minnesota, Department of Forest Resources, and Minnesota Pollution Control Agency, St. Paul, Minnesota, USA, Brooks, Kenneth N., University of Minnesota, Department of Forest Resources, St. Paul, Minnesota, USA

O-082 Impacts of Channel Relocation at Road Crossings on Channel Morphology and Sediment Transport Processes in Southern Minnesota Rivers. *(Oral Session 12)*

Abstract: The relocation of rivers at road crossings has altered sediment transport processes in the Elm and Center Creek watersheds of southern Minnesota by changing channel slope, unit stream power and sediment transport capacity, causing channel adjustment. Superficially, road crossings appear to have only localized impacts on streams, but with road crossings occurring at every mile in rural Minnesota, the impact is actually widespread. Road crossings represent a classic "cumulative impact" that has been ignored for their impacts on channel stability and suspended sediment loading. Using laser level equipment, we have conducted paired channel surveys of relict cutoff and active channels at three stream sections, with twenty more surveys planned for 2006. Data collection includes bed and water surface slope, cross sectional dimensions, particle size distribution, stability index values and sinuosity measurements. At each site we measured, the new channels had greater slope, unit stream power and sediment transport capacity than the original channel. Preliminary data collection shows that channel bed elevation of paired channels is up to six feet lower in the new channels, resulting in entrenchment and disconnection from the floodplain. The length of channel cutoff by relocation ranged from <50 meters to >8776; 500 meters, resulting in loss of sinuosity and related morphological changes. The geomorphic consequences of channel straightening at bridge crossings was likely unrealized by road engineers in the early 20th century. However, given the turbidity water quality impairment in the Elm Creek and Blue Earth River basins, TMDL plans will require consideration of all factors contributing to suspended sediment load. To improve channel stability and reduce sediment loading from streams destabilized by road crossings, we propose reconnection of relict oxbows at high flows (>1.5 year flow) where space allows, in order to reduce bed shear forces, channel erosion and suspended sediment load.

Lubinski, Kenneth S., The Nature Conservancy, Brownsville, Minnesota, USA, Barko, John, U.S. Army Corps of Engineers, Vicksburg, Mississippi, USA, Galat, David, U.S. Geological Survey, Columbia, Missouri, USA, Nestler, John, U.S. Army Corps of Engineers, Vicksburg, Mississippi, USA, Theiling, Charles, U.S. Army Corps of Engineers, Rock Island, Illinois, USA

O-083 Application of the Concept of Ecosystem Health to Adaptive Management of the Upper Mississippi River. *(Oral Session 34)*

Abstract: In 1986, the U. S. Congress officially proclaimed the Upper Mississippi River to be a nationally

significant waterway and a nationally significant ecosystem. This statement captured the prevailing attitude of many stakeholders - that somehow the river needed to be managed to achieve two different, and sometimes conflicting, sets of goals. Management objectives for operating the river as a navigation system had been established over the previous 130 years. Although several site-specific wildlife refuge plans were in effect, management objectives for the river as a comprehensive ecosystem had never been formulated. Now in 2006, after extensive study and the submission of a new multi-billion dollar proposal to Congress, river agencies and stakeholders are close to initiating an adaptive management approach to achieving long-term navigation and ecosystem objectives. By defining river ecosystem health through the development of specific ecosystem objectives at several spatial scales, scientists and managers are setting the stage for effective restoration, and measuring progress at regular intervals. The steps by which applied science will contribute, through modeling, monitoring, assessment, and data management have become more explicit. The new program is by no means a given. Critical problems that could still prevent the program from becoming operational include adequate funding, full commitment by primary stakeholders, resistance to change, consensus on priorities, and the evaluation of future trade-offs. However, the creation of a quantifiable and commonly supported definition of river ecosystem health, one of the most important pieces of the management process, will greatly increase the chances of the program's approval and eventual success.

Maas, Marian, Nebraska Wildlife Federation, Bellevue, Nebraska, USA

O-084 Our Missouri River - A Great River Once...A Great River Again? *(Oral Session 12)*

Abstract: The Missouri River, our longest river, drains one sixth of the United States, and its basin is home to 10 million people, 28 Native American tribes and 10 states. The pre-modern River represented one of North America's most diverse ecosystems with braided channels, riparian lands, adjoining prairies, chutes, sloughs, sandbars, and backwaters. Over time, riverine and floodplain habitats were created and maintained by a natural flow regime that allowed erosion and deposition to continuously reshape these areas as well as provide desirable habitat for Great Plains fish and wildlife. These backwaters provided nutrients – including invertebrates, vegetation, organic materials, minnows – for the larger fish, birds, and wildlife that inhabited the main channel. Native people relied on the river for sustenance, connectivity, and encampment sites. But by the late 1800s, the channel was cleared and straightened in its lower reaches, and by the mid-1940s, Congressional acts and the U.S. Army Corps of Engineers transformed the free-flowing river into a system of six reservoirs in the upper river and a highly altered lower river, that kept water within a narrow, armored channel and eliminated sandbars, depth diversity, and river connections with backwaters. Today, seasonal fluctuations are gone and our lower Missouri's flow is artificially Corps regulated to meet reservoir, power, agricultural, and navigational requirements. Threatened and endangered native species require the natural spring rise and a lowered summer flow for their recovery and restoration of the river's ecosystem. However, the Corps established a very minimal, almost nominal spring rise. Bitter disagreement over the flow regime places environmental groups at odds with commercial interests and agriculture, carrying the controversy to the courts. The plenary group's "negotiated" solution is unlikely to adequately address the endangered species' legitimate regeneration needs; the solution is "feel-good" at best. Given strong sentiments held by stakeholders, the issue remains essentially unresolved.

Mahrous, Esam El-Din, Kamal, Assiut University, Assiut, Egypt

O-085 Urban Development of Nile islands and Gulf: Suggested Strategies. *(Oral Session 34)*

Abstract: Egypt is considered the arid area in all of the world, therefore, the Nile River is the center of life in Egypt. Although 95% of the Egyptian population and rural and urban areas are concentrated around it and in spite of the clear importance of this river the best places around it and its banks are neglected, especially the gulfs and islands. This is the focus of this research. The Nile River contains more than three handred islands, These islands occupy about 525/km^2, most of them in Upper Egypt. The temporary and continuous violation from the government and the people is one of the most important features of the problem. The research adopts the possibility of the absence of precise development strategies to develop the river banks, especially the small islands. For example, in societies where illiteracy reaches about 40% and its population multiplier every several decades and with the absence of individual responsibility, culture and enviromental awareness plus the negative habits in dealing with the Nile and its banks, the importance of cultural dimination and environmental awareness appear and with a wider perspective the social convenience can be classified as one of the important development strategies for River banks. Sustainability is the strategy that should be applied in all desert, rural and urban areas including coastal areas in general and Islands and Gulfs in particular. The shrinkage of these area edges, shallow waters and the privacy of urbanization icology are the most important difficulties that face sustainability. The comprehensive and complementary development strategies for coasts are essential for the success of the development process and its continuity.

With the multiplicity of the essential economical patterns necessary for construction of any urban project, we find that tourism is the most appropriate economical choice fitting the coastal circumstances because of the availability of research areas in healthy atmospheres, nature beauty and appropriate weather, especially in summer. Experiments proved failure of the adoption of continous dependence on central or governmental support so the adopting of a specific economical strategy employes its profits in execution and continuity of the development process is an urgent demand and so the touristic development is one of the suggested strategies. The research ends after the detailed study of the most important suggested strategies for the development process of the Islands and Nile Gulfs to promote achievement of the study goals.

Mandima, Jimmiel J., African Wildlife Foundation, Kariba, Zimbabwe

O-086 Threats to Ecosystem Services: The Case of the Middle Zambezi and Lower Reaches of the Luangwa River Systems in Southern Africa. *(Oral Session 20)*

Abstract: The Zambezi is the fourth longest river in Africa within a basin area of 1,570,000 km² and a length of 2,574 km. The Luangwa River from eastern Zambia is a key tributary in the Middle Zambezi. These river systems provide important ecosystem services to the estimated 32 million people in the whole Basin. Key services include the generation of hydroelectricity at Kafue, Kariba and Cahora Bassa Gorges, water supply for large scale irrigation, the provision of water for viable ecosystem function in the Wildlife and Parks estates in all riparian countries, the sustenance of the wilderness value in the riparian woodlands to support tourism, and the support of viable aquatic resources (hippopotami, crocodiles and fish) that support livelihoods for local communities. These services are, however, under threat from largely incompatible anthropogenic activities in the watershed. A preliminary watershed assessment conducted by the African Wildlife Foundation in its Zambezi Heartland site noted key threats to ecosystem function to be (1) incompatible land uses especially floodplain agriculture that result in accelerated erosion and downstream sedimentation; (2) tourism infrastructure along the river front affecting water quality, bank stability and wildlife habitat; (3) dam operations that affect life history strategies for fish and other aquatic flora and fauna, and (4) general degradation from deforestation as settlement expands causing stream bank instability, depletion of nutrient capital in soils, with detrimental impacts on fish habitat. Qualitative assessments show that fisheries are on the decline, and in Cahora Bassa reservoir, productivity of the freshwater sardine, *Limnothrissa miodon* has been negatively affected by the high turbidity caused by increased silt load from upstream areas of the Luangwa river. No quantitative analysis of the impact of these processes on ecosystem services has been conducted.

Marlin, John C., Waste Management and Research Center, Illinois Department of Natural Resources, Champaign, Illinois, USA., Darmody Robert G., Department of Natural Resources and Environmnetal Science, University of Illinois, Urbana, Illinois, USA

O-087 Beneficial Use of Illinois River Sediment as Topsoil. *(Oral Session 38)*

Abstract: Illinois River backwaters and side channels have lost much of their depth to sedimentation over the past century. Typical backwaters are now less than 30 cm deep with a uniform bottom of fine particles. River restoration plans envision removing large quantities of sediment in an effort to maintain some depth diversity and prevent willow covered mudflats from dominating the areas. This will be done in combination with upland erosion control and bank stabilization. Researchers are evaluating potential uses of the sediment that in large part is derived from central Illinois topsoil which is the best in the world. The physical and chemical properties of the sediment are under study. This process is greatly aided by a vibro core capable of recovering a 3-meter core. Field and greenhouse tests proved that the sediment is fertile and will support a wide variety of plants and is useful as a soil amendment. Removal and handling demonstrations show that the sediment can be handled by a variety of equipment including the conveyors and positive displacement pumps commonly used to handle cement. A number of pilot projects used sediment for providing soil for parks on disturbed areas. The most ambitious to date is the $1.4 million Mud to Parks project which moved 68 barge loads of mud from Peoria to Chicago, Illinois, a distance of 265 km. The project generated benefits at both ends. It also prevented soil from being taken from Chicago suburbs and trucked through the city.

McGuiness, Daniel W, Upper Mississippi River Campaign, National Audubon Society, St. Paul, Minnesota, USA

O-088 A River that Works and a Working River. *(Oral Session 15)*

Abstract: As we have used the Upper Mississippi River and settled along its shores, we have also changed how the river flows and significantly modified its floodplain. We have improved and maintained the river for navigation, built levees to confine the river's flow and protect farms and cities. In the process, we have nearly destroyed the physical processes that sustain the natural resources of the river; its diverse habitat conditions and the plants and animals they support. In 2000, Audubon and the Upper Mississippi Conservation

Committee jointly produced a report, five years in the making, that describes nine tools and measures to restore the health of the river and its watershed. Since then the report has repeatedly been cited as the Corps of Engineers, the United States Fish and Wildlife Service, the five states along the river and others have helped shape a 50-year, $5.3 billion framework for ecosystem restoration on the Upper Mississippi River. This presentation will describe the process used to develop widespread support for the recommendations in this report, how the recommendations are being used by the scientific community, public agencies, private organizations and people along the river, and their applicability to other large floodplain rivers.

McMillin, T. S., Department of English, Oberlin College, Oberlin, Ohio, USA

O-089 Unconformity and Unfathomability: Literary Potamology. *(Oral Session 39)*

Abstract: I propose to discuss my interdisciplinary research on the meaning of rivers. This research is best described as an examination of the relationships between American ideas of nature and American ideas of culture in general, and between rivers and literature more specifically. In calling my approach Literary Potamology, I hope to suggest a necessary movement between categories of thought. Potamology being the study of rivers, Literary Potamology involves studying rivers and texts in relation to one another. A literary potamologist asks questions about nature and ecosystem, but also asks questions of culture and interpretation: What can literature tell us about rivers? What can rivers tell us about literature? The twofold hypothesis suggests that the humanities can play a significant role in understanding nature and ecology, but also that thinking more carefully about place, nature, and ecosystems can revitalize the humanities. Literature can help us learn about the meaning of rivers; rivers can help us rethink the nature of interpretation. To demonstrate how the hypothesis might be applied, I will consider two rather diverse riparian systems: the Colorado River and the Concord River. I approach each river system through a central literary text, John Wesley Powell's Exploration of the Colorado River & Its Canyons (1875) and Henry David Thoreau's A Week on the Concord & Merrimack Rivers (1849), which leads to other texts, other disciplinary treatments of rivers, other meanings of the rivers. An important part of my work involves bringing these different meanings together, in order to understand better what they can tell us about rivers and about ourselves, and to do so I use key terms that help organize the many lessons that rivers and their texts offer—in the case of the Colorado, "unconformity"; in the case of the Concord, "unfathomability."

Meade, Robert H., U.S. Geological Survey, Denver, Colorado, USA

O-090 Engineering the Mississippi: An Introductory Overview. *(Oral Session 4)*

Abstract: The Mississippi and its tributaries are among the most intensively engineered of the largest rivers of the world. Flood-control levees have been constructed for nearly three centuries, beginning on the lower Mississippi in the early 1700s. Major engineering progress, however, began less than two centuries ago with the introduction of steamboat navigation. During the middle 1800s, the first intensive phase of river engineering for navigation featured the removal of snags -- the remains of large riparian trees that had been undercut by the natural erosion of the alluvial banks and left to obstruct the channels of the Mississippi and its tributaries. Channel-constricting dikes and wingdams were built, first in the upper Mississippi and later in the tributaries and in the lower river, to narrow the flow and to direct scouring currents toward the deepening of the channel. High-dam construction began a century ago with the 130-megawatt hydroelectric facility on the Mississippi mainstem at Keokuk. Hydropower development continued through the 1940s mainly in the tributary Tennessee River Valley, and then, during the 1950s and 1960s, in a series of dams built across the Missouri River. Meanwhile, low-head dams designed principally to maintain navigable depths for river shipping were constructed on the Ohio River, upper Mississippi River, Illinois River, Arkansas River, and Red River. Bank-stabilization works, such as revetments and pile dikes have been steadily added to channelize the flow and to retard the lateral erosion of the banks. Major geomorphic consequences of two centuries of engineering on the Mississippi River include the stabilization and confinement of the main channels and the consequent cessation of regular annual exchanges of sedimentary material between channels and floodplains, and a significant decrease (by nearly three-quarters) in the quantity of fluvial sediment delivered to the coastal wetlands along the Gulf of Mexico.

Merem, Edmund C., Jackson State University, Jackson, Mississippi, USA

O-091 The Assessment of Human Influences on Riverine Ecosystem: The Case of the Niger River Basin of West Africa. *(Oral Session 7)*

Abstract: This paper assesses the impacts of human activities on the River Niger Basin of Sub Saharan Africa. Emphasis is on the issues, impacts, factors and restoration initiatives. To analyze the issues, the paper adopts a mix scale method based on secondary data and descriptive analysis. In the African literary imagination, the Niger River basin epitomizes the source of wealth and life support system for communities.

Yet as we move further into the mid decade of the second millennium, Niger River basin faces enormous challenges at a time when environmental degradation and climate change are already taking their toll on the river. Rapidly growing population and poverty are stretching the resources of the basin beyond its carrying capacity. The region has also been struck by a series of droughts coupled with the widespread discharge of untreated effluents from upstream nations into the river. By the time the river passes through tributaries of other nations, more untreated waste is offloaded into their waters, and as a result, down stream area waters become so highly polluted that it erodes aquatic life and the livelihood of river fishing communities. With more people concentrated on the tributaries, conflicts on how to use these resources not only heightens, but reconciling these competing demands becomes a challenge for policy makers. Consequently, human activity is eroding water resources and producing wastes at rates that are not sustainable in the region. This is threatening the vitality of the river ecosystem. While current efforts to deal with the issue embody an action plan for sustainability after a series of policy miscues by institutions charged with the affairs of the basin, there is an urgent need for a detailed assessment of the basin so that policy makers can build on it as a roadmap for riverine ecosystem health recovery in the region.

Mergler, Donna, University of Quebec at Montreal, Montreal, Canada

O-092 Ecosystem Approach to Mercury and Health in the Amazon Basin. *(Oral Session 1)*

Abstract: The Tapajós River is a major tributary of the Amazon. Here, over the past 10 years, our interdisciplinary group of Canadian and Brazilian researchers from the natural, health and social sciences has been working, using an ecosystem approach, with a strong participatory research component, to examine the pathways of mercury (Hg) contamination, human exposure and health effects, mitigation measures and their efficiency. Previous reports of high levels of mercury (Hg) in fish and in humans attributed the source of Hg to gold mining. Our study revealed that, in the mid-Tapajós region, where we were working, large-scale deforestation, mainly from "slash-and-burn" agricultural practices, was the major culprit, through soil erosion and lixiviation, releasing mercury into the river. The deforested areas are increasing in size due to large in-migration and the mounting need to clear the forest to produce food to feed the ever- increasing population. Climatic conditions and aquatic vegetation are optimal for Hg methylation, accelerating the incorporation of Hg into the trophic chain and contaminating the fish, a dietary mainstay of this population. Measurements of hundreds of fish samples showed that Hg concentrations vary greatly, depending upon feeding habits, growth rate, age, and location. Hg in humans, measured in hair samples, cut in centimeters, provided a chronological portrait of exposure. Exposure increased with fish consumption, was higher among those who ate more piscivorous fish and varied seasonally. Evaluation of nervous system functions showed significant declines in motor and visual functions in relation to increasing exposure. The integrated findings of this study were returned to the communities and discussed during village workshops, which examined short- medium-, and long-term solutions with respect to diet, fishing, and farming practices. Since fish is a highly nutritious food, a positive slogan, inviting people to "Eat more fish that don't eat other fish" was adopted. In addition, a chart with drawings of 42 fish species in red (high mercury), yellow (medium levels) and green (low mercury) was posted in every house. Re-assessment of fish consumption, exposure and neuro-outcomes, 5 years later, showed that the villagers ate the same amount of fish, but had reversed the proportion of herbivorous to piscivorous fish. Their Hg exposure decreased by 40 percent! There was improvement in motor functions, but visual functions continued to decline in correlation with previous exposure levels. To further foster maximizing nutritional input from fish and minimizing toxic risk, an extensive dietary study was undertaken with 26 village women, coordinated by the village midwife, who, for 13 months, kept daily food-frequency diaries. Hair Hg (HHg) concentration, evaluated for each month, showed that fruit consumption was inversely related to HHg, after controlling for fish consumption. Thus, those that ate more fruit displayed lower HHg levels for the same amount of fish intake. This positive influence of fruit consumption was further confirmed in an epidemiological study of more than 400 persons. The success of this project is attributed to the synergy of scientific interdisciplinary inputs, coupled with community participation and an ecosystem approach to human health.

Morse, Steve, University of Minnesota, St. Paul, Minnesota, USA, Keeney, Dennis R., Institute for Agriculture and Trade Policy, Minneapolis, Minnesota, USA, Daigle, Douglas, Mississippi River Basin Alliance, New Orleans, Louisiana, USA, Turner, R. Eugene, Louisiana State University, Baton Rouge, Louisiana, USA, Broussard, Whitney, Louisiana State University, Baton Rouge, Louisiana, USA

O-093 Introduction to the Mississippi River Basin: From Land to Sea. *(Oral Session 32)*

Abstract: We discuss two centuries of landscape changes that affect water quality changes in the Mississippi River water and the continental shelf ecosystems. First, we re-construct the timing of population growth and soil disturbance resulting from de-forestation, cultivation and drainage. We then make connections between the subsequently higher sediment yields and the loss of nutrients from the newly disturbed landscape. We

cite experiments on small watersheds where variables can be controlled, and anecdotal accounts from before the 1930s to support the conclusion that the release of nutrients stored within the pre-European period was large. A paleo-reconstruction of continental shelf sediments confirms the significance of these water quality changes to coastal food webs and suggests that the most recent influence on nutrient loading, from intense and widespread farming, has had a more significant effect than all previous landscape changes on the watershed.

Murray, Helene, University of Minnesota, St. Paul, Minnesota, USA, Boody, George, Land Stewardship Project, White Bear Lake, Minnesota, USA

O-094 Finding the Win-Win Solutions: Incorporating Sustainable Agricultural Approaches. *(Oral Session 33)*

Abstract: Landscape, human and animal health are inextricably linked in agricultural systems. Our work in Minnesota took a farm-centered, team-driven approach to educate Minnesotans about the need to increase perennial crops and locally grown foods. Three examples are used to highlight the possibilities. (1) A farm family in southeastern Minnesota developed an on-farm milk processing plant for their pasture-raised cattle as a strategy to reduce income volatility and to create permanent work opportunities for several of their adult children. (2) In western Minnesota, the "Pride of the Prairie" collaborative has promoted the production and use of locally grown food to develop a regional food system that nurtures a healthy environment and provides economic opportunity for entrepreneurs. (3) A team of scientists and farmers involved residents of two Minnesota watersheds to develop agricultural land-use scenarios and evaluate impacts on water quality, other ecological parameters, and farm profitability. Through these examples we found that the public and institutions have indicated a willingness to pay for improved environmental performance through new programs or by purchasing food grown with multiple environmental benefits. We also found that perennial and diversified farming systems provide significant ecological benefits.

Nakao, Megumi, University of Tulsa, Tulsa, Oklahoma, USA, Wichelns, Dennis, Rivers Institute at Hanover College, Hanover, Indiana, USA

O-095 Innovative Approaches to Improving Water Quality in River Basins. *(Oral Session 33)*

Abstract: Agriculture generates most of the nonpoint source pollution affecting rivers in North America. Efforts to reduce river pollution from agriculture have succeeded in some areas, but many rivers and streams remain out of compliance with water quality objectives, due largely to agricultural effluent. Many farmers have implemented best management practices (BMPs) to reduce effluent loads, while others have been slow to adopt such methods. Some of the slowness is due to the difficulty of measuring effluent leaving individual farms and imposing volumetric charges or other incentives often implemented to reduce point source pollution. Many states are implementing Total Maximum Daily Load (TMDL) programs for rivers not in compliance with water quality objectives. Many TMDL programs have limited effectiveness in agriculture, given the difficulty of identifying sources of sediment, nutrients, and pesticides. Some states and farmer organizations are seeking alternative approaches to improving water quality. The California Central Valley Water Quality Control Board requires farmers to join coalitions that monitor water quality and implement BMPs. Several irrigation and drainage districts along the San Joaquin River have implemented innovative programs to achieve water quality objectives in lieu of direct regulations imposed by the Board. In the Yakima Valley, Washington, two districts formed a joint control authority that requires members to reduce sediment loads entering the Yakima River. We describe how innovative programs, such as those in California and Washington, reduce costs for both public agencies and farmers. The public cost of monitoring and enforcing compliance is reduced when farmers assume responsibility for those activities. Compliance is enhanced when farmer organizations design cost-effective programs with membership approval. The likelihood of farmers shirking from implementing BMPs is reduced, and cooperation is enhanced in this framework. Our analysis should interest public agencies and farmers working to achieve water quality objectives.

Nakato, Tatsuaki, Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS), Muscatine, Iowa, USA

O-096 Rivers Embraced by the Japanese People – Some Examples Expressed in Japanese Literature and Arts. *(Oral Session 39)*

Abstract: Ever since ancient times rivers were historically very dear to Japanese people because irrigation waters were needed to raise rice. Their daily lives were so tightly connected to rivers that many rivers have been superbly lauded in Japanese literature, paintings, Noh, Kabuki, and other forms. There have been an abundance of records of the local features of rivers described for different seasons. Rivers' spatial and temporal variations were closely observed and were frequently used to describe human lives and changing

worlds. For example, Hitomaro Kakinomoto in Manyoshu "Collection of Ten Thousand Leaves" in 750 A.D. wrote a poem during the sovereign's visit to the Palace in Yoshinu "… And on the courtiers of great palace; its ramparts thick with stone; line their boats; to cross the morning river; like this river; never ending like these mountains; commanding ever greater heights; palace by the surging rapids; though I gaze on it; I do not tire." Chomei Kamono in the early 13th century wrote these famous lines in Hojoki "My Ten-Foot Hut" after having witnessed the devastation of the capital city of Kyoto by earthquake and fire "… The flowing river never stops; and yet the water never stays the same; Foams float upon the pools; scattering, reforming; never lingering long; So it is with men and all their dwelling places here on earth." Basho Matsuo, the first great Haiku poet in history, wrote in the 1660s in Oku-no-Hosomichi "Narrow Road to the Deep North" about the raging Mogami River in Yamagata Province, "… Gathering all the rains; Of May; The River Mogami rushes down; In one violent stream." Many woodblock prints in Ukiyoe (Pictures of Floating World) also describe river scenes, particularly man's use of rivers. Notably, Hiroshige Ando and Hokusai Kashituka recorded rivers flowing into the Pacific Ocean along the eastern part of Japan. These will be presented in the paper.

Nelson, Michael P., University of Idaho, Moscow, Idaho, USA

O-097 Can There Be a Water Ethic?: Aldo Leopold and the Bluing of Ethics. *(Oral Session 24)*

Abstract: The Land Ethic of Aldo Leopold has arguably been the most attractive and successful environmental ethic thus far formulated. Leopold's ethical framework has additionally become the lingua franca of the conservation world; bringing scientists, philosophers, historians, and conservationists, etc., together around a common figure and moral ideal. "All ethics," Aldo Leopold wrote, "rests on a single premise: that the individual is a member of a community of interdependent parts," a community that includes "soils, water, plants, animals, or collectively, the land." Considering the centrality and necessity of water to all life, water might be the greatest of these community members. Currently, however, there is an increasing call for a "water ethic," an "ocean ethic," or a "river ethic." But what are we to make of this call for ethical expansion? Are these calls for new ethics an indication that our current ethics are inadequate? Are they a rejection of Leopold's Land Ethic as incomplete? Or are they merely the attempt to expand those things covered by that ethical model? I would like to explore the dimensions of this call for an aquatic ethic as well as two possible approaches to extending ethical consideration to include blue bits of our world. In an attempt to give substance and direction to the call for a "bluing of ethics," one approach will be defended and the other cautioned against.Following Leopold, I would like to suggest a water ethic that grows from the intricate, life-giving relationships of people, and watery places might best serve as the basis for this critical ethical expansion.

Nestler, John M., U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi, USA, Baigún, Claudio R. M., IIB-INTECH, Chascomus, Argentina, Oldani, Noberto O., Instituto de Desarrollo Tecnológico para la Industria Química (INTEC-CERIDE), Santa Fe, Argentina, Vionnet, Carlos, Universidad National del Littoral, Santa Fe, Argentina, Weber, Larry J., IIHR Hydroscience and Engineering, University of Iowa, Iowa City, USA

O-098 Integrating Information Across Continents for Improved Ecosystem Management: The Case of the Paraná and Mississippi Systems. *(Oral Session 31)*

Abstract: The blending and scaling of processes that characterize normal functioning of the world's great floodplain rivers are disrupted. The disruptions cause major environmental quality problems that degrade habitat for desirable plant and animal communities. Restoration of large rivers is typically guided by historical or site "reference conditions." However, most large rivers were already extensively modified from their initial states before systematic collection of monitoring data. Using ordination analysis, we show that the Mississippi River of North America and the Middle Paraná River of South America are relatively similar and can, therefore, be considered to be references for each other. The unleveed mid and lower reaches of the Paraná River provide insight into probable conditions that existed in the Mississippi River more than one hundred years ago. In contrast, the present state of the Mississippi River can serve as a negative reference for the Paraná River and demonstrates what may happen to the middle reach of the Paraná River with unsustainable water resources development. We propose that scientists and engineers working in North America and South America collaboratively develop a single ecosystem management tool and calibrate the tool to both rivers. By so doing, resource managers in North America can be assured that tool forecasts for the restored condition are accurate. Concomitantly, resource managers in South America can be assured that forecasts of the impacts of development of the Paraná River are equally accurate. This scientific and engineering synergy will improve water resources management in both continents.

Newton, Teresa J., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Bartsch, Michelle R., U.S. Geological Survey, Upper Midwest Environmental Sciences

Center, La Crosse, Wisconsin, USA, Sauer, Jennie S., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Steuer, Jeff J., U.S. Geological Survey, Wisconsin Water Science Center, Middleton, Wisconsin, USA, Zigler, Steve J., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

O-099 Development of Landscape Models for Protection and Restoration of Freshwater Mussels in Large Rivers. *(Oral Session 6)*

Abstract: We assessed whether the spatial distribution of mussels could be predicted from physical, hydraulic, and biologic variables in a large floodplain river. Analyses of data from mussel beds at small (0.4 km) and moderate (6 km) spatial scales indicated that computed hydraulic variables (e.g., shear stress, Froude number) were more predictive than simple, measured variables (e.g., depth, velocity, substrate particle size). Similarly, classification tree models of mussel presence-absence in a 38-km reach of the river, which had a prediction success of ~75%, were largely driven by shear stress and substrate stability, but interactions with simple physical variables (e.g., slope) were also important. Moreover, discharge-specific models suggested that episodic events such as droughts and floods were more important in structuring mussel distributions than conditions during average flows. Because mussel species differ in shell features that may influence displacement during high discharge events, we evaluated if sculptured, thick-shelled species occupied areas with higher hydraulic stresses, compared to non-sculptured, thin-shelled species. Classification tree models predicted the presence of all mussels, regardless of shell morphology, in areas with low to moderate hydraulic stresses under low and high flow conditions. Overall, our studies suggest that mussels are influenced by a complex interaction of biotic and abiotic factors acting at various spatial scales, but that certain hydraulic variables can improve our ability to predict their spatial distribution in large rivers.

Nilsson, Christer, Umeå University, Sweden

O-100 Landscape ecology of large rivers: human modifications and management of floodplains and watersheds. *(Oral Session 13)*

Abstract: Large rivers are highly dynamic and diverse landscape complexes that integrate watershed processes at the scale of continents. Large rivers foster species-rich and productive biota and vital human cultures. Large rivers also belong among those ecosystems that have been most adversely affected by human intervention, including structural modification of river channels, and alterations of flow regime and water quality. In many parts of the world, human societies use most of the rivers' available freshwater, mostly for agriculture, leading to deterioration of riverine ecosystems and drawbacks to human cultures. Increasing water demands and climate changes imply that many rivers will face dramatic, future increases or decreases in water availability. Some rivers are the targets of restoration efforts to ameliorate their ability to provide ecosystem goods and services. However, balancing the water needs of human societies and riverine ecosystems on a global scale is an immense challenge. This paper will provide a general overview of the development and current status of the landscape ecology of large rivers. It will give consideration to human modifications and management of riverine floodplains and watersheds and their effects on ecosystems. It will also discuss salient issues pertaining to policy and public involvement in landscape management and conservation of riverine ecosystems.

O'Donnell, T. Kevin, University of Missouri-Columbia, Columbia, Missouri, USA, Galat, David L., U.S. Geological Survey Cooperative Research Units, University of Missouri-Columbia, Columbia, Missouri, USA

O-101 River Restoration in the Upper Mississippi River Basin: Insights from Project Managers and Practitioners. *(Oral Session 34)*

Abstract: A group of United States freshwater scientists under the auspices of the National Science Foundation and American Rivers, a leading river conservation organization, are engaged in a unique undertaking – a National River Restoration Science Synthesis (NRRSS). We are evaluating the scientific state of restoration programs in streams and rivers of the United States, including the Upper Mississippi River Basin (UMSRB). We have synthesized 62,108 individual river restoration projects within the UMSRB, populated a relational database with individual project characteristics (e.g., project location, goal, activities, cost), and conducted phone interviews with a subset of project contacts within the UMSRB to determine accuracy of project data synthesized to date and collect finer detailed project information. A total of 13 projects located within UMSRB navigable rivers (e.g., Mississippi and Illinois rivers) and 57 projects located within smaller streams and rivers were randomly selected from our database for phone interviews. Persons participating in interviews from smaller stream projects most often indicated they managed/coordinated projects, while navigable river project interviewees most often indicated they were responsible for evaluating projects. Small stream project interviewees most often indicated past experience as an important source of knowledge for the project design plan, while navigable river project interviewees most often indicated biologists and engineers were important sources of knowledge. Project interviewees more often indicated projects

contained a monitoring component compared to original data sources from which synthesized data was obtained. Phone surveys provided an in-depth investigation of specific success criteria chosen for projects, monitoring variables most often chosen to evaluate projects, and lessons learned after project completion.

Ogorek, Jacob, M, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Haro, Roger, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Rolfhus, Kristofer, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Wiener, James, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

O-102a Methylmercury Relationships Between Sediments and Resident Benthic Macroinvertebrates in Chequamegon Bay (Wisconsin), Lake Superior. *(Oral Session 40)*

Abstract: Substantial contributions of methylmercury to aquatic systems may originate from *in situ* sedimentary formation and watershed sources. The overall conditions of Lake Superior (cold, oligotrophic, and little shoreline influence) and its basin (relatively unpolluted and small watershed) are unfavorable for methylmercury contamination. However, hazardous levels of methylmercury in Walleye and Lake Trout have been measured. The greatest exposure of biota to methylmercury is likely in riverine influenced coastal wetlands. Conditions in wetland environments favor microbial methylmercury formation in sediments, while lotic systems transport methylmercury from upstream wetlands and the watershed. Further, riverine influenced coastal wetlands are shallow and warm, relatively productive, provide substantial habitat for many organisms, and function as an interface between lentic and lotic systems. We examined sediment-benthic macroinvertebrate methylmercury coupling in Chequamegon Bay, Lake Superior (Wisconsin). Sampling areas included an open water reference site and coastal wetlands with and without lotic influences. Sediment cores, pore water, and resident benthic macroinvertebrates were collected in the summer of 2005, with the top 5-20 centimeters of intact cores (homogenized or sectioned) analyzed for methylmercury concentration. Methylmercury concentrations in homogenized sediments (0.016 – 0.607 ng/gdw) were greatest near coastal wetlands with riverine influence, intermediate in the coastal wetland without riverine influence, and lowest near the center of the bay. Results from recent sampling suggest that methylmercury concentrations of select benthic macroinvertebrates follow similar trends. Sediment core methylmercury variations with depth were as high as 28-fold, with maximum concentrations occurring at a variety of depths due to distribution of organic matter. Ancillary variables, such as pore water concentrations of sulfate, sulfide, and dissolved organic carbon, as well as sediment organic carbon and total mercury concentrations were also measured. Sediment methylmercury concentrations were correlated with several ancillary variables. We suggest that Lake Superior methylmercury is the result of both watershed exportation as well as *in situ* formation.

Pascoe, Jessica A., National Great Rivers Research and Education Center, Godfrey, Illinois, USA

O-103 The National Great Rivers Research and Education Center: A Confluence of Partners. *(Oral Session 10)*

Abstract: The National Great Rivers Research and Education Center (NGRREC), founded in 2002, is a unique partnership between Lewis and Clark Community College (LCCC), University of Illinois at Urbana-Champaign (UIUC) and the Illinois Natural History Survey. Several NGRREC and LCCC staff also serve as board members for The Meeting of the Rivers Foundation supporting the acquisition, maintenance and replacement of exhibits at the National Great Rivers Museum operated by the U.S. Army Corps of Engineers. NGRREC's mission is to "study the ecology of the big rivers, the workings of the watersheds that feed them, and ties to the river communities that use them. NGRREC aspires to be a leader in scholarly research, education and outreach related to the interconnectedness of large rivers, their floodplains and watersheds, and their associated communities." NGRREC's full-time environmental educator develops standards-based K-12 activities and community workshops. NGRREC sponsors an annual water festival at Lewis and Clark Community College for 1,000+ 5th grade students each May. A water stewardship committee comprised of teachers and professionals meets once a month to plan the festival and accompanying teacher workshop. Four years of post-secondary student internships have involved over 70 students from seven institutes of higher education working under the guidance of faculty members and advisors from the private and public sectors. The 10-week internships begin with a one-week orientation in aquatic ecology, terrestrial ecology and river systems. The past two years have included a conflict resolution component that has since developed into an Environmental Protection Agency Environmental Education grant proposal for "Participative Education in Environmental Conflict Resolution." In February 2006, NGRREC partnered with Lt. Governor Pat Quinn's Office to manage Illinois RiverWatch. RiverWatch was a sub-program of EcoWatch Network established by Illinois Department of Natural Resources in 1995.

Perkl, Bradley E., U.S. Army Corps of Engineers, St. Paul District, St. Paul, Minnesota, USA

O-104 Managing the Resource: Problems and Prospects for Archaeological Site Conservation

Along the Upper Mississippi River. *(Oral Session 30)*

Abstract: The construction of the locks and dams on the Upper Mississippi River (UMR) in the 1930s created a series of relatively shallow impoundments (navigation pools) on the river as part of the 9-foot navigation channel. This system provides relatively stable water levels during non-flood periods. As a result, profound impacts have occurred and continue to negatively affect cultural resources along the UMR. Among a variety of complex mechanisms affecting cultural resources is shoreline erosion, principally caused by fluvial processes associated with streamflow, fluctuating water levels of the pool, and wave action from wind and commercial and recreational boat traffic. While the idiosyncratic nature of each site and its natural setting (e.g., bank geometry, vegetation), in addition to other factors, determines the susceptibility and extent that erosion will have on a site, erosion in general is detrimental to cultural resources. In addition to site destruction, indirect impacts from erosion potentially include site vandalism and artifact looting. During a recent study examining twenty UMR shoreline archaeological sites, bankline retreat ranges from 5-50 meters with an average of approximately 18 meters (55 ft) of shoreline loss and associated archaeological deposits over the past 60+ years. In some instances, shoreline erosion is abating with the natural establishment of vegetation. In response to shoreline erosion and other processes destructive to UMR archaeological resources, the U.S. Army Corps of Engineers and other federal and state agencies are confronting this situation by implementing shoreline protection schemes on the most threatened sites as funding allows, along with other actions. Shoreline protection measures may include the placement of rip-rap and other features, such as rock wedges and off-shore rock mounds, log-cribbing and establishing vegetation. This presentation will highlight erosion derived archaeological site destruction and shoreline protection methods along the UMR.

Petersen, Jim, U.S. Geological Survey Western Fisheries Research Center, Vancouver, Washington, USA

O-105 Glacial Floods to Reservoirs - Historical Changes in the Columbia River. *(Oral Session 22)*

Abstract: The Columbia River drains an area roughly the size of France, is one of the premier salmon rivers in North America, and provides water for expanding populations and commerce in the Pacific Northwest. The geomorphology of the area was largely shaped by massive floods during the ice ages that swept through the Columbia River Basin from Lake Missoula in Montana, scouring large areas and leaving structures and remnants still evident today. Lewis and Clark, the first Europeans to explore the Columbia from its headwaters, traveled down the river in 1805 and returned upriver across the country in 1806. Native Americans used the river for transportation, sustenance, and cultural purposes, depending largely on Pacific salmon that migrate back to the river to spawn. During the last 60 years, the Columbia River has become one of the great hydroelectric systems in the world, with dams that produce power that is distributed and used throughout the Western United States. Current issues in the Basin include salmon recovery, water for irrigation and growing populations, invasive species, transportation and port development, the impacts of climate change on the river, and protection of water quality.

Pinter, Nicholas, Southern Illinois University, Carbondale, Illinois, USA, Jemberie, Abebe Andualem, Southern Illinois University, Carbondale, Illinois, USA, Remo, Jonathan W.F., Southern Illinois University, Carbondale, Illinois, USA, Heine, Reuben, Augustana College, Rock Island, Illinois, USA

O-106a An Empirical Multivariate Model of Flood Response to River-System Engineering. *(Oral Session 4)*

Abstract: A multivariate statistical model has been constructed for over 4000 km of the Mississippi River and the Lower Missouri River in order to assess the impacts of historical river engineering and floodplain modifications upon flood response. The independent variables in this model consist of parameterizations of river-system infrastructure, including bridges, lock-and-dams (navigational weirs), wing dams (wing dikes or groynes), bendway weirs, meander cutoffs, and levees. These independent variables were measured from multiple generations of historical maps, surveys, charts, structure-history databases, and other sources that were scanned, rectified to common vertical and horizontal coordinate frames, and digitized into GIS vector layers with appropriate attributes. The dependent variables in the model were changes over time in specific stages – stages associated with fixed discharge conditions. For all rated stations in the study area – and for additional stage-only stations for which we interpolated synthetic discharge records – we compiled historical hydrologic records from digital and paper sources, checked and corrected for change of datum and other sources of heterogeneity, calculated specific stages for several multiples of mean annual flow, and then calculated differences relative to the beginning of record at each station. This empirical assessment documents large-scale changes in flow conveyance, including increases in stages for flood conditions of up to 3-4 m. Four reach-scale and one systemwide time-series panel data model were generated, and each model run for a range of different discharge conditions. Of the many statistically significant relationships identified, among the strongest and most interesting included wing-dam construction and levee growth.

Both activities show strong positive correlations with rising flood-stage trends through all portions of the study rivers. The coefficients provide a predictive tool for empirically estimating future changes in flooding in response to new and proposed engineering projects on the Mississippi, Missouri, and similar rivers.

Pinter, Nicholas, Southern Illinois University, Carbondale, Illinois, USA, Remo, Jonathan W. F., Southern Illinois University, Carbondale, Illinois, USA

O-106b Title: 200+ Years of Geomorphic, Land-cover, and Land-use Change on the Middle Mississippi River: Implications for Flow Dynamics and Flood Risk. *(Oral Session 41)*

Abstract: A database of historical geospatial and hydrologic data for the Mississippi River has been compiled at Southern Illinois University. On the Middle Mississippi River – between the confluences of the Ohio and Missouri Rivers – systematic maps sets, surveys, hydrographic data, and other sources date back to the early 19th century, documenting a detailed history of change to the river channel and its floodplain over the past two centuries. Early changes to the river system include widening during the early- to mid-19th century in response to deforestation of the river banks. Quantitative assessments of this deforestation and its effects are problematic because of heterogeneity in the historical map sources, for example apparent discrepancies between the early 19th century General Land Office (GLO) survey and contemporaneous accounts of riparian and floodplain vegetation distributions. Later surveys are more detailed and include more rigorous coordinate systems, including a reach-scale map set dating to the 1880s produced by the Mississippi River Commission. During the last years of the 19th century and through the 20th century, the Middle Mississippi River was progressively engineered to facilitate navigation and control flooding. The channel was narrowed and simplified, and the floodplain has been covered by levees that have increased in extent and height over the past 80-125 years. This history of growing river-engineering infrastructure and geomorphic and land-cover change has caused dramatic changes in the flow dynamics and, in particular, flood conveyance along the Middle Mississippi and elsewhere in the river system. Large-scale shifts in the stage-discharge relationship along the river are documented over the duration of the instrumental hydrologic record, which stretches back to 1861 at St. Louis. Additional stage-only measurement stations were added beginning in the latter half of the 19th century and additional rated stations in the early 20th century, with all documenting rising trends in flood levels. One-dimensional unsteady-flow modeling, as well as hydrologic records, suggest increases of as much as 3.4 m in stage for equal flow conditions during the past century, resulting in progressively more frequent and more severe flooding. These trends are linked to channel constriction, increased roughness due to emplacement of wing dams (groynes), and levee growth. On-going modifications of the Mississippi River system, including continued levee construction, should be evaluated in the context of empirical evidence that such activities significantly increase flooding.

Polasky, Stephen, University of Minnesota, St. Paul, Minnesota, USA

O-107 Valuing Ecosystem Services. *(Oral Session 20)*

Abstract: Human society is to a great extent dependent on vital services that humans receive from managed and natural ecosystems. But human actions threaten to erode the ability of ecosystems to provide these services. Systematic accounting of the value of ecosystem services, and how these values are affected by human actions, is needed to better inform societal choices affecting ecosystems. Such systematic accounting requires advances in both ecology and economics in the following areas: (1) Ecological production functions that describe the relationship between the structure and function of ecosystems and the provision of various ecosystem services, (2) Economic valuation methods that can be applied to generate estimates of the value of ecosystem services in a common metric, (3) Integration of ecological production functions and economic valuation methods in a unified approach to ecosystem services. This talk will discuss applications of ecosystem service valuation in aquatic ecosystems with particular emphasis on issues of nutrient cycles and water quality. Discussion will focus on the current state of knowledge and research priorities.

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O-108 Reconstructing a Semi-arid Riverine Landscape with Historical Surveys, Stratigraphic Evidence, and Process Studies. *(Oral Session 22)*

Abstract: In the western United States, a significant portion of historical Pacific Salmon production originated from streams in semi-arid ecoregions, where upland areas were characterized by sagebrush and valley floors were a combination of wet meadow ecosystems and willow thickets supporting large beaver populations. Between 1860 and 1910, thousands of kilometers of these streams incised between 1 m and 22 m into their historical valley floors, isolating channels from their floodplains, decreasing summer stream flows, and increasing stream temperatures. Consequently, much of this habitat is now unusable by salmon, contributing to listing of salmon and steelhead under the U.S. Endangered Species Act. Reconstructing the

mid-19th century riverine landscape illustrates that fine sediments dominated historical sediment supplies in basins dominated by loess deposits and erosive volcanic rocks. Stratigraphy of pre-incision valley fills is dominated by silt and finer sediments several meters thick, indicating that aggradation occurred in low-energy depositional environments that contrast markedly with today's gravel-bed stream environment. Pre-settlement surveys and recent field studies suggest that sedge meadows and beaver dams were likely agents retaining those fine sediments on valley floors, and local history indicates that beaver trapping and grazing were likely causes of incision. Vegetation patterns reconstructed from 19th century surveys indicate mainly conifer riparian forests in the mountains, hardwood riparian forests at mid-elevation, and willow and sedge meadow riparian areas at lower elevations. Today, recovery of these systems for salmon is dependent upon recovery of critical sediment retention mechanisms (sedge meadows and/or beaver dams). Sedge meadows can recover in a few years, but time to aggrade incised channels to their historical elevations can be on the order of 10^1 to 10^2 years. Combining historical reconstructions with a process-based understanding of recovery mechanisms illustrates where stream recovery will be most rapid and have the greatest benefit to salmon populations.

Porter, Karen A., Hanover College, Hanover, Indiana, USA

O-109 Harnessing River Power: Irrigation, Gender, Social Continuity, and Social Change in South Pare, Tanzania. *(Oral Session 7)*

Abstract: Do indigenous people harness river resources and if so, how? This poster project offers a longitudinal analysis of how the Pare of the Gonja area of the South Pare Mountains, Tanzania, conceptualize and utilize the Hingilili river to provide economic benefits, sustain ecological balance, and create and re-create a sociological, ideological, and religious order through careful construction and management of irrigation canals. Pare harnessed the river prior to colonial contact, extended cultivation to a third growing season, and used surplus production to engage in long-distance trade during the 19th century, thereby extending their influence and power over people. Irrigation continues to support intensive agricultural production in the contemporary period and involves a complex system of use rights rooted in concepts of gender, religion, and hierarchy. With the recent introduction of modern irrigation development schemes in the lowlands, Pare management of river resources has been contested, leading to struggles over access, meaning, and ecological sustainability.

Poulton, Barry C., U.S. Geological Survey, Columbia, Missouri, USA

O-110 Comparison of Aquatic Macroinvertebrate Biodiversity Among Habitat Units in the Lower Missouri River Floodplain: Implications for Biological Assessment and Monitoring. *(Oral Session 42)*

Abstract: Historically, biological surveys in aquatic systems were conducted to characterize community structure and function, to identify the existence of rare or economically important species, and to provide research support for taxonomic, zoogeographic, and life history studies. Today, this basic ecological knowledge is often overlooked in its importance, as more applied biosurveys are targeted toward evaluations of ecological condition for specific types of water bodies or individual habitats. In large river floodplain corridors, adequate interpretation of biosurvey data across multiple spatial and temporal scales requires knowledge on life history requirements and contribution of key species or assemblages to the ecosystem as a whole. During the last decade, several studies have been conducted on aquatic macroinvertebrates within the lower Missouri River floodplain. Species inhabiting the river corridor and their habitat affinities and ecological requirements can be used to demonstrate the contribution of specific habitat units to overall floodplain biodiversity and the importance of including them in monitoring programs and biological assessment of river status or condition. A total of 167 species are known from wetland basins of various types, and 136 species from the mainstem Missouri River, with only 15 percent common to both. Dike backwaters account for 62 species, of which only 10 percent are also found in off-channel wetlands, indicating that these dike habitats do not mimic wetlands or non-connected backwaters in their contribution to floodplain biodiversity. Among mainstem habitats, heterogeneous substrate types had the highest diversity, and unstable homogeneous substrates had the lowest. By partitioning the total floodplain biodiversity into individual components, results of bioassessment and monitoring studies can better characterize losses of floodplain habitats and the species associated with them, as well as the functionality of habitats that have been artificially created, restored or rehabilitated.

Powell, John Wesley, Arlington National Cemetery, Arlington, Virginia, USA

O-111 Selected Prose of John Wesley Powell. *(Oral Session 21)*

Abstract: Since my last writings and public appearances, many words have been penned, many works published, and several biographies made available, among them Lincoln, Darrah, Stegner, Terrell, and

Worster (please see: Marcia Thomas, John Wesley Powell: An Annotated Bibliography; and Earle E. Spamer, Bibliography of the Grand Canyon and Lower Colorado River). Though thousands of words have appeared on the pages and innumerable thoughts have crossed the minds, I have been particularly silent in response. I take this opportunity to join the discussion at the 2006 Great Rivers Conference to reiterate my views of western reclamation and arid lands and the implication of science in their implementation.

Quartaroli, Richard D., Northern Arizona University, Flagstaff, Arizona, USA

O-112 John Wesley Powell's Cartography of the Colorado River System. *(Oral Session 21)*

Abstract: Beginning in the late 1860s, John Wesley Powell led exploring expeditions into the "Great Unknown" of the American west, mapping the last blank spots of the continental United States. His successful completion of the first intentional trip on the Green and Colorado Rivers, along their greater course and through the Grand Canyon, continued with both his successful mapping of the Colorado Plateau and a career in the scientific and government environs of Washington, D.C. Powell carried the latest available maps of the region, both overland and along the rivers, and accurately corrected and updated those rivers' course. The story of discovering his resources and methods for doing so is a complete and interesting story in itself. His plans for mapping the entire nation and the west on a grand scale are still being continued today. But Powell also thought that the land "beyond the hundredth meridian" did not have adequate resources needed to develop the land as in the east. His ideas for larger land allotments and irrigation districts on a smaller, regional scale would have dramatically altered reclamation in the west. If Powell's cartography of the "arid lands" had followed his irrigation concepts, what might the maps of the river drainages and irrigation districts looked like? Would that visual representation of place have better influenced the politicians and populace and led to more efficient use of our seemingly vast, but limited, western resources?

Rashid, Harun, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Haider, Wolfgang, Simon Fraser University, Burnaby, British Columbia, Canada

O-113 Floodplain Residents' Choices for Flood Alleviation in Bangladesh and Canada. *(Oral Session 28)*

Abstract: This paper tests the application of a maximum difference conjoint (MDC) model and a discrete choice experiment (DCE) to elicit floodplain residents' preferences for flood alleviation measures in the Ganges-Brahmaputra floodplains in Bangladesh and the Red River Valley in Manitoba, Canada. The results of an MDC-based experimental survey among 200 floodplain residents inside and outside of an enclosed embankment, called compartmentalization pilot project (CPP), on the left bank of the Brahmaputra indicated that an overwhelming majority of the respondents preferred regulated water level of 0.6 m in their rice field, no flooding either on their courtyard or inside their houses, no significant changes in floodplain fisheries, and no major problem with the drainage system of the enclosed embankment. The results of a follow-up survey, based the DCE model, among nearly 400 residents from the Ganges, the Brahmaputra and the Meghna floodplains indicated that more than 50% of the respondents were in favor of the compartmentalization projects, about 40% preferred isolated polders, and only 10% preferred no structural measures, including embankments. In the Red River Valley, three successive surveys were conducted among nearly 350 respondents, all using the DCE model, to assess urban residents' preferences for emergency flood evacuation policies and rural residents' choices for structural and non-structural flood alleviation measures. The urban surveys indicated that mandatory evacuation was preferred significantly over no evacuation as well as over voluntary evacuation when the risk of flooding was stated as 2 feet above the 1997 historic flood level. The rural survey found that nearly three-quarters of the respondents preferred flood-proofing their homesteads, irrespective of the financial incentives for flood relief or for relocation.

Reidy, Catherine A., Landscape Ecology Group, Department of Ecology and Environmental Science, Umeå University, Umeå, Sweden, Nilsson, Christer, Landscape Ecology Group, Department of Ecology and Environmental Science, Umeå University, Umeå, Sweden

O-114 Predicting Global Losses of Freshwater Fish Resulting from River Channel Fragmentation and Flow Regulation. *(Oral Session 6)*

Abstract: The world is currently facing a decline in biodiversity, due in large part to human alteration of ecosystems. River systems especially have been altered through impoundments and diversions to meet human needs for water, energy and transportation. To combat the global decline of freshwater biodiversity, we are working to predict losses of freshwater fish species due to dam-induced habitat loss. Our project objectives are to (1) determine the global distribution of freshwater fish species that are vulnerable to extinction; (2) determine the global distribution of river systems affected by dam-induced habitat loss; and (3) predict what proportion of fish species will be threatened by extinction as a result of dam-induced

habitat loss, and how this proportion varies among continents, watersheds and ecoregions. Over half of the large 350 $m^3 \cdot s^{-1}$ pre-anthropogenic mean annual discharge) river systems in the world (172 out of 292) have lost freshwater fish habitat because of fragmentation and flow regulation by dams, including the eight most biogeographically diverse. Preliminary data show that the basins that have historically supported the highest numbers of freshwater fish species and rates of endemism are included among these 172 systems, suggesting critical threat to global freshwater fish biodiversity. These systems include the Amazon-Orinoco, Congo, Zhujiang (Pearl), and Mississippi systems. Attributes of fish species that relate to extinction vulnerability and that are potentially impacted by dams include: migratory behavior (both diadromy and potamodromy), parity, breeding habitat (e.g., substrate) requirements, trophic level, dependence on floodplains, degree of rheophily, maximum body size and growth rate. To elucidate the relative importance of these vulnerability attributes, we seek empirical data from pre- and post-dam species inventories. It is critical to account for factors such as lag time between dam construction and species inventories, post-dam introduction of exotics and ecological memory of basins (e.g., disturbance history and the possibility of extinction filtering having already occurred).

Remo, Jonathan, W., Environmental Resource Policy Program, Southern Illinois University, Carbondale, Illinois, USA, Pinter, Nicholas, Department of Geology, Southern Illinois University, Carbondale, Illinois, USA

O-115 Retro Modeling of the Middle Mississippi River. *(Oral Session 18)*

Abstract: A one-dimensional unsteady flow model was developed using HEC-RAS to estimate historic flood stages on the Middle Mississippi River (MMR) for the beginning of the 20th century. Bathymetric and land-cover data for the model were digitized from a map set derived from the Mississippi River Commission's Upper Mississippi River Survey conducted between 1888 and 1897. Floodplain elevations for this model were derived from a modern high-resolution digital elevation model. The bathymetric and floodplain elevation data were used to develop cross sections of the river channel and adjacent floodplains. Land-cover data were used to establish realistic floodplain roughness values. Comparison of the modeling results with the United States Army Corps of Engineers' 2004 Upper Mississippi River System Flow Frequency Study revealed increase in flood elevations of 0.2 to 3.4 m. The only exception to the increase in flood levels was between Jefferson Barracks and Selma, Missouri, where flow events with < 5 year recurrence interval showed no change or a slight decrease (up to 0.3 m). The decreases in these minor flood levels are attributed to local riverbed incision. The changes in flood levels are attributed to river engineering structures and their effects on floodway geometry and flood conveyance. Between 1897 and 2000, river channel and floodway widths through the study reach have decreased approximately 30% and 60%, respectively. These hydro-fluvial changes have significantly impacted hydraulic connectivity of this reach of the Mississippi River. These engineering modifications are likely associated with impairments in key ecological processes including carbon and nutrient processing, floodplain succession patterns, and lateral aquatic biota migrations. The model developed in this investigation provides a useful framework for modeling both hydrodynamic and ecological responses to altered hydrologic regimes resulting from more than a century of river engineering.

Renöfält , Birgitta, M., Umeå University, Umeå, Sweden, Nilsson, Christer, Umeå University, Umeå, Sweden, Jansson, Roland, Umeå University, Umeå, Sweden

O-116 Spatial and Temporal Patterns of Species Richness in a Riparian Landscape. *(Oral Session 11)*

Abstract: This study tests for control of vascular plant species richness in the riparian corridor of the free-flowing Vindel River in northern Sweden. We explored three contrasting (although not mutually exclusive) hypotheses: (1) longitudinal patterns in riparian plant species richness are governed by local, river-related processes independent of the regional species richness, (2) riparian plant species richness is controlled by dispersal along the river (longitudinal control), and (3) the variation in riparian plant species richness mirrors variation in regional richness (lateral control). The study comprises three surveys, undertaken at 10-year intervals, of riparian reaches (200-m stretches) spanning the entire river. In addition, we surveyed species richness of vascular plants in the uplands adjacent to the river in 3.75-km^2 large plots along the same gradient. We explored the relationship between riparian and upland flora and various environmental variables and evaluated temporal variation in downstream patterns of the riparian flora. The strongest correlation between species richness and the environment was a negative one between species number and soil pH, but pH varied within a narrow range. We did not find evidence for a correlation between species richness on regional and local scales. We found that the local patterns of species richness for naturally occurring vascular plants were temporally variable, probably in response to large-scale disturbance caused by extreme floods. Most previous studies have found a unimodal pattern of species richness with peaks in

the middle reaches of a river. In contrast, on two of three occasions corresponding to major flooding events, we found that the distribution of species richness of naturally occurring vascular plants resembled that of regional diversity: a monotonic decrease from headwater to coast. We also found high floristic similarity between the riparian corridor and the surrounding landscape. These results suggest that local processes control patterns of riparian species richness, but that species composition is also highly dependent on the regional species pool. We argue that inter-annual variation in flood disturbance is probably the most important factor producing temporal variability of longitudinal species richness patterns.

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O-117 The Lower Mississippi as a Technological System: The Engineering Challenges. *(Oral Session 9)*

Abstract: The story of navigation and flood control (or nowadays the preferred term, flood damage reduction) on the Mississippi River begins at the beginning of the eighteenth century, when landowners erected modest earthen barriers to protect New Orleans against the river's periodic onslaughts. The unequal task continued throughout the following century, when first plantation owners and then levee districts erected levees in an often uncoordinated effort to develop viable defensive lines along the lower Mississippi's banks. Aside from donations of land for reclamation (the Swampland Acts), surveys and planning reports (including the famous Humphreys-Abbot report on the Mississippi published in 1861), the federal government's contribution to controlling the Lower Mississippi's waters was not extensive until the last two decades of the nineteenth century. A succession of floods gradually led to an extension of the federal effort, led by the U.S. Army Corps of Engineers. These early efforts culminated in the 1928 Flood Control Act, which followed the disastrous 1927 flood. This Act initiated a construction program that no longer depended on levees, but on outlets, dredging, channel training, and associated works. The work continues, but the result is already clear. The Corps has turned the lower Mississippi into a vast technological system that looks on paper somewhat the same as a household plumbing diagram, with outlets, inlets, and valves to regulate the water. This paper shows how this technological system evolved and what it means for the Lower Mississippi Valley. It concludes with a few remarks on the recent Hurricane Katrina disaster and what that event suggests about the application of technological fixes to immensely complicated social problems.

Richardson, William B., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Strauss, Eric A., Fort Hays State University, Hays, Kansas, USA, Bartsch, Lynn A., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Cavanaugh, Jennifer C., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

O-118 Patterns of Nitrogen Cycling in the Upper Mississippi River (UMR) and Floodplain. *(Oral Session 33)*

Abstract: Current loads of total nitrogen in Navigation Pool 8 of the UMR range from 15 x10^3 tmonth^{-1} (spring) to about 1 x10^3 tmonth^{-1} (winter), with NO_3^- making up 90-95% of the total load. A 3-year study to evaluate nitrogen cycling processes and budget in Navigation Pool 8 (2000-2002) showed floodplain backwaters and impounded areas with highest rates of denitrification (microbial conversion of nitrate into inert nitrogen gas) potential (10.9 and 7.6 μg Ncm^{-2}hr $^{-1}$, respectively); side and main channels exhibited the lowest rates (2.2 and 1.6 μg Ncm^{-2}hr $^{-1}$, respectively). Rates of denitrification were similar across all habitats (0.18 μg Ncm^{-2} hr^{-1}). Nitrification rates (microbial conversion of ammonium to nitrate) were also highest in backwaters and impounded areas (1.1 and 1.4 μg Ncm^{-2}hr $^{-1}$, respectively) and lowest in main and side channels (0.3 and 0.6 μg Ncm^{-2}hr^{-1}, respectively). We estimate that denitrification removes about 6900 tons of NO_3^--N annually from Pool 8, which represents 7% of the total NO_3^- load. Much of the NO_3^- removal is offset by nitrification, which contributes 7 tons of nitrogen per year in Pool 8. Backwaters and impounded areas are generally the most biogeochemically active areas of the floodplain river system due to high carbon sediments and relatively long hydraulic retention times. NO_3^- processing is limited by NO_3^- delivery from nitrate-rich main channel waters, while nitrification is often limited by low sediment oxygen..

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O-119 The River Studies Center: Partnerships in Science Research and Education. *(Oral Session 10)*

Abstract: The River Studies Center (Center) at the University of Wisconsin-La Crosse was established in 1972 as a non-curricular unit to focus on research and informational programs pertinent to the Upper Mississippi River and its related resources. During the past 30 years, the Center has expanded its research program to other aquatic resources across Wisconsin, the Upper Midwest, and the Nation. Faculty with the Center teach aquatic and environmental science courses in biology, microbiology, chemistry and geography & earth

science. Scholarly investigations by the Center have provided research opportunities to nearly 100 graduate students and more than 250 undergraduates. The research of Center faculty addresses resource issues and environmental problems of pressing, regional and national concern, such as environmental pollutants and contaminants that have caused widespread degradation of our aquatic resources. A strength of the Center is developing partnerships with state and federal natural resource agencies. One of the most rewarding accomplishments of the past decade has been the establishment of a formal Cooperative Education Agreement with the Upper Midwest Environmental Sciences Center, a research laboratory with the Biological Resources Division of the U.S. Geological Survey. This partnership was established to promote internships and research opportunities for our students and to encourage professional collaboration among scientists of the two institutions. Scientists from the U.S. Geological Survey serve as adjunct faculty to the University and, with Center faculty, co-write research proposals, advise students, and publish the results of their research. The strength of our partnership is based on the guiding principles that guide our cooperative education agreement. Both the University and the USGS must benefit from any project that we jointly undertake. This synergistic partnership, which is a national model for collaboration between federal agencies and state universities, creates new research and learning opportunities that would not be possible without this unique relationship.

Siebentritt, Mark A., Murray-Darling Basin Commission, Canberra, Australian Capital Territory, Australia
McLeod, Tony, Murray-Darling Basin Commission, Canberra, Australian Capital Territory, Australia

O-120 The Murray-Darling Basin's Living Murray Initiative: Ecosystem Services Management in Practice. *(Oral Session 20)*

Abstract: The past decade has seen significant progress to realign water sharing in the Murray-Darling Basin (MDB) with the aim of changing the balance between social, economic and environmental outcomes of water use. Examples of such work, which is coordinated by the Murray-Darling Basin Commission, include the MDB Cap and more recently The Living Murray, which was agreed to by the MDB Ministerial Council in November 2003. The vision of the Living Murray is to achieve a healthy, working river system. While not always stated, implicit to this vision is the role of ecosystem services for communities within the Basin and those outside the Basin that rely on its resources. The First Step decision for the Living Murray aims to achieve environmental outcomes at six Icon Sites by investing $150 million in environmental works and measures and recovering up to 500 GL of water with $500 million from consumptive users for use at the sites. The decision on the volume of water to be recovered was based on a process of ecological and economic modelling in concert with extensive community consultation based on three scenarios: recovery of 350 GL, 750 GL and 1500 GL of water. While the policy development phase of the Living Murray was technically challenging, the implementation phase is likely to prove equally complex. For example, application of the water at the Icon Sites – which straddle three states - will require a contemporary understanding of river operations teamed with knowledge of the functioning of ecological systems and an agreed priority setting process. It is unlikely that a strict adherence to reconstructing the natural flow regime will deliver the balance of ecosystem services sought. Instead, the future of river operations is likely to focus on using infrastructure to manipulate flow, supplemented by environmental water allocations to enhance natural freshes/floods.

Soliman, Hassan, Assiut University, Assiut, Egypt

O-121 The Development of the Natural Resources on the Nile River Basin and Their Environmental Impact. *(Oral Session 12)*

Abstract: The rifting of the Nile valley in Egypt, for millions of years, has cropped out several kinds of natural resources which could be summarized as follows:- water and land resources, constructing and manufacturing materials, The Nile Valley Museum of Historical Cultural Heritage. The Nile is the main water resources of Egypt. It provides the country with about 55.5 Km^3/Year which cover 95% of all need of water for irrigation of 36000 km^2 cultivated land and for domestic purposes. For evaluating the water quality of the Nile water, samples are collected from several localities in front and behind the high Aswan dam and barrages along the Nile course. Also, the suspended materials and the bottom sediments collected from the same localities are analysed. The results will be presented at the Conference. The cultivated land in Egypt is fairly limited. These areas are not sufficient to meet the abnormal increase in population. Thus, reclamation of desert areas adjacent to the cultivated areas has become an essential need. For more than two decades, a scientific team from the Geology Department of Assiut University has been conducting tens of groundwater exploration and evaluation projects. These studies resulted in thousands of hectares of new agricultural lands and seven new cities and contributed widely for giving relief to the severe intensive population in the old Nile valley. The present research will discuss and present some of these important results as an example of the good management of natural resources in arid areas. GIS, an important tool for

storing spatially referenced data and producing geopotential maps, was used in this study for developing a good management scheme of these natural resources. The economical value of the carbonate rocks forming the western and eastern plateaus was evaluated in terms of construction materials and cement industry. Furthermore, the clay deposits are evaluated in the central laboratory of the University for the production of Zeolite bearing minerals. These minerals are very important for different industries.

Sowl, John H., Natural Resources Stewardship and Science, National Park Service, Omaha, Nebraska, USA, Bolwahn, Jessica A., Effigy Mounds National Monument, Harpers Ferry, National Park Service, Iowa, USA, Boudreau, Denise L., Effigy Mounds National Monument, Harpers Ferry, National Park Service, Iowa, USA, Hawkins, Authur S., Upper Mississippi River National Wildlife and Fish Refuge, U.S. Fish and Wildlife Service, Winona, Minnesota, USA, Rovang, Rodney D., Effigy Mounds National Monument, National Park Service, Harpers Ferry, Iowa, USA

O-122 Yellow River Initiative, Iowa, USA: Setting the Stage for Watershed Resource Sustainability. *(Oral Session 24)*

Abstract: Between 2003 and 2005, local, state and federal representatives of government and non-government organizations – in addition to private citizens and landowners – collaborated under the auspices of the Midwest Natural Resources Group (www.mnrg.gov) to pool information sources and ideas for supporting and promoting resource conservation within a 154,500-acre watershed in northeastern Iowa, USA. The Yellow River Initiative partners envisioned a way of tapping local knowledge and pride in outstanding resource features to implement this dynamic small watershed project while creating a model for other initiatives within the Upper Mississippi River basin and beyond. A rapid assessment methodology was utilized to survey and acquire *existing* resources, which were later organized and packaged for internet web access, including an on-line tool kit featuring interactive mapping, planning tools and direct links for conservation assistance (www.northeastiowarcd.org/yrw). In addition, a watershed coordinator position was created within a local Resource Conservation and Development (RC&D) area to provide long-term guidance and continuity for sustainable resource stewardship within the watershed. After development and testing, this approach can be applied to consecutive neighboring small watersheds over time until higher order major watersheds are addressed in this way. By creating a universally accessible and user-friendly information clearinghouse, resource information is made available to all. Through this "democratization" of information, the watershed partners aim to increase the efficiency of environmental restoration efforts, making limited human and monetary resources stretch farther to better address local needs. These tools establish the foundation for a more holistic view of the watershed's resource condition, demonstrating critical resource linkages and facilitating adaptive management. With greater public understanding of resources and options for enhancing local resource stewardship, people and organizations can find opportunities for expressing and putting into practice their own land ethics using this model.

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O-123 INTAFERE – Integrated Analysis of Mobile Organic Foreign Substances in Rivers: New Approaches for Coping with Risk and Uncertainty. *(Oral Session 40)*

Abstract: Worldwide more than 100,000 chemicals are in constant use. However only a small fraction of them are extensively investigated concerning human and eco-toxicological impacts. This is in particular true for mobile organic foreign substances (MOF). Due to their high water solubility, MOF are normally extremely mobile in rivers. For some, a high biological activity even at trace levels is already demonstrated. MOF are present in everyday materials and products such as plastics and foams. Via consumption and disposal, they enter the waste waters and can be detected in rivers in environmentally relevant concentrations. The interdisciplinary research project INTAFERE investigates the particular hazard of MOF for nature and society from an integrative perspective. In this paper we focus on the societal aspects of MOF in rivers. Analytical and eco-toxicological results are addressed in a complementary paper by P. Di Benedetto. Partial knowledge about fundamental mechanisms of action leads to uncertainties in the assessment of the hazardous potential of MOF. Facing the multitude of MOF, established assessment procedures on the basis of simple cause effect relations and threshold values for single substances are hardly appropriate to cope with this situation. Drawing on the concept of a participatory risk assessment, INTAFERE is developing an innovative approach towards precautionary based assessment procedures. On a conceptual level, the assessment of the reliability of the available knowledge base is included in the assessment procedures. Furthermore, additional assessment criteria, such as persistence, irreversibility of impacts and long-term adverse effects are emphasised. The impacts of mixtures of substances are included on a methodological level. Finally, the perspectives of the stakeholders affected are introduced in the assessment procedure, using actor network analysis, scenario workshops and participatory modelling techniques.

Strauss, Eric A., Fort Hays State University, Hays, Kansas, USA, Richardson, William B., U.S. Geological Survey, La Crosse, Wisconsin, USA, Bartsch, Lynn A., U.S. Geological Survey, La Crosse, Wisconsin, USA, Cavanaugh, Jennifer C., U.S. Geological Survey, La Crosse, Wisconsin, USA

O-124 In-stream Nitrogen Loss Due to Denitrification in the Mississippi River from Minneapolis to the Atchafalaya River Diversion. *(Oral Session 33)*

Abstract: Highly productive and oxygen stressed coastal waters are often associated with high nutrient inputs from riverine systems. For example, nitrogen export from the Mississippi River into the Gulf of Mexico is an important factor causing eutrophication and seasonal hypoxia. Modeling studies of nitrogen flux in large rivers, including the Mississippi River, suggest that much of the nitrogen that enters rivers is conserved and exported. However, patterns of nitrogen cycling, including denitrification, in the Mississippi River are known to be complex and vary according to habitat type and season. We used spatial habitat data and empirically derived denitrification rates to extrapolate nitrogen loss to the 2,400 km reach of the Mississippi River from Minneapolis, Minnesota to the Atchafalaya River diversion in Louisiana. Nitrogen load at the Atchafalaya River diversion has been estimated at 1.5 million Mg N y^{-1} and our analysis yielded a system-wide in-stream nitrogen loss of 159,044 Mg N y^{-1} (about 9.5% of the total nitrogen load). Our results also indicate that nitrogen removal was greater in the northern reaches compared to that in the southern reaches because of increased habitat complexity in the navigation pools that occupy the northern half of the river. The southern reaches contain primarily main channel and side channel habitats; whereas in the northern reaches, impoundments and backwater lakes contribute a combined 40% of the surface area. Overall, our results are consistent with high throughput of nitrogen in this large river, but specify that habitat diversity and river channel complexity are driving factors that influence retention time, depth, and other physical/ chemical variables that lead to increased riverine nitrogen loss.

Strigel, Michael, J., Wisconsin Academy of Sciences, Arts and Letters, Madison, Wisconsin, USA

O-125 Waters of Wisconsin - An Initiative for the Future of Wisconsin's Waters. *(Oral Session 26)*

Abstract: Between 2001 and 2003 the nonprofit Wisconsin Academy of Sciences, Arts and Letters led the Waters of Wisconsin initiative. This initiative brought together members of the public with experts and stakeholders from virtually all areas of water use and management—from agriculture, industry, conservation, business, all levels of government and public agencies, education, and Native American tribes—to discuss how to best use and protect Wisconsin's waters now and for future generations. The initiative culminated in the Water of Wisconsin Forum held in October 2002 with more than 700 participants gathered to provide input on the Water of Wisconsin Recommendations. This unique forum integrated arts and culture into a discussion primarily focused on science and policy. The findings of the Waters of Wisconsin Initiative were compiled into a 180-page report that provides an overview of the Waters of Wisconsin process; a summary of the status and trends in Wisconsin's waters; a look at the future of water in the state using scenario narratives focused on key variables such as agriculture, demographics, and climate change; a discussion of sustainability, state water policy and the initiative recommendations. The Water of Wisconsin initiative is a model effort that engaged over 1000 participants over a three-year period that could be emulated on many different scales and locations. This landmark effort not only brought together stakeholders from very different perspectives to develop a common set of recommendations to protect Wisconsin's water for the benefit of future generations, but also successfully provided a forum for long term integrated thinking about water resource and ecosystem issues. The integration of arts and culture into the program was critical to the initiative's success by reinforcing the personal connection to water and energizing engagement in policy discussions.

Styles, Bonnie, Illinois State Museum, Springfield, Illinois, USA, Buikstra, Jane, Arizona State University, Tempe, Arizona, USA

O-126 Long-term Human Interactions with the Environment in the Illinois River Valley. *(Oral Session 36)*

Abstract: Analyses of remains from archaeological sites in the Midwestern United States document changes in human-land interaction. During the late Pleistocene, humans encountered open spruce woodlands and exploited both extant and extinct animal species. Early Holocene occupants exploited deer, small mammals, and a diverse variety of nuts from the closed, mesic forests that replaced boreal settings. Early to mid-Holocene environmental changes exaggerated differences between resource catchments within and outside large river valleys, such as those of the Illinois and Mississippi rivers. The development of productive, bottomland lakes and an open, patchy forest-prairie mosaic in the mid-Holocene enhanced productivity of fish, white-tailed deer, and certain nut resources. These changes in resource productivity and distributions stimulated changes in human settlement, mobility, and subsistence practices. Mid-Holocene populations

made greater use of white-tailed deer, aquatic resources, and hickory nuts than did their early Holocene predecessors. In large river valleys, the trend toward increased use of aquatic resources, particularly fish, continued into the late Holocene. Residentially more sedentary horticulturalists made increased use of seed crops and fish--cultivated and renewable resources that can withstand heavy exploitation. However, representation of white-tailed deer and other terrestrial mammals declined because of hunting pressure and human impacts on habitat. This pattern continued and intensified after the introduction of maize around A.D. 600. Increased population aggregation and subsistence change in late prehistory is associated with increases in infectious disease, shorter lifespan, high infant mortality, and diminished dental health. The broad patterns of subsistence change and human health correspond to diachronic patterns in landscape evolution and settlement and mobility strategies.

Sullivan, Timothy, Mississippi River Institute for Global Cooperation, Red Wing, Minnesota, USA, Anderson, Jim, Water Resources Center, University of Minnesota, Saint Paul, Minnesota, USA

O-127 The Mekong-Mississippi Partnership. *(Oral Session 25)*

Abstract: River systems have two primary functions. They sustain essential ecosystems and they connect communities, states and nations - providing agriculture, trade and resource development opportunities with a wide range of economic and social benefits. But development also creates environmental problems and social challenges. Worldwide, entire eco-regions are threatened by river pollution, ecological destruction and environmental health problems. Nations, states and local governments are attempting to address these difficult issues by investing in sustainable development systems, water resource conservation plans, environmental health education and the improvement of policy planning processes. Overcoming jurisdictional barriers and fairly balancing competing social, economic and environmental needs is the challenge. Panel members will include Tim Sullivan, President of the Mississippi River Institute for Global Cooperation; Jim Anderson, Co-Director of the University of Minnesota Water Resource Center; and a representative of the Mekong River Commission (which represents Lao PDR, Vietnam, Cambodia and Thailand). The presenters will discuss the efforts of the Mississippi-Mekong Partnership to promote conservation of water resources; facilitate transboundary cooperation in water resource management; increase the participation of civil society in policy planning and decision making processes; and address importance of social and environmental justice policy issues.

Swai, Elinami V., Penn State University, State College, Pennsylvania, USA

O-128 The Dangers of Marginalizing Women in the Management of Water Sources: Some Lessons from Tanzania. *(Oral Session 24)*

Abstract: In many African societies, it is the role of women and children to fetch water for entire household needs. In this paper, I seek to place African women within the discourse of water as both a social and economic capital. Utilizing post-structural feminism, symbolic interactionism and cultural historical activity theories, I will show how women's knowledge and skills have been ignored in water management in Tanzania. Using examples from rural Tanzania, I will argue that the marginalization of women in management of water sources is dangerous. I will show a link between restricted access to clean water and the feminization of poverty in rural Tanzania. I will place women at the center of Tanzania's water sector, assessing their actions through African feminist theoretical framework under which such scholars as Marjorie Mbilinyi, Penina Mlama, Elizabeth Okeke, Maria Nzomo, Amina Mama, Oyeronke Oyewumi and others have written against the grain of a contemporary indictment and erasure of African women's voice in development. I show that in many communities in Tanzania, water is regarded as a 'female' commodity, and this brings about certain aspects of marginalization and disempowerment. Women, and to a lesser extent children, draw water for household use, transport it home, store it until it is used, and use it for cooking, cleaning, washing, and watering household animals. In principle, women must put in a lot of time, energy, and resources to gather water from wherever it can be found, sometimes in places several miles away. The feminization of water in Tanzania has meant that women bear the burden of making it available for household use. Thus it is women who feel most acutely the impact in the over 70 percent of the Tanzanian population that does not have access to piped and improved water quality in their homes. In many parts of Tanzania, women may spend up to 6-8 hours per day collecting water for domestic use, usually in the early hours of the morning or late afternoon and evenings. That is why the history of water in Tanzania is essentially the history of women. In many parts of Tanzania, it is women who evaluate water sources, analyze supply patterns, lobby relevant authorities, and launch protests when water availability reaches calamitous levels. I will interrogate the place of African women's voices in conservation and management of water sources, which have been ignored in the past. I will confirm the vital role that Tanzanian women play in provision of water and yet they are marginalized in the development of modern water infrastructure. My discussion of the marginalization of women in water conservation and management will be centered on

women's knowledge of water sources as opposed to men's. The paper will demonstrate the constraints that Tanzanian women face as individuals, as part of groups, social classes, and race in the struggle to access water and how their voices are rarely heard in the management of water sources that are increasingly diminishing, adding to their poverty.

Taylor, Davis F, College of the Atlantic, Bar Harbor, Maine, USA, Dodge, Eric R., Rivers Institute at Hanover College, Hanover, Indiana, USA

O-129 Watersheds as Units of Analysis and Planning for Local Sustainable Economic Development: Do They Make Any Sense? *(Oral Session 7)*

Abstract: This paper is based on findings suggested by two case studies in which a watershed, not a municipality or county, was used as the unit of analysis for socioeconomic baseline studies conducted with an eye toward sustainable local economic development. Not surprisingly, due to traditional economic development, commerce, and commuting patterns, current socioeconomic patterns are largely independent of watershed boundaries. However, applying recent approaches to sustainable community development to these watersheds suggests that they can have a significant role in local, sustainable economic development. Our case studies highlight three major contexts in which a watershed-based perspective can facilitate local sustainable community development: watersheds as common, open access amenity/option value/existence value resources, watersheds as common open access "use" resources, and watersheds as sources of a common historical legacy. In all three, this linking role of watersheds can generate social capital within the watershed vital to fostering local sustainable economic development. In the first two, the creation of social capital and community development that is presumed to follow is implicit at best: watershed groups/ coalitions build social capital that likely contributes to the overall social capital within the watershed. Rarely is the watershed explicitly designated as an analytical unit for social capital and/or community economic development. The creation of social capital for the purposes of community development goes unrecognized. Use of the third context appears to be uncommon. The historical legacy of rivers is widely acknowledged, and the use of historical legacy as a means of creating social capital is often recognized. Linking these two concepts is largely unrecognized. All three contexts represent underutilized dimensions for creating social capital for local sustainable economic development, especially between rural communities that see themselves as independent or rival. Recognizing a watershed perspective in local sustainable economic development stresses an interdisciplinary perspective to human activity in watersheds.

Taylor, Debra L., U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, Minnesota, USA, Angradi, Theodore R., U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, Minnesota, USA, Bolgrien, David W., U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, Minnesota, USA, Hill, Brian H., U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, Minnesota, USA, Jicha, Terri M., U.S. Environmental Protection Agency Mid-Continent Ecology Division, Duluth, Minnesota, USA

O-130 From Data to Information: Development of Integrative Habitat Indices for Great River Ecosystems. *(Oral Session 42)*

Abstract: The Great Rivers of the mid-North American continent represent significant wildlife habitat and are important human recreational destinations and transportation corridors. If Great Rivers are to be sampled in a scientifically defensible and cost-effective manner, resource managers need to know what habitat data to collect, and how to integrate this data into indices that express the habitat needs of river biota, as well as human priorities and values. Four habitat and human impact indices are proposed. Preliminary data from the 2004-2005 Environmental Monitoring and Assessment Program for Great River Ecosystems (EMAP-GRE) sampling operations on the Missouri, Upper Mississippi, and Ohio Rivers will be used to illustrate the indices. The channel erosion potential index includes variables related to bank stability and fine sediment supply, such as bank height and angle, bank soil types, impervious surface cover in the riparian zone, observed bank erosion, and extent and root structure of riparian vegetation. A riparian runoff retention index will be quantified by integrating data on riparian buffer width, vegetation types and densities, and riparian soil types and topography. These two indices will also evaluate the impacts on biota when the buffering and filtering capacity of riparian zones is defeated by culverts, ditches, and highly altered tributaries. The riparian habitat index will consider the relative distribution of ground cover, understory, and canopy vegetation, nearby human land disturbance, ease of wildlife access to the river, and dominance of exotic and invasive plant species. Lastly, the human disturbance index will combine data on land alterations in the river channel, riparian zone, and watershed, incorporating measures of agriculture, urbanization, recreational uses, and consider the hydrological changes caused by locks, dams, and channel stabilization efforts. This index will incorporate the both the type of constituent impacts and the proximity of these impacts to the river. *Abstract does not necessarily reflect Environmental Protection Agency policy.*

Theler, James L., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

O-131 The Woodland Tradition: Mounds, Pottery Containers, and the Spread of Plant Cultivation in the Upper Mississippi River Valley. *(Oral Session 30)*

Abstract: The Woodland Tradition emerges in the Upper Mississippi Valley about 2200 years ago. This tradition is first signaled by the occurence of pottery containers followed by the construction of earthen mounds to cover the remains of the dead, and finally by the cultivation of native and domestic food plants. The Early Woodland is marked by the first pottery containers and burial mounds in some regions. Next, the Middle Woodland burial mounds are often found to contain remarkable artifacts made of 'exotic' raw materials such as copper, marine shell, and obsidian indicating a period of long-distance trade. For reasons unknown, long-distance trade in exotic materials stops in many areas 1700 years ago, marking the end of the Middle Woodland. The final Late Woodland stage has increasing human populations, with many regional variations, and a new relance on horticulture as subsistence patterns change. The best known of the Late Woodland groups are the Effigy Mound builders of the Upper Mississippi Valley. The Effigy Mound people constructed earth mounds in the shape of animals, such as birds and bears. The Woodland Tradition came to an end about 900 years ago, under the stress of population pressure and the arrival of "Mississippian" cultural peoples from the south.

Thomas, Marcia L., University of Wisconsin-Baraboo/Sauk Co., Baraboo, Wisconsin, USA

O-132 John Wesley Powell and the Popular Press. *(Oral Session 21)*

Abstract: When John Wesley Powell began his voyage down the Colorado River in May 1869, he knew that capturing public attention was critical in his bid to acquire public funding for a survey of the unmapped Colorado River Plateau. Major Powell and several members of his ten-man party maintained frequent correspondence with editors of the *Chicago Tribune, Rocky Mountain News*, and other prominent newspapers. The sensational but false news of his supposed drowning cemented public interest in Powell's great adventure. By the time the Major emerged from the Grand Canyon in August, he had achieved the status of national hero. America's fascination with the dramatic landscape and commercial promise of its western territories meshed perfectly with Powell's ambition to build a strong and prominent role for government science. His savvy employment of the flourishing popular media and his ability to cultivate political allies helped him secure simultaneous directorships of the Bureau of American Ethnology in 1879 and the U.S. Geological Survey (USGS) in 1881. Powell held the BAE post until his death in 1902, but resigned from the USGS in 1894 after unsuccessfully pitting himself against powerful political and economic interests pushing for rapid settlement on public lands in the arid West. Clashes with Congress, his alignment with paleontologist Othniel Marsh in a very public battle with Edward Cope, and his declaration before the International Irrigation Congress in Los Angeles that there was "not enough water to irrigate all this arid region" played out unfavorably in the press. His vision that science would inform a progressive new land policy for western settlement never stood a chance with the people of an optimistic nation ready and eager to occupy the whole of its vast continent.

Thompson, Charles M., Mississippi Depaartmentof Environmental Quality, Pearl, Mississippi, USA, Beiser, Mike C., Mississippi Department of Environmental Quality, Pearl, Mississippi, USA

O-133 Department of Environmental Quality's Non-wadeable Stream Bioassessment Methods Development Project. *(Oral Session 37)*

Abstract: The Mississippi Department of Environmental Quality's (MDEQ) Surface Water Division obtained funding to develop a sampling method and an IBI-type assessment tool for use in the state's non-wadeable streams. A Large River Technical Advisory Group (LRTAG) was also formed to assist in determination of an appropriate sampling strategy. After review of the output from the LRTAG, and after much consultation with Dr. Joe Flotemersch, it was decided that some modification of the method currently being developed by Dr. Flotemersch would be used. Since this method is quite rigorous and many state agencies lack resources to carry out all components of the methodology, considerations were given to items such as the length of the sampling reach, the number of samples collected, the location of specific sampling areas, and the number of organisms processed and identified. Our sampling project began in August 2005 with the MDEQ Laboratory Biological Services Section assuming project lead, and focused upon three of the state's major river basins--the Big Black, Tennessee-Tombigbee, and the Pascagoula. The Tennessee-Tombigbee is a highly modified system, the Big Black is a system largely influenced by non-point source pollution and is experiencing head-cutting, and the Pascagoula is known to have some areas with high-water quality (potential reference). Collections were made on the Big Black and Tennessee-Tombigbee rivers, but Hurricane Katrina caused major fish kills on the Pascagoula, so sampling on that river, and possibly others, will be undertaken in August 2006. Results are pending. Several other questions have been raised since the

onset of sampling. Among these are: "Can we expand the length of the sampling zone in order to capture more woody debris?"

Tidwell, Michael, Author-Filmmaker, Takoma Park, Maryland, USA

O-134 Life After Katrina: Allowing the Mississippi River to "Flood" Again Is the Only Way to Save New Orleans from the Next Hurricane. *(Oral Session 35)*

Abstract: Poor evacuation plans and faulty levees were only the symptoms of a much larger disease that led to the Katrina disaster. The real problem was the catastrophic loss of one million acres of wetlands and barrier islands along the Louisiana coast over the last 100 years. This lost land, triggered by the flood levees of the lower Mississippi River, created the watery flight path that allowed Katrina to slam into the heart of New Orleans. The good news is there's a plan to restore the coastal land by letting the river to "flood" again in a controlled way, and so rebuild the natural land barriers that protect against hurricane surge tides.

Tornes, Angela, M., National Park Service, Milwaukee, Wisconsin, USA

O-135 National Trends in Water Trails. *(Oral Session 28)*

Abstract: Rivers, lakes, coasts, and waterways across the United States are being explored by canoeists and kayakers as never before. With an increased awareness of the multiple values these watery resources bring to individuals and communities, few waterways (including urban environments) have been left unexplored. Boaters are replicating the explorations of our ancestors who investigated and paddled rivers by necessity; today's boaters tour these places out of curiosity, wonder, and respect. Communities embrace the concept of water trails as a way to connect with each other while promoting stewardship and ecotourism. Learn what a water trail is, how they are developed, traits of successful water trails, funding possibilities, and the wide range of water trails being created in this country.

Varley, Jane, Muskingum College, New Concord, Ohio, USA

O-136 Rivers Rising: The Mississippi and Beyond. *(Oral Session 8)*

Abstract: Jane Varley's conference presentation focuses on the changeability of rivers and the consequent changes these rising and falling waters make in our lives. If we believe, as the Greek philosopher Heraclitus did, that "you could not step twice into the same river; for other waters are ever flowing on to you," we can come to understand how the rivers around us are in constant motion, and they form us mind, body, and spirit as we experience them through fishing, swimming, drinking, damming, diking, and draining. The presentation will share specific examples from a girlhood on the Mississippi River near Dubuque, Iowa, and also from a recent disastrous flood in North Dakota, when a whole city went under water. Participants will be asked to reflect on their contact with rivers throughout their lives. What rivers do you know? What sort of figurative power do these rivers hold for our communities and for each of us individually? This session encourages participants to find their own connections and express them in discussion and writing.

Voris, Harold K., Field Museum of Natural History, Chicago, Illinois, USA, Karns, Daryl R., Rivers Institute, Hanover College, Hanover, Indiana, USA

O-137 River Systems and the Origin of Biodiversity in Southeast Asia. *(Oral Session 11)*

Abstract: Recent studies have shown that the biodiversity of many groups of organisms has been greatly underestimated in Southeast Asia and elsewhere. Molecular data (e.g., DNA sequence analysis) have contributed to uncovering many cryptic species (genetically distinct biological entities that are similar in physical appearance). We examine the important role that river systems play in the generation and maintenance of biological diversity in Southeast Asia. In terms of gene flow among populations, rivers and river basins can enhance connectivity among populations or create barriers leading to isolation and divergence, dependent on the biology and dispersal capabilities of species. Southeast Asia has an exceptionally complex biogeographical history. Plate tectonics, volcanism, climate change, and sea level changes have influenced the history of river drainage systems in Southeast Asia. We analyze how these factors have changed the course of rivers, contributed to cycles of connectivity and isolation among populations, and influenced the generation of biodiversity in the region. For example, analysis of genetic variation among populations of the semi-aquatic homalopsine snake, *Enhydris plumbea*, indicates that this widespread species actually consists of at least two species. Our study indicates that populations associated with the lower Mekong River basin and mountainous regions of northern and western Thailand are genetically distinct from populations associated with lowland drainages of the Central Plain and Southeastern drainage basins of Thailand. Using different terrestrial and aquatic species as examples, we will illustrate how dynamic river systems have influenced the process of speciation and helped to create the remarkable biodiversity of this region of the world.

Wagner, Mark, The National Mississippi River Museum and Aquarium, Dubuque, Iowa, USA

O-138 National Mississippi River Museum and Aquarium. *(Oral Session 5)*

Abstract: Mark Wagner, Education Director from the National Mississippi River Museum and Aquarium, in Dubuque, Iowa, will present a program about the 2005 Regional Student Ocean Conference. This conference was open to high school students and teachers from the four states of Minnesota, Wisconsin, Iowa, and Illinois. This two-day conference, held in May of 2005, was funded by the National Geographic Society through the museum's Coastal America partnership with federal agencies. The theme of the conference was the Mississippi Watershed Connects to the Sea, and the objective was to gather students and their teachers to learn from experts, explore through field trips and hands-on activities, and enter into discussion about their role in protecting the watersheds that flow to rivers and lakes and ultimately feed the ocean ecosystems.

Wegner, David L., Ecosystem Management International, Inc., Durango, Colorado, USA

O-139 John Wesley Powell: A Dream Unrealized for the Colorado River. *(Oral Session 21)*

Abstract: A great deal has been written about John Wesley Powell's explorations of the West and the Colorado River. Most writings explore his adventures and resultant activities in Washington, D.C. Powell had a vision and a dream for the West, a vision that he based on the concept of developing a Western agricultural society that had balance between available water and suitable land. Powell's belief was that a sustainable relationship could be developed between Western expansion and the watershed. Instead of Major Powell's dream of a sustainable West, a plumbing system dependent on inaccurate water forecasts, dams, and economically inappropriate water distribution systems today define the Western landscape. As populations continue to grow, the constraints of limited water will lead to increasing conflicts between the new and the old West. John Wesley Powell's dream of a society living within its means has been shattered. Today, besides the traditional agricultural water users, cities, boaters, fishermen, conservationists, and Indian tribes are fighting over a diminishing supply of water. What would the West look like if Congress and the President had followed John Wesley Powell's recommendations? Would it be any better off? This presentation will address the atmosphere that existed in Washington and the country in the late 1800s and explore the resulting history of Western water development and conflict. An alternative scenario based on the Powell recommendations will be articulated and discussed as to whether Powell's dream has merit in today's world and perhaps offers a roadmap for the future.

West, Paul C., The Nature Conservancy/University of Wisconsin-Madison, Madison, Wisconsin, USA, Foley, Jonathan A., University of Wisconsin-Madison, Madison, Wisconsin, USA, Kucharik, Chris, University of Wisconsin-Madison, Madison, Wisconsin, USA, Barford, Carol, University of Wisconsin-Madison, Madison, Wisconsin, USA

O-140 Spatial Distribution of Ecosystem Services Within Large River Basins. *(Oral Session 14)*

Abstract: Large river basins are managed to meet multiple societal goals. There is an increasing desire to incorporate ecosystem services into management and policy decisions to meet these multiple goals. Understanding the biophysical quantities of ecosystem services is a critical first step to inform policy or monetary valuation. This presentation will discuss the preliminary results of using existing data sets and a global ecosystem model to create indexes that quantify flood regulation, climate regulation, food production, and biodiversity in several dozen large river basins. Spatial distribution and correlation among ecosystem services will also be presented. The approach presented will later be applied to additional ecosystem services. The results of this research will be used to make comparisons among large river basins, inform management of uplands to meet biodiversity and other societal goals, and create a dataset that can be used for assessing tradeoffs among ecosystem services.

White, William P., Illinois Department of Natural Resources--State Water Survey, Peoria, Illinois, USA

O-141 Watershed Assessment Framework for Rapid Project Identification and Restoration of the Illinois River System. *(Oral Session 38)*

Abstract: Erosion has been recognized as a main environmental problem in the Illinois River Valley. Restoration of the landscape is necessary to reverse the effect of past disturbances and ensuing trend toward further ecological degradation. Watershed assessments which rapidly identify on-the-ground natural resource restoration targets are well received by the public and by public institutions in charge of funding ecosystem restoration efforts. The Illinois State Water Survey is coordinating the assessment and evaluation of the Illinois River watershed in order to facilitate implementation of the larger goals of the Illinois River Basin Ecosystem Restoration Plan. Watershed assessments conducted by the Illinois Scientific Surveys under the auspices of this project include use of existing data and collection of new data. The main effort for the assessment includes analysis of existing Geographic Information System (GIS) data, collection of digital

aerial imagery of specific sub-basins selected for survey by selected criteria, and field data collection and analysis of geomorphological data and biological indicators. Existing and newly collected data is being used specifically to locate, characterize, and prioritize multi-objective restoration projects that reduce erosion, restore habitat, and protect overall ecosystem health. Assessment using a low level aerial camera attached to a helicopter with a synchronized Global Positioning System allows for rapid identification and geographic positioning of areas exhibiting potential instability. After general GIS and aerial assessments pin-point the location and general nature of critical erosion areas, potential wetland restoration sites, channel re-meandering opportunities, etc., more thorough biological and geomorphological field assessments are performed to understand local reach and stream segment erosion issues and systemic causative factors. Senachwine Creek, a direct tributary to Peoria Lakes in the central part of Illinois, USA, is used to illustrate the assessment approach. This paper briefly describes the framework for the aerial assessment and data collection effort, utilizing an example from Senachwine Creek, and briefly suggests the use of a data retrieval and analysis system (Illinois Rivers Decision Support System) for tracking activities, evaluating project performance, and making management decisions.

Wiener, James, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Davis, Jay, San Francisco Estuary Institute, Oakland, California, USA, Brodberg, Robert, California Office of Environmental Health Hazard Assessment, Sacramento, California, USA, Ujihara, Alyce, California Department of Health Services, Richmond, California, USA

O-142 A Framework for Near-Term Reduction of Human Exposure to Methylmercury During Restoration of the San Francisco Bay-Delta Ecosystem. *(Oral Session 40)*

Abstract: Many sites within the San Francisco Bay-Delta and tributaries are undergoing ecological restoration in an effort to improve the health of this ecosystem, which has been highly modified and degraded by human activities. This ecosystem is extensively contaminated with inorganic mercury from historic mining activities and other sources. Certain restoration activities could increase the microbial production and abundance of methylmercury, a toxic compound that can bioaccumulate to high concentrations in organisms atop aquatic food webs. Methylmercury can adversely affect wildlife, diminish socioeconomic and cultural benefits derived from fisheries, degrade water and sediment quality, and pose health risks to humans who consume contaminated fish. Success in achieving strategic restoration goals for this ecosystem will, therefore, depend partly on an ability to mitigate the production and bioaccumulation of methylmercury and to reduce the associated exposures of humans and wildlife. We outline a Mercury Strategy developed to integrate mercury investigations, ecological restoration, management, and risk assessment and describe a related project for monitoring mercury in fish within the ecosystem. The Fish Mercury Project (www.sfei.org/cmr/fishmercury) is a 3-year effort begun in 2005 to quantify mercury concentrations in fish and to provide a scientific foundation for developing fish consumption advice for humans who eat fish, the primary pathway for human exposure to methylmercury. Edible fish will be sampled at about 120 locations, including the Delta, the Sacramento River, and the San Joaquin River, to enable the development of fish-consumption advice for a large portion of the watershed. Stakeholder involvement is being used to focus fish monitoring efforts on popular species and fishing locations and to develop effective channels for risk communication. Information will be communicated to increase public awareness of (1) species of fish with high concentrations of mercury (to be avoided) and species with comparatively low concentrations, (2) locations where fish have comparatively high and low concentrations of mercury, (3) the health risks of methylmercury exposure, (4) steps that can be taken to reduce exposure, and (5) the health benefits of eating relatively "clean" fish. Research is underway to identify and evaluate potential remedial approaches for reducing methylmercury contamination of this ecosystem. Within a timeframe of a few years, however, risk communication linked to a well-designed monitoring program is the most realistic approach for reducing human exposure to methylmercury in this contaminated ecosystem.

Wiens, John, The Nature Conservancy, Arlington, Virginia, USA

O-143 Great Rivers as Great Integrators: Linking Land with Water, People with Conservation. *(Oral Session 19)*

Abstract: Large rivers of the world are perhaps the ultimate integrators. Through their watersheds, they link land with water and land uses with water quality and biodiversity. The emerging concepts of landscape ecology can broaden our understanding of these linkages and provide insights into how land and water management may be joined together. Rivers also link people with conservation. While large rivers harbor significant (but largely unseen) biodiversity, they also provide an array of ecosystem services to human populations. Awareness of the diversity, importance, and value of these ecosystem services is just emerging, providing a way to make conservation of rivers compatible with human activities and relevant to those who find "biodiversity" uninspiring. Using the newly initiated Great Rivers Partnership of The Nature

Conservancy as an example, I will discuss how these integrating roles of rivers are forming the foundation of conservation efforts in China, Brazil, and the United States.

Wilding, Joyce M., Sewanee University of The South, Sewanee, Tennessee, USA

O-144 Protecting and Healing Rivers One Watershed At A Time: Secular and Religious Collaborative Programs. *(Oral Session 28)*

Abstract: The collaborative work of the Cumberland River Compact and ENTREAT, a science and religion program at Sewanee University of The South, are described in this paper. Cumberland River Compact and ENTREAT offer models for local and regional initiatives to address the problems that destroy and threaten the watersheds in middle Tennessee: increasing demand for water, rapid population growth, development, and urbanization. ENTREAT explores the implications of the Christian idea of human stewardship of creation, and its impact on a spiritual, social and ecological transformation of watersheds. Multi-disciplinary programs support vital public policy and conservation practices that protect watersheds and rivers. The roles of activism for people of faith with science backgrounds are promoted. Many issues at the religion/science interface do not impact the way people live their lives. What happens to the natural landscape, to the animal and plant life living in it and the quality of the water they drink affects them deeply. Thus, people need to learn more about the scientific and ethical principles that govern decisions about environmental issues especially decisions that are based on a solid water ethic. The Cumberland River Compact Watershed Outreach programs in each of its 14 watersheds enhances water quality of the Cumberland River and its tributaries through education and by promoting cooperation among citizens, businesses, and agencies in Kentucky and Tennessee. Its sustainable green building projects implement water conservation and prevent pollution, producing measurable improvement in water quality and serve as teaching tools for replication. The Cumberland River Compact leaders disseminate the lessons of their projects on an extensive interactive website. ENTREAT endorses the projects of the Cumberland River Compact that stimulate renewed appreciation for the streams, creeks, rivers and water bodies that flow into and out of the Cumberland Basin. Their collaborative secular and religious programs advocate dynamic watershed stewardship.

Wunderlich, Juergen, J.W. Goethe-University, Frankfurt am Main, Germany, Houben, Peter, J.W. Goethe-University, Frankfurt am Main, Germany, Schmidt, Michael, J.W. Goethe-University, Frankfurt am Main, Germany

O-145 Controls and Long-Term Geomorphic Effects of Slope-to-Channel Fluxes – A Case Study from the Rhine Basin (Central Germany). *(Oral Session 18)*

Abstract: Global climate change and changing land use patterns will affect river systems and their catchments, altering flows of water and the material fluxes. The complex responses of fluvial systems to those changes are difficult to anticipate. Therefore, it is a key interest of the LUCIFS (Land Use and Climate Impacts on Fluvial Systems During the Period of Agriculture) initiative, which is a constitutive part of research focus 5 of IGBP-PAGES, to better understand fluvial system response to climate and land use change and the effects of internal controls. The German contribution to LUCIFS concentrates on the Rhine catchment (RhineLUCIFS). Early, intense and continuous settlement in combination with the advanced industrial transformation characterizes the Rhine system. Geomorphological, archaeological and historical geography working groups are involved in several case studies, which focus on mass balances for Holocene sediment fluxes in representative sub-catchments, statistic modelling of Holocene sediment sinks, and the development of quantified time series of colonisation and land use from 6 ka to 300 AD. Within this framework our research objectives are to develop quantitative models of sediment fluxes into and from sources and sinks for a typical loess-mantled sub-catchment in the Rhine basin system. Thereby the focus lies on the effects of man-induced soil erosion and the redistribution of soil-derived materials on slopes and in downstream alluvial sinks. An empirical sediment budget, based on extensive sediments and soils surveys, was accomplished by GIS modelling. In addition to a general sediment budget for the entire period of 8,000 years of land use in the studied area, OSL and radiocarbon dating and historical data serve to provide a model of temporally resolved sediment budgets. The first results demonstrate how the spatial distribution of sediment production and sedimentation changes in time. In general, the results suggest a chiefly man-controlled transfer of sediments through catchments and the importance of land use pattern as the crucial control of Holocene soil- and landscape change. Furthermore, they give evidence of the scale-dependent out-of-phase response of the affected fluvial system to human interferences.

Yin, Yao, U.S. Geological Survey, La Crosse, Wisconsin, USA

O-146 An Evaluation of a Structural Method Versus a Non-Structural Method Applied to Restore Aquatic Vegetation in Pool 8 of the Upper Mississippi River. *(Oral Session 11)*

Abstract: Pool 8 of the Upper Mississippi River near La Crosse, Wisconsin, USA has been a test ground of two different methods for restoring aquatic vegetation. The structural method was the building of physical, earthen structures that created new habitats suitable for vegetation establishment, with an emphasis on rebuilding historical structures that were lost to erosion. The non-structural method was the creation of summer low water level episodes similar to the natural flow regime that was lost after the river was impounded for navigation in 1938. A pool-wide, stratified random sampling protocol has been adopted since 1998 by the Long Term Monitoring Program of the Upper Mississippi River to collect aquatic vegetation data annually in five key-monitoring reaches, including Pool 8. I will present the results of my analyses of the data set with the objective of quantifying the effects of each of the two restoration methods.

Yuan, Wen, East China Normal University, Shanghai, China, Yang, Kang, East China Normal University, Shanghai, China

O-147 Impact of Urbanization on River System and Its Storage and Flood Control Capacity in Urbanized River Network Plain Area. *(Oral Session 43)*

Abstract: Stream structure in an urbanized river network area has unique characteristics under the affection of physical factors and human modification. It brought out the issues about what and how such changes work on river network storage and flood control capacity. Taking Shanghai as a sample area, which is one of the largest cities in China located in the eastern of Yangtze Delta, using Horton-strahler classification and Horton laws as reference based on the stream classification system that is commonly adopted in Shanghai and the other cities around Shanghai, this paper analyzed the stream structure characteristics in each catchment under various urbanization levels; approached the affection of urbanization on stream structure development; and demonstrated the possible relations between stream structure and river network storage and flood control capacity. The flood storage and control functions of streams in each order were further discussed in this paper. The main results of our research were: (1) Stream structure could only be modified when urbanization was up to a certain high level. Physical laws still played important roles in those catchments with lower urbanization level. (2) Stream structure expressed the possible trends from comprehension to simpleness, from multiformity to singleness during the process of urbanization. (3) There was an obvious converse change between river network storage and flood control capacity and urbanization level. River network storage and flood control capacity were influenced both by the quantity of water area and stream structure and much more closely related to the number and length of streams in lower order. (4) For those streams in higher order, storage capacity was stronger than control capacity, and the converse situation existed in those streams in lower order. (5) Proper quantity of water area and better stream structure were the infrastructure to assure ecological flood storage and control in urban areas.

Zeller, Thomas, University of Maryland/German Historical Institute, College Park, Maryland, USA

O-148 A River with a Regional Identity: The Isar in Bavaria, 1880-1930. *(Oral Session 24)*

Abstract: That the Isar River is a tributary to the Danube and flows through Munich—-these were almost the only two qualities which were not contested during a debate about the meaning and use of the Isar beginning around 1880. Different interests and motivations brought forward by different societal groups coalesced in altercations about the physical shaping of the river. Doctors and hygienists recommended straightening the river, thereby lessening the dangers of flooding for disease-stricken working-class neighborhoods of Munich. A newly established river administration sought control over the river to regulate land use on its banks. Engineering visionaries promoted the idea of hydroelectric power as a basis to modernize the predominantly agricultural Bavarian economy. Proponents of early conservationist groups acknowledged the need to harness the hydroelectric potential of the river, yet promoted an aestheticized version. This paper will analyze the interests and motivations of these respective groups and their relative degrees of success in the physical reshaping of the river. It argues that economical interests and seemingly uneconomic, aesthetic concerns could be negotiated together. The results of these conflicts were a compromise serving contemporaneous needs and norms of beauty as well as those of industrial performance. The "taming" of the river transformed a potential natural menace into a cultural artifact in need of new meanings. Thereby, the Isar could be integrated into the politics of regional identity.

Poster

Poster Presentations

Adams, F. Jeffrey, U.S. Fish and Wildlife Service, Fairbanks, Alaska, USA, Patronski, Timothy J., U.S. Fish and Wildlilfe Service, Minneapolis, Minnesota, USA

P-01 Fishery Resources of the Yukon River. *(Theme 6)*

Abstract: The Yukon River drains the fourth largest watershed in North America and travels over 3,000 km from British Columbia through the Yukon Territory and Alaska before entering the Bering Sea. Although the basin provides ecosystem services typical of large rivers, one of its primary values is its fishery resources. The drainage supports many stocks of whitefish (including sheefish), Arctic grayling, lake trout, Arctic char, Dolly Varden, northern pike, burbot, longnose sucker, Alaska blackfish, and lamprey, as well as Chinook, chum, coho, pink, and sockeye salmon. These resources have been harvested by Alaskan Native and Canadian First Nation peoples since the beginning of time with commercial and sport fisheries being established in the more recent past. Estimates of harvest for Chinook and chum salmon are the most comprehensive with annual harvests from all fisheries in both countries ranging from 50,187-220,511 fish for Chinook salmon and 100,901-2,175,699 fish for chum salmon. Harvests of other species were only available for Alaska with estimated annual harvests for coho salmon from all fisheries ranging from 10,425-171,407 fish. Non-salmon species typically are not targeted by commercial fisheries, but are used extensively by subsistence and sport users in the state. Whitefish comprise the largest subsistence harvest with an estimated annual harvest ranging from 55,163-105,721 fish. Arctic grayling comprise the largest sport harvest with an estimated annual harvest ranging from 4,392-12,399 fish. Although a primary value of fishery resources in the Yukon River is for human use, these resources are also critical for other aspects of the ecosystem. These resources act as food sources for predators and scavengers, and the nutrients delivered by returning salmon from the marine environment support productivity throughout the basin. Fishery resources of the Yukon River support the river's natural processes and provide critical ecosystem services to users in the basin.

P-02 Withdrew

Bajuyo, Catalina H., Rivers Institute at Hanover College, Hanover, Indiana, USA, Good, DeAndra, Rivers Institute at Hanover College, Hanover, Indiana, USA

P-03 Plein Air Depiction of Rivers: The Great River Paint Out. *(Theme 1)*

Abstract: *Plein Air* is a French expression meaning "open air." It is defined as painting or drawing outside. *Plein Air* painters produce accurate, detailed depictions of nature and contemporary life. The *Plein Air* tradition began in 19th century Europe. Claude Monet, the quintessential *Plein Air* painter, was obsessed with capturing the effects of light and atmosphere on landscapes. His approach was avant-garde, due to the swiftness needed to capture the fleeting effects of light and atmosphere. Today, *Plein Air* painting is practiced around the world. It is also a tool for training artists to capture landscape movements and enhance concentration. *Plein Air* artists often paint in groups, sharing their techniques for depicting life and movement. Rivers and riverine landscapes provide wonderful venues for *Plein Air* painters. Artists gather at vista points overlooking large rivers or find spots along rivers where they paint river scenes. The natural motion of a river, the movement of plants and animals, and the changing light and sky provide the ingredients that inspire *Plein Air* painters. Many river scenes painted in the *Plein Air* tradition express the history and culture embodied in river systems. The paintings contribute to river folkore just as essays written by historians enhance understanding of river life and culture. Our poster describes how a *Plein Air* painting event involving the Ohio River promotes cultural values and enhances understanding of rivers. The Great River Paint Out at Hanover College enables regional artists to experience the *Plein Air* tradition by painting the Ohio River from a spectacular vista. We describe how painters of all ages learn from each other about the light, color, and techniques used with oil and watercolors while painting in the open air. We focus on the role of rivers in attracting artists with a wide range of skills and experience.

Barko, Valerie A., Missouri Department of Conservation, Jackson, Missouri, USA, Herzog, David P., Missouri Department of Conservation, Jackson, Missouri, USA, O'Connell, Martin T., Pontchartrain Institute for Environmental Sciences, University of New Orleans, New Orleans, Louisiana, USA

P-04 Response of Fishes to Floodplain Connectivity During and Following a 500-year Flood Event in the Unimpounded Upper Mississippi River. *(Theme 6)*

Abstract: We examined fish assemblage structure among three differing floodplain types (broad, moderate, and narrow) during the 1993 flood in the unimpounded reach of the upper Mississippi River. This 500-year flood event provided a unique opportunity to investigate fish-floodplain function because the main river

channel is typically disjunct from approximately 82% of its floodplain by an extensive levee system. Fishes were sampled during three separate periods, and 42 species of adult and young-of-the-year (YOY) fishes were captured. Analysis of variance revealed that Secchi transparency, turbidity, water velocity, and dissolved oxygen were significantly different among the floodplain types. However, only depth of gear deployment and Secchi transparency were significantly correlated with adult assemblage structure. None of these variables were significantly correlated with YOY assemblage structure. The numerically abundant families (adult and YOY catches combined) on the floodplain included Centrarchidae, Ictularidae, and Cyprinidae. Both native and non-native fishes were captured on the floodplain, and several of the numerically abundant species that were captured on the floodplain peaked in catch-per-unit-effort 1-3 years after the 1993 flood event. This suggests that some species may have used flooded terrestrial habitat for spawning, feeding, or both. The findings from our study provide much needed insight into fish-floodplain function in a temperate, channelized river system and suggest that lateral connectivity of the main river channel to less degraded reaches of its floodplain should become a management priority to not only maintain faunal biodiversity but also potentially reduce the impacts of non-native species in large river systems.

Bartels, Andrew D., Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA, Dukerschein, Jeanne T., Wisconsin Department of Natural Resources, La Crosse, Wisconsin, USA, Ickes, Brian, U.S. Geological Survey, La Crosse, Wisconsin, USA

P-05 Exploratory Analysis of Index of Biotic Integrity Scores Calculated from Datasets Obtained by Three Different Day Electrofishing Protocols. *(Theme 4)*

Abstract: We analyzed fish community data from the Upper Mississippi River (UMR) collected by the Long Term Resource Monitoring Program (LTRMP), the Environmental Monitoring and Assessment Program – Great Rivers Ecosystems (EMAP-GRE), and Wisconsin's non-wadeable stream monitoring program (WDNR). Each of these programs uses day electrofishing to sample fish communities, but protocols and sampling designs differ. We calculated Index of Biotic Integrity (IBI) scores per metrics calibrated for Wisconsin rivers by Lyons et al., 2001 and compared results among programs. We used non-metric multi-dimensional scaling (NMDS) and univariate plots of the data to examine statistical differences among the programs and to suggest factors that might have contributed to those differences. The combined dataset provided significant discrimination between all five IBI scoring categories (very poor to excellent), but IBI scores calculated from the EMAP dataset suggested that three rating categories might be more suitable for that program. NMDS yielded significant differences between the WDNR program and the other two programs, but not between EMAP and LTRMP. Both EMAP and LTRMP span the entire Upper Mississippi River mainstem, whereas WDNR encompasses only Wisconsin waters. In Wisconsin waters, IBI scores from all 3 protocols increased or remained stable from north to south. However, in the context of the entire UMR, IBI scores for both LTRMP and EMAP-GRE declined from north to south. Ten years of LTRMP sampling generally demonstrated consistent scores through time except for the area near Bellevue, Iowa, a recognized zone of ecological transition. Plots of individual metrics against river mile suggested that some metrics (i.e. round-bodied suckers) in the Lyons IBI may be affected by geographic range limitations of the species selected for those metrics.

Bartsch, Lynn A., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Richardson, William B., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Cavanaugh, Jennifer C., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Strauss, Eric A., Department of Biological Sciences, Fort Hays State University, Hays, Kansas, USA

P-06 Hydraulic Connectivity of Backwater Areas to Flowing Channels Influences Nitrogen Dynamics Within Upper Mississippi River. *(Theme 3)*

Abstract: Channel-floodplain connectivity has a strong influence on nitrogen dynamics in large river ecosystems. In 2000, we measured denitrification (microbial conversion of nitrate to nitrogen gas), nitrification (microbial conversion of ammonium to nitrate), and several other physical and chemical variables in duplicate transects from four sites in Pool 8 of the Upper Mississippi River. These sites were located at increasing distance from major river side-channels. Each transect was positioned perpendicular to the riverbank along an inundation gradient (always dry to always wet). Seasonal water-level fluctuations were minimal that year; thus we did not observe significant inundation effects. However, distinct patterns were evident between sites located close to flowing channels (highly connected sites) and those located farther away from channels (less connected sites). Highly connected sites received nitrate rich water (0.5 to 5 mg N/L) and exhibited increased denitrification rates (1.5 to 6 ug N/cm^2/h) relative to less connected sites

(0.5 to 2 ug N/cm²/h). Nitrate concentrations at highly connected sites were significantly correlated ($P < 0.01$, r = 0.66) to denitrification rates while sites with low connectivity exhibited no relationship ($P = 0.99$, r = 0). Thus, the degree of hydraulic connectivity of backwater sites was directly related to rates of nitrogen processing in these areas.

Bartsch, Michelle R., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Zigler, Steve J., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Newton, Teresa J., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA

P-07 Influence of Shell Morphology on Unionid Distributions in the Upper Mississippi River. *(Theme 6)*

Abstract: Attempts to predict the distribution of unionids from *in situ* habitat descriptors have been largely unsuccessful, but certain biological and calculated hydraulic variables have recently shown some predictive power. We used historic and recent unionid data and hydraulic conditions at 606 sites over a 38-km reach of the Upper Mississippi River to compare the distribution of unionids with different shell morphologies. We hypothesized that heavier, thick-shelled species with sculptured projections on their shells would be more effective at maintaining their position in the substrate and thus more likely to occur in areas with high velocity and shear stress, compared to thin-shelled, non-sculptured species. We used classification trees to model the presence and absence of thick-shelled, sculptured and thin-shelled, non-sculptured species to determine which variables were most likely to predict their distribution. Candidate predictor variables included sampling gear, field substrate, water depth, slope, and velocity, shear stress, and Froude number under low, moderate, and high discharges. Our analyses predicted that thick-shelled, sculptured species occupy a larger portion of the total aquatic area in this reach of the river than thin-shelled, non-sculptured species. However, thin-shelled, non-sculptured species use areas of higher shear stress and velocity than thick-shelled, sculptured species, but were also present in backwaters with low energy. Overall, these data are consistent with the flow refuge concept in that unionids are more prevalent in areas with low to moderate hydraulic stresses regardless of shell morphology. Thus, future studies could benefit from incorporating abiotic and biotic variables into predictive models.

Berlin, Cynthia, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Handley, James, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

P-08 The 2001 Mississippi River Flood: Assessing Flooding in La Crosse, Wisconsin. *(Theme 4)*

Abstract: The Mississippi River responds regularly to extreme precipitation events by flooding low-lying areas. Assessment of the such events is crucial to emergency management planning and to the distribution of damage compensation. It is also important to assess the extent to which natural features, such as wetlands, aid in the retention of flood waters. The winter of 2000-2001 brought above normal snowfall to the northern regions of the Upper Mississippi River Valley. In early Spring 2001, a sudden warming trend led to rapid melting of this snow as storms delivered heavy rainfall. The Mississippi River and its tributaries were overwhelmed and began flooding low-lying areas progressively southward from Minnesota and western Wisconsin. By April, flood waters were encroaching on river-front communities in La Crosse. The resulting flood was the third highest recorded for this area and provided an excellent opportunity for assessing the utility of satellite imagery and aerial photography in flood research. This research examined the spatial variability in flooding through the use of remotely-sensed and digital topographic data. Of particular interest was the potential for estimating water retention by a wetland. The study focused on the La Crosse area and included a small urban wetland. The Landsat ETM satellite passed over this region on April 18, the day the flood peaked in the area. At the same time, the U.S. Geological Survey acquired aerial photography. Both data sets were interpreted to identify flooded and non-flooded land cover. The spatial extent of inundation was evaluated by comparing the results to a post-flood image, and water retention for the wetland was estimated using a GIS model. The results indicate that satellite imagery and aerial photography provide a means of assessing flood extent and that surface flood water retention by a natural feature can be modeled.

Berry, Charles, R., U.S. Geological Survey, South Dakota Cooperative Fish and Wildlife Research Unit, South Dakota State University, Brookings, South Dakota, USA, Wall, Stephen S., South Dakota State University, Department of Wildlife and Fisheries Science, Brookings, South Dakota, USA

P-09 Management and Recovery of Fish Species-At-Risk in the Upper Missouri River Basin: A Basin-Wide Approach. *(Theme 6)*

Abstract: In North America approximately 364 of an estimated 1061 (34%) freshwater fish species are declining

and in need of protection. Decision supports tools are needed that identify fish habitat and distributions to direct conservation efforts. Gap analysis is an innovative decision support tool that uses biological data, remote sensing, and geographic information systems technology to predict species distributions, habitat, and locations where conservation programs can best protect species at risk (SAR) and biodiversity. We completed a basin-wide gap analysis of fish species across the Upper Missouri River Basin (UMRB) that included 26 major drainages and six ecoregions in portions of six states and two Canadian provinces. Stream segments were attributed with ten enduring systemic and local habitat features. A species was associated with stream segments, and fish-habitat models predicted potential occurrence of species in other streams and watersheds. Locations of existing conservation areas were compared to locations of streams and watersheds with high biodiversity and SAR to identify "gaps" in protection and to identify areas in need of conservation. Most SAR (97%) in the UMRB had some portion of their distribution on public lands. Status 1 and 2 lands provided protection for 69% of SAR in the UMRB. Status 1 land has permanent protection from conversion of natural land cover; Status 2 land has similar protection, but may receive use or management practices that degrade the quality of existing natural communities. Seven of 19 ecological regions provided protection for SAR in Status 1 and 2 lands in >10% of the species distributions. A total of 248 conservation areas that would protect fishes and their habitat in the basin were identified based upon a combination of fish species data, riverine habitat attributes, ecoregions, land stewardship, land cover, and existing conservation initiatives.

Bevis, Kenneth A., Rivers Institute, Hanover College, Hanover, Indiana, USA, Otto, Mark H., Rivers Institute, Hanover College, Hanover, Indiana, USA

P-10 Aggregate Resources of the Central Ohio River Valley: A Geologic History. *(Theme 5)*

Abstract: Quaternary deposits and landforms within the Ohio River valley between Cincinnati, Ohio, and Louisville, Kentucky, were identified, and soil-landform-sediment associations were developed as map units in order to generate a geologic map for the study area. The relative ages of these units were established using geomorphic, stratigraphic, and soil weathering relationships; from oldest to youngest, they represent: (1) isolated benches of till and outwash about 120 feet above the modern river; (2) an extensive outwash terrace capped by eolian sediment about 70 feet above the modern river in the main valley and lacustrine sediments located in the lower portion of tributary stream valleys graded to the same level; and (3) strath terraces cut and backfilled into, or colluvial wedges and alluvial fans formed on, older landforms. Stratigraphic and sedimentologic analyses of the lacustrine unit in lower Indian-Kentuck Creek near Brooksburg, Indiana, indicate a decrease in bedding thickness, grain size variation, and overall grain size upvalley; and an increase in organic matter and total carbonate content upvalley. Faunal analyses have identified several species of freshwater pelecypods and gastropods (including Gyraulus altissimus, extinct since the late Pleistocene). Shell fragments obtained from two locations provide bracketing radiocarbon ages of 17,910 +/- 90 BP and 10,580 +/- 50 BP for the lacustrine unit. We interpret the following sequence of geomorphic events: (1) initial valley entrenchment resulting from one or more pre-Illinoian glaciations; (2) Illinoian ice sheet advance into an extant Ohio River valley depositing till and outwash; (3) Wisconsinan ice sheet advance into the northern portion of the Ohio's watershed, providing meltwater to extensively erode Illinoian features while depositing a broad braided-stream floodplain concurrent with lacustrine sedimentation in dammed and ponded tributary valleys; and (4) Holocene erosion and sedimentary backfilling to form strath terraces and concurrent deposition of colluvial wedges and alluvial fans.

Bhowmik, Nani G., Center for Watershed Science, Illinois State Water Survey, Champaign, Illinois, USA

P-11 The Great Flood of 1993 on the Upper Mississippi River. *(Theme 5)*

Abstract: The Great Flood of 1993 on the upper Mississippi, Missouri and Illinois Rivers is now twelve years old. This flood that took place on these great rivers has had tremendous amounts of physical, ecological, and environmental effects. Not all of the effects of this great flood were negative and/or detrimental. During and right after the flood, local, state, federal, and nongovernmental entities not only evaluated the physical, economical, environmental and societal impacts of this great flood but also the benefits of such floods to the aquatic environment. After a decade since the flood took place, various corrective measures have been implemented even though more need to be done. This flood resulted from an unusual weather pattern lasting more than one year or so. In many areas the precipitation was record breaking. The flood was not a single event, but a series of events taking place in quick succession resulting in prolonged damages to the surrounding areas. These events also resulted in many levee breaches effecting the floodplains including agricultural land and cities. The flood displaced more than 16,000 people and impacted about 550 miles of the navigable waterway. The river also transported tremendous amounts of sediments and trace materials. In some cases, flood waters also impacted the domestic water supplies. Not all the effects of the flood were

negative. The flooded floodplain enhanced fisheries production, and the deposited alluvial soils in some case was a welcome sign similar to what has been happening in the Yellow River in China or Gangetic Plains of Indian subcontinents. The flood also pushed many states and the federal government to better understand the hydrology of the river and implement measures for better floodplain management. This talk will provide background of the 1993 Great Flood, the actual flood event, aftermath of the flood, and examples of some of the corrective measures now being implemented.

Bowler, Melvin C., Iowa Department of Natural Resources, Bellevue, Iowa, USA

P-12 Evaluation of a Catch and Release Regulation for Largemouth Bass in Brown's Lake, Pool 13, Upper Mississippi River. *(Theme 6)*

Abstract: Due to declines in the fishery observed from 1991-1997, a harvest regulation mandating the catch-and-release of all largemouth bass *Micropterus salmoides* was initiated in Brown's Lake on January 1, 1998. The effect of this regulation was evaluated over a 13-year pre- and post-regulation period, using focused research data from Brown's Lake and data collected by the Long Term Resource Monitoring Program. The establishment of this catch-and-release bass fishery improved the abundance of preferred length largemouth bass (>15 inches) and improved angler catch rates and angler satisfaction. However, the regulation did not have a prolonged effect on the size structure (relative stock density) of largemouth bass within Brown's Lake. Initially largemouth bass size structure increased for a period of two years, then returned to levels consistent with other backwater lakes in Pool 13. These initial changes in size structure could not be attributed to any one factor and could be the result of the regulation, natural variation in local largemouth stocks within Pool 13, or low compliance with the regulation. Recommendations include continuing the present catch-and-release regulation in Brown's Lake; continuing the annual collection of fall electrofishing data; and periodically assessing largemouth bass abundance and size structure to evaluate the long-term effect of the regulation.

Brown, Rebecca L., Eastern Washington University, Cheney, Washington, USA

P-13 The Effects of Dams on Riparian Plant Species Diversity on the Elwha River, Olympic National Park, Washington. *(Theme 6)*

Abstract: Riparian areas represent uniquely connected ecosystems that are strongly influenced by flooding. This connectivity, particularly in the form of flood-borne seed dispersal, contributes to the role that riparian areas play as "hotspots" for plant diversity and as corridors for the spread of invasive plant species. Dams, by altering this connectivity, may negatively affect the diversity of riparian plant species. The presence and future removal of the 32 m high Elwha Dam and 62 m high Glines Canyon Dam on the Elwha River in Olympic National Park, Washington, have created a unique "experimental perturbation" that modifies the flood regime and alters downstream seed transport compared to the relatively pristine upstream reach. To assess the impact of these dams on riparian vegetation diversity in the Elwha River, I compared the species richness of native and non-native vascular plant species in 118 100m^2 plots located in 5 transects per reach above, below and between the Elwha and Glines Canyon Dams. The vegetation plots were stratified across the range of landforms found on the floodplain. I found that native species richness was lowest below the dams, decreasing from an overall average of 30 species per 100 m^2 in the reach above both dams, to 25 species per 100 m^2 between the dams, and 21 species per 100 m^2 below both dams ($P = 0.015$). Conversely, the number of non-native species was highest below the dams. My results suggest that the dams are directly or indirectly impacting plant species diversity and the spread of exotic species into more isolated habitats upstream in the watershed. Because these dams are scheduled for removal in 2009, this research will provide baseline data for assessing changes in species diversity that occur post dam-removal.

Buswell, Debra, Longfellow Middle School, La Crosse School District, La Crosse, Wisconsin, USA, Hansen, Jeff, Longfellow Middle School, La Crosse School District, La Crosse, Wisconsin, USA

P-14 School-on-the-River Program. *(Theme 7)*

Abstract: The curriculum developed by School on the River integrates natural science, social science, the humanities, and philosophy. The Mississippi River's ecological systems are studied because these systems lead to students' understanding of how cultural, economic, political and organizational systems work in the real world. This curriculum is based on a systems model where everything is dependent on everything else, which is how people naturally learn. This approach takes students to a new depth of understanding. **What is School on the River?** School on the River is a multi-aged program composed of seventh and eighth grade students in a two-year experience. The core classes consisting of math, science, social studies, and literature are integrated into a seamless curriculum that focuses on the study of the Mississippi River Watershed. Students are in grade level classes for math and writing, while science, social studies and

literature are taught in a multi-age format. Classroom and fieldwork make for a busy and challenging year. Time management and a strong work ethic are encouraged. Field studies are a significant part of our program. Students are given opportunities to work with the latest field-testing technology. Collaboration with community resources and governmental agencies provide mentoring experiences and help students meet the high expectations set by the classroom teachers. Our program values problem solving, reading and writing. Through authentic, hands on learning, students enhance these life skills through a self-chosen research project. School on the River is designed to (1) create a learning experience, in which students accept responsibility for their learning, (2) emphasize the importance of fundamental thinking and communication skills, (3) create a learning experience that promotes cooperative rather than competitive learning, (4) show the interrelated nature of all learning, (5) emphasize learning from primary and secondary resources, (5) determine that effective learning goes beyond the limits of the school's wall, (6) illustrate that education is the best achieved through the collaborative efforts of students, parents, teachers, and community agencies, and (7) emphasize the economic, ecological, historical, political, and cultural importance of watersheds.

Cavanaugh, Jennifer C., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Richardson, William B., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Bartsch, Lynn A., U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Strauss, Eric A., Department of Biological Sciences, Fort Hays State University, Hays, Kansas, USA

P-15 Nitrogen Cycling in Sediment During Water Level Drawdown on the Upper Mississippi River. (*Theme 3)*

Abstract: Water level reductions, or "drawdowns," are being used more frequently in large rivers to improve vegetation growth and wildlife habitat. We selected two areas of the Upper Mississippi River system (Navigation Pool 8 and Swan Lake, Illinois) to examine the effects of water level drawdown on nitrogen cycling. Navigation Pool 8 experienced summer drawdowns in 2001 and 2002, and certain areas of Swan Lake have been drawn down annually since the early 1970s. In a 2002 Pool 8 study, we determined the effects of sediment drying and rewetting resulting from water level drawdown on (1) patterns of sediment nitrification (conversion of ammonium to nitrate) and denitrification (conversion of nitrate to nitrogen gas) and (2) concentrations of sediment total nitrogen, nitrate, and ammonium. Sediment ammonium decreased significantly in Pool 8 during periods of desiccation, while sediment nitrate and denitrification increased, although there was no reduction in total sediment nitrogen. Ammonium in sediments that have dried annually in Swan Lake appeared lower but was not significantly different from sediments that remain wet. The reduction in sediment ammonium in Pool 8 was likely a result of increased plant growth and nitrogen assimilation, which is then re-deposited back to the sediment surface upon plant senescence, resulting in a net gain of sediment nitrogen. Similarly, the Swan Lake study suggested that drawdowns do not result in a long-term reduction in sediment N. Water level drawdowns may actually reduce water retention time and river-floodplain connectivity, while promoting significant accumulation of organic nitrogen (i.e., dead plant material). These results indicate that water level drawdowns are probably not an effective means of removing nitrogen from the Upper Mississippi River system. Given the already high concentrations of nitrogen in the Upper Mississippi River system, there is a need for management strategies to improve water quality before the water reaches the Mississippi River.

Cochran, Philip A., Saint Mary's University of Minnesota, Winona, Minnesota, USA, McConville, David R., Saint Mary's University of Minnesota, Winona, Minnesota, USA, Drazkowski, Barry, Saint Mary's University of Minnesota, Winona, Minnesota, USA

P-16 The Mississippi River as a Classroom. *(Theme 7)*

Abstract: When the value of a habitat or an ecosystem is tallied, an important service often overlooked is its role in education. Because field trips to engage in first-hand observation or hands-on data collection are often logistically difficult to arrange, convenient sites are especially important, yet these same sites are often most at risk. Their usefulness for education may be underappreciated because field trips tend to occur during the working day and out of the public eye, and they pass "under the radar" of most citizens. The Mississippi River provides an especially important example, and we use our own institution's history to illustrate the river's role as an educational resource. Our undergraduate biology majors have been required to complete independent research and a senior thesis since 1936, and many have collected data on the Mississippi River or its tributaries. They have been introduced to the river and its habitats through field trips in several core and elective classes. Graduate programs for high school teachers during the 1950s to 1970s and in biology and resource analysis (GIS) from the 1970s to the present resulted in additional

research involving the river. Supporting these educational activities were faculty research programs and efforts to secure grants and contracts. Saint Mary's personnel were involved in some of the first watershed investigations of Mississippi River tributaries, followed by analyses of radioisotopes in riverine communities in the 1950s and 1960s. Participation by Saint Mary's and other schools in the GREAT studies during the 1970s represented a high point in academic involvement in real life environmental assessments of backwater systems. Since then, government funding for academic institutions to engage in large-scale monitoring and research on the river has dwindled. Nevertheless, participation by post-secondary academic programs in Mississippi River scientific endeavors is important not only because they train future agency personnel but also because they produce citizens in all walks of life with an appreciation for the environmental issues that affect the river.

Dadje, Paktano, Pascal International Relations Institute of Cameroon, University of Yaounde II, Yaounde, Cameroon

P-17 Global Restoration and Preservation of Lakes: A Comparative Analysis of Caspian and Chad Lake Basins. *(Theme 4)*

Abstract: The water crisis that is currently threatening world water resources is characterised by the severe reduction of freshwater and particularly lakes. Lake Chad and the Caspian Sea are one of these inland waters which support intensive economic, social and even political activities from their respective neighbouring countries and peoples in general. With the support of the international community, the concerned states are engaged in vast programs of revitalising these lakes. But each of them is characterised by its geopolitical, economical and cultural particularity. As a matter of consequence, they do not benefit from the same attention or political will of the political and technical elite. The aim of our paper will be to give an account of the restoration process of each of these inland waters particularly focusing on their respective adaptive capacity. The comparative analysis lens will allow us to evaluate the influence of political, geographic and demographic and economic factors on the success or failure of the projects mentioned above. The technical, cultural and financial roles played by regional or continental institutions or mechanisms for international water resources management such as The New Partnership for African Development or The European Water Directive Framework, for example, will be of great importance.

Delong, Michael D., Winona State University, Winona, Minnesota, USA

P-18 Transported Organic Matter in a Floodplain River: Evidence of Hydrological Controls. *(Theme 6)*

Abstract: Food web studies have generated increasing evidence that phytoplankton and benthic microalgae are principal drivers of energy flow in large rivers. These snapshots of trophic linkages made it possible to begin testing new hypotheses on the functioning of large river ecosystems. We examined changes in composition and quality of the algal and detrital components of transported organic matter (TOM) in the Mississippi River by assessing chlorophyll concentration plus carbon and nitrogen stable isotope ratios April–September 2004 in main channel, secondary channel, and backwater habitats. Rather than follow expected climatic-based temporal shifts, all measures of phytoplankton and detrital TOM responded to more strongly to hydrological conditions. Phytoplankton chlorophyll concentrations were highest in spring and summer when hydrological retention time was high (low discharge). Stable isotopic ratios also responded to hydrological conditions, possibly reflecting changes in inorganic nutrient sources. Moreover, quality of detrital TOM was also highest during low discharge, suggesting that senescent phytoplankton were a major part of detritus during these periods. Isotopic ratios of two from the main channel were examined concurrent to this study. The nitrogen isotope ratio of both caddisflies corresponded closely to the temporal pattern observed for phytoplankton. This study illustrates the importance of hydrologic dynamics to resource availability and trophic dynamics in floodplain rivers.

Desotelle, Micaleila, D., University of Kansas, Lawrence, Kansas, USA, Thorp, James, H., University of Kansas, Lawrence, Kansas, USA

P-19 Trophic Dynamics of Aquatic Organisms in Grassland and Forested Ecoregions. *(Theme 6)*

Abstract: Loss of biotic diversity in Midwestern rivers is a concern because of extensive water extraction and watershed disturbance, but its measurement is challenging. Food web complexity and the related measure of trophic position are related to diversity and can be analyzed readily using stable isotopes. Trophic position of top predators, for example, usually rises with increasing trophic complexity. Consequently, trophic position should vary among ecoregions and can be used to assess both differences in feeding dynamics of aquatic biota and the general health of ecosystems over time. We used stable isotopes (primarily $\delta^{15}N$ but also ^{13}C) to determine trophic positions of multiple trophic levels of fish and invertebrates from 2-4 rivers in

grassland ecoregions of northern Kansas and Missouri and 2-4 rivers from a forested ecoregion of the Ozark Highlands of southern Missouri during two sample years. Fish were collected with seines and by electrofishing while invertebrates were collected with hand nets in shallow water. Water quality was obtained from the USGS NWIS water quality data, and watershed greenness (calculated as NDVI) was assessed using satellite imagery. Our data clearly demonstrate differences in trophic position and complexity among ecoregions and suggest that watershed characteristics strongly influence biotic diversity and trophic complexity.

Eckblad, Jim, Luther College, Decorah, Iowa, USA, Swenson, Michael, Luther College, Decorah, Iowa, USA, Reynolds, Benjamin, Luther College, Decorah, Iowa, USA, Evans, Betsy, Luther College, Decorah, Iowa, USA

P-20 Estimating the Productivity of Backwaters of a Large River System. *(Theme 6)*

Abstract: Conventional ecological wisdom often depicts backwaters of large river systems as having relatively high biological productivity, as well as providing a nursery habitat for many river species. How this impacts the main stem of the large river has been less often studied. In an earlier study, it was shown that backwaters can provide large quantities of allochthonous drift (e.g., plankton) to the main stem. In this study, we focused on benthic macroinvertebrates of backwater lake systems and what variables might be useful in comparing the productivity of different lakes. We measured 13 abiotic variables (water depth, surface temperature, bottom temperature, surface dissolved oxygen, bottom dissolved oxygen, surface specific conductance, bottom specific conductance, secchi disk depth, sediment sand percentage, sediment silt percentage, sediment clay percentage, sediment pore water, sediment organic matter) for each of 138 ponar grab samples of benthic macroinvertebrates, taken from 12 lakes from Pool 9 of the Upper Mississippi River during June - July 2005. Multiple regression models using these variables accounted for 32 percent of the variation in total numbers, 19 percent of the variation in fingernail clams and mayflies, 11 percent of the variation in oligochate worms, and less than 10 percent of the variation in chironmid numbers. Water depth was the most consistent important variable in these regression models.

Emanouilidou, Maria, Serres UNESCO Club, Serres, Greece, Tsakiri, Dimitra, Serres UNESCO Club, Serres, Greece, Apsilidis, George, Serres UNESCO Club, Serres, Greece

P-21 River Strymon, Macedonia, Greece. *(Theme 1)*

Abstract: River Strymon is situated in Macedonia, Greece, within the boundaries of the Prefecture of Serres. Its source is in Bulgaria. The river enters Greece at the village of Kula and flows into the Aegean Sea through the Strymonikos Gulf. The river's total length is 415 kilometers. The Greek part of the river is 125 kilometers long. River Strymon has transformed Serres into a fertile and productive plain. It has played a crucial role in the cultural and social life of many communities. The villages along the river have been the ones most affected, in socio-economic and cultural terms, due to their proximity to the river. None of these villages have ever been abandoned. During ancient times, the river was worshipped by the citizens as a God. An ancient coin was found in Amphipolis of Serres, which shows an image and underneath it, the name 'God Strymon.' There are various myths and folklore stories related to the river and the life that developed around it. During periods of war, the river provided protection against invaders. Near the Greek Bulgarian borders, it has created passages between Mount Belles and Mount Aggistro that could be well protected by the Greek army. Today, there is a partnership between Greece and Bulgaria concerned with the development of Greek and Bulgarian villages along the river. River Strymon has created the wetland of Lake Kerkini and the wetland of the Strymon Estuary. The former is of national and international importance, and it is protected by various directives. The UNESCO Club of Serres wishes to expand awareness and promote multi-disciplinary research related to River Strymon, and rivers in general. For this purpose, it requires the knowledge and experience of other communities whose life depends upon and/or is affected by rivers.

Farouque, Chowdhury Mohammad, Institute for Environment and Development Studies, Dhaka, Bangladesh

P-22 Need to Restore the Historical River Burigonga. *(Theme 2)*

Abstract: A cruise on Bangladesh's historic Buriganga River used to be a must for visiting dignitaries; but these days they are confronted with foul smells and rotting fish resulting from massive pollution. "This stench is unbelievable, you must do something about it," a senior visiting official of the World Bank told AFP during a recent cruise on the river which flows through the capital Dhaka on its way to the Bay of Bengal. She and the other ferry passengers were forced to cover their noses as they looked in horror at the black water and floating fish that had choked to death. Hundreds of years ago, the banks of the Buriganga were a prime location when the Mughals made Dhaka their capital in 1610. The house-turned-museum of the Nawab (ruler) overlooks the river, which is the country's main waterway for trading and ferry travel. It was once the main source of drinking water for Dhaka's residents and an hour downstream from the capital city the river

is still crystal clear. But as it flows through the capital, waste from sewers and factories--especially tanneries--pour into it. According to an estimation, up to 40,000 tons of tannery waste flows into the river daily along with sewage from Dhaka, a city of more than 10 million. Human waste is responsible for 60 percent of pollution in the river, followed by industrial waste at 30 percent. The rest is solid waste. Moreover, illegal structures have sprung up along its banks, narrowing the river and adding to the dirt, while ferries spill oil into its waters. It is a dying river and the situation will get worse unless steps are taken urgently. The situation would be even worse if it were not for the annual monsoons, which help to clear the river to some extent as the water flow increases after the heavy rains. An urgent priority is to dredge the bed of the Buriganga as silt and rubbish, including polyethyene bags, have lessened its depth. Environmentalists also want tanneries to be moved away from the river and sewage to be diverted to treatment plants. However, the government adopted a plan to maintain the navigability and normal flow of Buriganga and remove all illegal structures on its banks. A high-level meeting decided to ban brick kilns within 250 metres (825 feet) of the river bank, structures within 540 metres (1,782 feet), remove garbage and silt from the river bed and divert water from the Jamuna river to keep a good flow of the Buriganga year round. The government has already relocated the tannery factories to other places, and concerned authorities have been ordered to find alternative ways to dispose of sewage. But environmentalists warned that unless the government implemented the plan quickly the river would be as good as dead in three years. The waters of the three tributaries of the Buriganga river (that surround a large part of the capital) look like discarded engine oil, since it is blackened and thickened by untreated waste dumped by WASA and numerous industries at Tejgaon. As toxic wastes continue to flow into the rivers day and night, thousands of men, women and children of several villages under Khilgaon thana are exposed to serious health hazards. The rivers, which used to be the lifelines of the vast eastern fringe of the city only a few years back, now emit poisonous gas into the air. Boatmen, traders, farmers and others have been left with no other alternative than living with these manmade hazards. The fertility of arable lands along the rivers has dropped drastically due to the river pollution. Food production has plunged radically. Crop production has suffered as the pollutants, having leached into the soil, have poisoned parts of the farmlands. This has resulted in poor harvest amounting to only a third of what used to be produced in a normal year. And the daily catch of fish in the rivers has also registered an equivalent one-third decline. The inadequacy of safe drinking water as well as water for bathing and washing is critical. This Institute has observed that the water of the three tributaries of the Buriganga river were so clean only a few years ago that the villagers even drank it. The rivers were said to have so much fish that a large chunk of the area could survive on aquatic resources. Today the fishermen's community has nothing left to make a living on. Most of the pollutants pour into the rivers from the Tejgaon industrial area through the city's Rampura point. The localities along the rivers face a bleak future unless something is done immediately to tackle the pollution. Though the Ministry of Environment and Forest has set up an Environment Court, punitive action is yet to be taken against the offenders. Factories alongside the rivers have not set up waste treatment plants despite the notices in this regard already served on them. Environmentalists urged the villagers of the area along the three rivers to carry on a social movement till the pollution of the rivers is checked and River Burigonga is restored with her historical pride.

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P-23 Large River Rehabilitation Within an Adaptive Management Framework: Setting Goals and Objectives for Successful Ecological Restoration. *(Theme 4)*

Abstract: We review guidelines for ecologically successful restoration: a guiding image exists, ecosystems are improved, resilience is increased, no lasting harm is done, and an ecological assessment is completed. Specifying goals and objectives for restoration projects is the most important aspect of restoration as it sets expectations, drives plans for action, and determines the kind and extent of monitoring. The Upper Mississippi River (UMR) Ecological Sustainability Program illustrates an approach to defining goals and objectives for ecological restoration. Goals are stated as broad societal values and desired future conditions. They provide the *guiding image* of the dynamic, ecologically healthy river that could exist within a regional context. We show a tiered approach to setting goals and objectives that emphasizes their hierarchical nature. First tier objectives for ecological restoration are developed within broadly defined essential ecosystem characteristics (EECs) of biogeochemistry (water quality), geomorphology, hydrology/river hydraulics, habitat, and biota. Operational objectives are then established using the SMART criteria of

Specific, Measurable, Achievable, Results oriented, and Time dependent. Billions of $US are currently being spent on river restoration with little evaluation of ecological success. It is imperative that funding agencies and restoration practitioners adopt accountable criteria for setting goals and objectives and measuring ecological success.

Gammon Purvis, Michelle D., Rivers Institute at Hanover College, Hanover, Indiana, USA

P-24a "Deep River, My Home Is Over Jordan": Abolitionism and the Underground Railroad in the Ohio River Valley. *(Theme 1)*

Abstract: Rivers form cultural and political barriers, yet they also facilitate interaction between cultures. For more than half of the 19th century, the Ohio River divided states that supported the culture of slavery and states that embraced free labor. In the border cities on the banks of the Ohio, America's symbolic "River Jordan," these disparate philosophies conflicted with one another. Situated opposite Kentucky in the Ohio River Valley, Jefferson County, Indiana and Madison, its county seat, sustained a movement to eradicate the culture embraced by its neighbor to the south. The county's location on the Ohio River shaped the development of grassroots antislavery activity and allowed abolitionists to aid in the escape of freedom seekers who had been enslaved throughout the South. Several historians have explored the role of these borderlands between the North and the South and their influence on the antislavery movement. Keith Griffler's Front Line of Freedom: African Americans and the Forging of the Underground Railroad in the Ohio Valley (2004) and J. Blaine Hudson's, Fugitive Slaves and the Underground Railroad in the Kentucky Borderland (2002) each stress the importance of this region. My presentation will add to this discussion by describing how Madison, Indiana's location on the Ohio River enabled the establishment of an active antislavery society and a vibrant free-black community. Numerous primary sources, including slave narratives, reminiscences of antislavery activists and contemporary newspaper accounts, reveal that although the Ohio River sustained the system of slavery in various ways, it also provided the escape route for many slaves. The river enabled an antislavery movement to develop in border communities like Madison. My presentation will enhance understanding of the history of the Ohio River Valley by analyzing the experiences of freedom seekers and abolitionists who contributed substantially to the region's cultural identity.

Gladyshev Pavel, International University of Nature, Society and Man "Dubna", Dubna, Moskow Region, Zuev Boris, International University of Nature, Society and Man "Dubna", Dubna, Moskow Region, Morzhuhina Svetlana, International University of Nature, Society and Man "Dubna", Dubna, Moskow Region

P-24b River Health and the System of Diagnostics of Water Quality on the Basis of Parallel Analytics for Verhnevolzhsky Region. *(Theme 3)*

Abstract: The system of diagnostics of health of the river and its water quality is based on the idea of medical diagnostics using the theory of homeostasis. The homeostasis concept covers biocenose and natural water objects. In ecologically friendly regions, these natural water objects are in balance with the surrounding biosphere, and steady biocenoses are formed in them. The river and riverside are considered to be a homeostat – self-organizing system that, thanks to adaptation mechanisms, is able to maintain physical and chemical parameters determining vital functions of the system (river) and to vary within a comparatively limited range in spite of significant variations of the environment conditions. Homeostasis ensures permanency of water characteristics provided the burden of pollution is moderate and maintains basic water parameters within the limits necessary for the life of biocenoses. It has a certain buffer pollution capacity and is able to resist harmful outer effects as well as to self-purify. Thus, the state of water biota and its deviation from the natural standard for a particular water object can serve to be a measure of water quality. As long as we consider water to be biota habitat and a single whole with it, it is appropriate to speak about natural water homeostasis and carry out diagnostics of its deviation from the standard ("water diseases") that is very similar to diagnostics of diseases – medical diagnostics. It is necessary to find a sensible parameter or a limited number of parameters that will make it possible to get reliable information about the state and quality of the water. From the homeostasis theory view point, it is essential for an individual organism and biocenoses to maintain acid-base, oxidation-reduction and saline balance within narrow limits. Violation of these balances causes abnormal functions of nucleic acids, proteins and ferments and, therefore, metabolism of organisms and their populations. Under such conditions any violation of balances at the worst may lead to disastrous effects for living organisms. Violation of such balances may be stated in a relatively easy way. One of the parameters of oxidation-reduction balance is the concentration (activity) of oxygen in the water. However, when these parameters in the environment go beyond the limits of adaptability of biological organisms dangerous changes of organisms may be caused. So it is essential to measure those changes of the above balances in water environment which exceed biological organisms'

adaptability. This applies not only to these balances but also to other indexes of pollution with various substances. As a matter of fact, it is the MPC levels that serve to be such thresholds of dangerous pollution with certain substances. Thus, it can be stated that the degree of violation of acid-base, saline and oxidation-reduction balances is the measure of water quality violation of this object and the evidence that there are foreign matters potentially dangerous for biota and human beings in the water. Based on the abovementioned, a very important index of abnormal deviation of the state of a particular water object is its biota state, the current changes taking place in it. Biota can serve to be an inner system to test dangerous pollution. In case one can learn to automatically measure the integral state of biota inherent to a particular water object, the task of primary monitoring can be considered fulfilled to a major degree (if the speed of biota response to pollution is not taken into account). One of the approaches can be based on the total biota breath or its individuals' mobility. Nevertheless, the question of what exactly should be measured is left open, and it requires a system theoretical consideration. A system approach to giving proof to an optimum set of integral and generalized chemical and biological indexes of water pollution and to processing of primary analytical signals particularly for Verhnevolzhsky Region has been considered.

Greenlee, David D., U.S. Geological Survey EROS, Sioux Falls, South Dakota, USA

P-25 GIS for the Gulf: A Geographic Reference Database for Hurricane Affected Areas. *(Theme 4)*

Abstract: GIS for the Gulf: A Geographic Reference Database for Hurricane Affected Areas

GIS for the Gulf (GFG)is a Geographic Information System (GIS) database for areas of Louisiana, Alabama, Mississippi and Texas that were affected by Hurricanes Katrina and Rita. GIS data were collected by USGS and contractors for as much of the area as possible, resulting in partial coverage for the priority areas. GFG is built on the GIS for the Nation Data Model, a set of 14 themes (and hundreds of sub-themes). The USGS provided transportation, boundaries, hydrography, and elevation from The National Map, using sources of nationally consistent data (e.g. National Hydrography Dataset, National Elevation Dataset). The GFG data model was further populated by subjecting partner data in native form to an Extract, Transform, and Load (ETL) procedure that is repeatable and that results in a single consistent data model.

Grigorovich, Igor A., Wilson Environmental Laboratories, Inc., Duluth, Minnesota, USA, Stroom, Kevin T., Wilson Environmental Laboratories, Inc., Duluth, Minnesota, USA, Sandberg, John, Wilson Environmental Laboratories, Inc., Duluth, Minnesota, USA, Angradi, Theodore, U.S. Environmental Protection Agency, Mid-Continent Ecology Division, Duluth, Minnesota, USA

P-26 Invasive Mussel Species and the Integrity of Large Rivers. *(Theme 6)*

Abstract: Exploration and commercial development in North America and Europe during the 20th century greatly facilitated the introduction of species beyond their historical range. Construction of interbasin canals, reservoirs and other human-made habitats in the basins of large temperate rivers of Europe and North America altered or eliminated geographic constraints to species distribution and set the stage for biological invasions. The zebra mussel (*Dreissena polymorpha*), quagga mussel (*D. bugensis*), and Asiatic clam (*Corbicula fluminea*) are among the most notorious invaders in both continents. The former two species are native to the Ponto-Caspian region of Eurasia, where they have greatly extended their distributions since the late 1800s, and the latter species is native to Asia. At the continental scale, the zebra mussel and Asiatic clam have rapidly expanded their distribution along connected waterways in North America and Europe, whereas the quagga mussel has been dispersing more slowly in both continents. Known as endemic to the South Bug estuary of the northwestern Black Sea Coast in the 1940s, by the early 2000s, the quagga mussel extended its range to the drainages of many eastern European large rivers – Dniester, Dnieper, Don, and Volga – and dispersed into the northern Caspian Sea. In North America, this species remains restricted to the Great Lakes and St. Lawrence River. The geographic patterns of spread of these species are consistent with pathways provided by large rivers. The gradual processes in expansion of these species are intermingled with rapid long-distance jumps. Global and regional trade provides dispersal opportunity for these mussels, indicating that the further colonization of isolated regions and habitats by these species is anticipated. Some of this work was completed under Environmental Protection Agency (EPA) contract 68-D-03-060. This abstract does not necessarily reflect EPA Policy.

Hagerty, Karen H., Corps of Engineers, Rock Island District, Rock Island, Illinois, USA, Thompson, Brad E., Corps of Engineers, Rock Island District, Rock Island, Illinois, USA

P-27 Illinois River Basin Ecosystem Restoration. *(Theme 4)*

Abstract: The combined effects of habitat losses, through changes in land use, human exploitation, habitat degradation and fragmentation, water quality degradation, and competition from aggressive invasive species have significantly reduced the abundance and distribution of many native plant and animal species in the

Illinois River Basin. In addition, human alterations of the Illinois River Basin landscapes have altered the time, magnitude, duration, and frequency of habitat forming and seasonal disturbance regimes. The cumulative results of these complex, systemic changes are now severely limiting both the habitats and species composition and abundance in the Illinois River Basin. The Rock Island District, in partnership with the Illinois Department of Natural Resources, has developed an overarching goal of restoring ecological integrity, including habitats, communities, and populations of native species, and the processes that sustain them, for an ecosystem that has been severely disturbed. This overarching goal guides six goals specifically formulated to address the limiting factors in the basin. These goals are: 1. Reduce sediment delivery to the Illinois River from upland areas and tributary channels; 2. Restore aquatic habitat diversity of side channels and backwaters; 3. Improve floodplain, riparian, and aquatic habitats and functions; 4. Restore aquatic connectivity on the Illinois River and its tributaries; 5. Restore Illinois River and tributary hydrologic regimes; and 6. Improve water and sediment quality in the Illinois River and its watershed. Each of these goals contains specific, measurable objectives, which have been developed to optimize ecological integrity in the basin. These objectives were developed by the interagency study team, resource managers, and stakeholders and represent a desired future condition or virtual reference of ecological condition for the Illinois River Basin. Various alternative restoration plans were evaluated based on percent attainment of the desired future condition and their cost effectiveness. The Corps, Illinois Department of Natural Resources, numerous Federal and state agencies, and nongovernmental organizations worked together to develop an implementation framework to restore the Illinois River Basin, which includes approximately 30,000 square miles in three states. Projects will be developed by local stakeholders and reviewed at the Regional Team level. Those projects that meet the program objectives will be forwarded to the System Team, which will conduct a system-level evaluation and sequencing of the projects, leading to recommendations of projects that best meet system ecological needs and goals. This restoration program also includes systemic and site-specific monitoring, special studies to address data gaps, and adaptive management.

Hartman, Kerry E., Fort Berthold Community College, New Town, North Dakota, USA, Rickerl, Diane H., South Dakota State University, Brookings, South Dakota, USA

P-28 Dam Nations: The Missouri River and the Yangtze. *(Theme 2)*

Abstract: Dams have been constructed to control flooding in river systems and to offer economic benefits from irrigation, power generation and increased navigation. However, negative impacts which occur simultaneously to river cultures and ecosystems have been documented. This paper compares two huge dam projects: The Pick Sloan Projects of the 1940s-50s in the United States and the Three Gorges Project currently underway in central China. The historical background of both projects includes the early population of rich bottomlands and flood plains. As populations grew, the need to control the devastating effects of massive floods also grew. In 1943, a series of floods along the Missouri resulted in a management plan from the Corps of Engineers and the Bureau of Land Management which became the Pick-Sloan Plan. Flood control on the Yangtze was proposed in 1919 by Dr. Sun Yat-sen, but was not implemented until Premier Li Peng in the 1980s authorized the construction of the Three Gorges Dam. The Pick-Sloan Plan involved the construction of five earthen dams while the Three Gorges Dam is a single massive concrete structure, projected for completion by 2009. The Pick-Sloan Dams at maximum efficiency will generate 1.6 million kilowatts per year, and it is estimated that the Three Gorges Dam will generate 18.2 million kilowatts. The Pick Sloan Plan relocated 50,000 people. Current predictions estimate that 1.5 million people will be relocated as a result of the Three Gorges Dam, and 50 known archaeological sites will be covered by the reservoir. The Three Gorges Project may result in the addition of 1.2 billion tons per year of wastewater to the reservoir, and 73 rare or endangered species will be lost. These two construction projects in vastly different cultures and environments offer an important comparison of man's attempts to control large river systems.

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P-29 Upper Midwest Environmental Sciences Center Communication Program as a Model for Environmental Education. *(Theme 7)*

Abstract: The Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, is a federal research center that collects, monitors, analyzes, and provides scientific understanding about biological resource conditions, issues, and problems. The UMESC provides information and tools to decision makers at all levels of government--and citizens in all walks of life--in order to address pressing societal issues. On a local, regional, and national scale, science communication and cooperation with partners and customers are a vital part of our mission. The UMESC strives to provide a variety of advanced educational opportunities

for the public and our partners. During the summer, UMESC hosts a two-day Environmental Explorers Camp for fourth through sixth grade students to learn about the Mississippi River ecosystem. Students have the opportunity to volunteer, job shadow, or participate in internships. Teachers have the option to bring their classes to visit UMESC for tours, invite scientists to classrooms as guest speakers, or use existing databases for classroom instruction. Universities can benefit by forming partnerships with UMESC to provide opportunities for students to use the Center facilities, serve as interns in our research, and conduct graduate and post-doctorate programs. Hosting annual UMESC open houses for the general public, speaking to local citizen groups, and participating in environmental awareness events are also other parts of being a true civic partner.

Johnson, Jennifer, U.S. Fish and Wildlife Service, Columbia, Missouri, USA

P-30 Reproductive Development of Missouri River Chubs in Relation to Environmental Variables.*(Theme 6)*

Abstract: Sicklefin (*Macrhybopsis meeki*), speckled (*M. aestivalis*), and sturgeon (*M. gelida*) chubs are small-bodied, short-lived, turbid river Cyprinids that have experienced >50% reduction in their former distribution along the
Missouri River mainstem. Knowledge of spawning modes and patterns of reproductive development are essential for conservation and management of the Missouri River's small-bodied, short-lived fishes. Information on their
reproductive requirements can aid in design of flow and habitat modifications to benefit imperiled chubs along with the endangered pallid sturgeon (*Scaphirhynchus albus*). Our objective is to determine if environmental variables (temperature, flow, photoperiod, lunar cycle) are associated with reproductive development by using the gonadosomatic index (GSI) and histological stages.

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P-31 Shoreline and Water Quality Impacts from Recreational Boating on the Upper Mississippi River - A Compilation of Findings from Agency Reports. *(Theme 4)*

Abstract: The rapid growth in the numbers and size of recreational boats is having serious ecological and social effects on the Upper Mississippi River System (UMRS). Environmental studies have shown that the height and frequency of waves generated by recreational traffic is the principal causal factor for the high rates of erosion affecting the entire streambank profile. Shorelines exposed to significant recreational boat traffic are eroding at an average rate of 2-3 feet/year. Over the period of a decade, this translates to a loss of 20-30 feet of main channel shoreland and the ecological values associated with the floodplain forest community. In addition to the loss of forested shorelines, this mobilized sediment contributes to the chronic resource problems of sedimentation and infilling of Lake Pepin and important backwater areas; high turbidities and the reduction of light transmission necessary for aquatic plant growth; and the economic costs to the public for dredging the fraction of these sediments deposited in the navigation channel. The discussion in this summary report focuses on upper Pool 4, defined as that river reach from Lock and Dam 3 to the head of Lake Pepin. Because of the similarity in geological conditions in Pools 2, 3, and upper 4, study results are most directly applicable to these reaches of the Mississippi River. However, observations of resource managers indicate that these problems are pervasive throughout the UMRS. Protection and enhancement of the critically important ecological and social values of the river requires that local, state, federal, and private constituencies begin a collaborative process to identify and implement new management strategies. http://www.dnr.state.mn.us/aboutdnr/reports/impacts_mississippi.html

Kadiri, Medina, University of Benn, Benn City, Edo, Nigeria

P-32 Freshwater Phytoplankton Diversity of Rivers in Edo State, Nigeria. *(Theme 6)*

Abstract: The phytoplankton rivers in Edo state of Nigeria is considered floristically diverse with a total 74 taxa. These were made up of three divisions namely Bacillariophyta (diatoms) with 43 taxa or 58.1%, Chlorophyta (green algae) with 26 taxa or 35.1% and Cyanophyta (blue-green algae) comprising five taxa or 6%. The bulk of the diatoms were Pennales comprising six families with Naviculaceae as dominant. Centrales were made up of Thalassiosiraceae and Biddulphiaceae. Chlorophyta comprised eight orders and eight families, the majority being desmids (Zygnematales- Desmidiaceae), the bulk being Closterium spp. The blue-green algae were made up of Oscillatoriales and Nostocales. Ecologically, taxa included Amphora, Anomoeneis serians, Eunotia flexuosa, E. monodon and Frustulia rhomboides. Heterogeneity indices showed Shannon-Wienner diversity indices of 0 – 4.42 and equitability indices of up to 0.98.

Klein, Jill, Yukon River Drainage Fisheries Association, Anchorage, Alaska, USA, King, Darcy, Yukon River Drainage Fisheries Association, Anchorage, Alaska, USA, Patronski, Timothy J., U.S. Fish & Wildlilfe Service, Minneapolis, Minnesota, USA

P-33 Yukon River Educational Exchange Program. *(Theme 7)*

Abstract: Fisheries management in ecosystems that span a range of socio-cultural, economic and political boundaries can be very challenging. Educational exchange opportunities among diverse people within a large ecosystem can further communication and transfer of knowledge, while fostering an increased appreciation for others' perspectives and needs. The 2001 Yukon River Salmon Agreement between the United States and Canada prioritizes greater collaboration on the conservation of Canadian-origin chinook and fall chum salmon. In 2002, 2003, and 2004, the Yukon River Drainage Fisheries Association, in cooperation with many partners, coordinated educational exchange trips among Alaskan and Canadian fishery users who live along the 3,187 kilometer Yukon River. Over three years, 14 upriver participants from Yukon, Canada, visited 4 communities in Alaska, and 13 lower river participants from Alaska visited 7 communities in Canada. Participants and host communities learned about upriver and downriver differences in the bio-physical, socio-cultural, economic and political aspects of the Yukon River salmon fishery. It is hoped that these exchanges will increase community awareness about salmon conservation goals and lead to improved collaborative conservation efforts.

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P-34 Changes in Aquatic Vegetation Between 1975, 1991, and 2004 near Stoddard, Wisconsin, Pool 8, Upper Mississippi River System. *(Theme 4)*

Abstract: Aquatic vegetation surveys were conducted near Stoddard, Wisconsin, in Pool 8, Upper Mississippi River System in 1975, 1991, and 2004. Percent frequency of aquatic vegetation detected along fixed transects decreased dramatically from 1975-1991. In his study in 1991, Fischer hypothesized that increased exposure to wind fetch due to loss of small islands in the area, along with other factors, may have contributed to the decline in aquatic vegetation between 1975 and 1991. From 1997 to 1999, islands were built as part of an Upper Mississippi River Environmental Management Program Habitat Rehabilitation and Enhancement Project (HREP) in the Stoddard Bay area of Pool 8. One project objective was to promote aquatic vegetation growth by reducing current velocity, wind fetch, and resuspension of sediments. By 2004, data from random samples taken in the same area, as the transects suggested, aquatic vegetation had rebounded to near 1975 levels. Eleven species were recorded in 1975, two species in 1991, and 15 species in 2004. Longleaf pondweed, not recorded in 2004, was found in the Stoddard Bay area during surveys conducted in 2002 and 2003. The dominant species in 1975 and 2004 was wild celery. European watermilfoil (an exotic) and American lotus were the only species recorded in 1991. Overall, community structure and species frequency and dominance were very similar between 1975 and 2004. Electrofishing surveys done in the HREP area in 1990 and repeated from 1999 to 2002 showed an increase in relative abundance of bluegills, largemouth bass, and black and white crappies between 1990 and 2002.

Little, Gillian L., University of Missouri-Kansas City, Kansas City, Missouri, USA

P-35 Project No. 459: The Dammed Osage and the U.S. Hydroelectric Industry. *(Theme 2)*

Abstract: Identified as Project No. 459 by the U.S. Federal Power Commission, the Bagnell Dam in central Missouri and its resident power plant operated by Union Electric of St. Louis were completed in the spring of 1931. The dam impounded 646 billion gallons of water that engorged the Osage River valley over the previous months to beget the Lake of the Ozarks, the largest man-made lake in the world at that time. Completed, Project No. 459 was an astounding engineering achievement. But this alone is not why we should care about another dam across another river. By examining the Bagnell we can find clues to how power flowed in 1930s America. The dam is important for it represents the critical link between explosive unfettered growth of private utility companies and universal Federal power utility regulation. The Bagnell Dam was planned as profit venture and then built by big business during an era of explosive growth of power utility companies. As a sign of the changing approach to power in America, the Great Osage River Project would be the last large dam project in America financed with private money. The Bagnell dam is a physical monument that marks a pivotal time in America's economic and political landscape. No federal project of this size would be problem free; however, the unique nature of the Project No. 459 as private enterprise highlights the pitfalls of unregulated utilities on the social, political, and economic course of natural landscape regulation. The Bagnell Dam not only represents the ending of one way of life in exchange for the birth of another. The dam signifies the change in the landscape of an economic and political era of

unregulated utilities and business systems susceptible to private corruption to the U.S. federal government's role as direct producer of electrical power on mainly public lands.

P- 36 – Withdrew

Mauldin, Louise, M., U.S. Fish and Wildlife Service, LaCrosse, Wisconsin, USA

P-37 Midwest Driftless Area Restoration Effort. *(Theme 4)*

Abstract: The Midwest Driftless Area Restoration Effort is a broad partnership formed under the National Fish Habitat Initiative (NFHI) to improve aquatic resources in the 24,000 square mile unglaciated area of Minnesota, Wisconsin, Iowa and Illinois. The nation's aquatic resources have been declining at an alarming rate, primarily from loss, degradation and alteration of habitat. Recognized as a national problem, the National Fish Habitat Initiative was established to address aquatic habitat health. The mission of the National Fish Habitat Initiative is to protect, restore and enhance aquatic habitat and reverse the decline of fish and other aquatic species across the nation. Similar to the highly successful North American Waterfowl Management Plan, the NFHI uses the "joint venture" approach. It is centered on the establishment of partnerships and the implementation of restoration efforts at multiple geographic scales. The Midwest Driftless Area Restoration Effort partnership is a coordinated effort to improve riparian and aquatic habitat, reduce nutrient and sediment inputs to coldwater streams and rivers, improve water quality, enhance trout, smallmouth bass, and conservation priority species, increase angling and other recreational opportunities, and raise awareness as to the importance of the Driftless Area and its aquatic resources.

McEnaney, Katherine A., University of Wisconsin- Madison, Madison, Wisconsin, USA, Bryson, Reid A., University of Wisconsin- Madison, Madison, Wisconsin, USA

P-38 The Modeled Discharge of the Mississippi During the Holocene. *(Theme 5)*

Abstract: Middle America and the Mississippi watershed are almost synonymous. Culture history in the area has been closely related to the Mississippi River itself, as well as its many tributaries from the Woodland cultures in the east on the Ohio drainage, to the Middle Mississippians around Cahokia and the upper Midwest, to the various Plains cultures of the tributaries. The Holocene history of this great river system as modeled will be presented with a focus on cultural impacts.

Metcalf, Sara, Department of Geography, University of Illinois Urbana-Champaign, Illinois, USA, BenDor, Todd, Department of Urban and Regional Planning, University of Illinois Urbana-Champaign, Illinois, USA, Wheeler, Emily, Program in Ecology and Evolutionary Biology, University of Illinois Urbana-Champaign, Illinois, USA, Lubinski, Ken, U.S. Geological Survey, La Crosse, Wisconsin, USA, Hannon, Bruce, Department of Geography, University of Illinois Urbana-Champaign, Illinois, USA

P-39 Process as Product: Seeking Common Ground for Floodplain Functionality and Development. *(Theme 4)*

Abstract: In August 2005, the Nature Conservancy sponsored a group modeling workshop in Dubuque, Iowa, to better understand issues related to functionality and development in the Upper Mississippi River (UMR) floodplain. Participants created two computer-based dynamic models to explore the questions: (1) What causes land-use change in the floodplain? (2) What are the consequences of land-use patterns for ecological, economic, and social functionality? Components of the workshop included the identification of model boundaries and elements on the first day, the recognition of explicit interrelationships between model components on day two, and the final production of functional models on day three. Two subgroups were created to encourage the persistence of divergent thinking throughout the workshop. The participants were assisted by an expert modeling team that translated ideas into mathematical equations and icons. Placing environmental issues in an icon-based modeling framework (STELLA) assisted participants in articulating and merging their understandings of the UMR floodplain. The independent groups produced surprising conceptual convergence in the final outputs. While the two models differ considerably in structure, they capture similar fundamental concepts as to the effect of ecological, economic and social drivers of floodplain land-use decisions and the impact of such decisions on valued functions of these lands. The value of this multidisciplinary approach lies not only in the production of functional models but also in creation of a shared language for more sophisticated communication and knowledge capture. The ability of participants to think symbolically about complex problems will enhance future communications among these river stakeholders. Mediated group model building has great promise for facilitating environmental consensus building on river issues of great import. This poster provides an overview of this three-day workshop, demonstrating how the modeling process can itself become the desired "product." In so doing, a common ground is created for stakeholders with diverse perspectives.

Miller, Carol D., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

P-40 Foreign-ownership, Firm-size and Toxic Releases: The Perception and Reality of Pollution in the Menominee River. *(Theme 3)*

Abstract: A Finnish-based forest products company recently purchased the paper mill on the Menominee River in Northeastern Wisconsin. Using data from a community survey (N=352) of residents in the paper mill town, I present the community's perceptions of pollution by the mill. Then I juxtapose those perceptions of the pollution with the empirical evidence provided by the E.P.A. Toxic Release Inventory. I present trends in the mill's emissions of regulated pollutants into the Menominee River over the fourteen years (1988-2002) and use this data to test statistically whether violations have increased or decreased with the size of the firm owning the mill and/or foreign ownership.

Monfreda, Chad, University of Wisconsin-Madison, Madison, Wisconsin, USA, Foley, Jon, University of Wisconsin-Madison, Madison, Wisconsin, USA

P-41 Agricultural Tradeoffs of Ecosystem Services in the Mississippi Basin. *(Theme 4)*

Abstract: Ecosystem functions provide people-essential services, such as flood control, disease regulation, and carbon storage. Agriculture and other land uses often maximize single functions, causing sub-optimal delivery of other services. This study uses simulated data to develop analytically solvable equations of corn yield and nitrate leaching as functions of N-fertilizer application. These functions provide a simplified framework for exploring a range of policy options for optimizing ecosystem services without running computationally expensive numerical models. In doing so, they demonstrate how such an approach can address the spatial and economic effects of (1) local leaching limits and (2) regional reductions of nitrate export.

Mueller, Robert, F., Ball State University, Muncie, Indiana, USA, McConville, David R., Saint Mary's University, Winona, Minnesota, USA

P-42 Utilizing Geographic Information Science For Bathymetric Mapping and Dredging Assessment in a Small Urban Lake in Southeastern Minnesota USA. *(Theme 4)*

Abstract: Currently emphasis on accurate and timely collection of fisheries data generates a need for investigation into advanced techniques in bathymetry, including recent refinements in Geographical Information Science (GIS) and Global Positioning Systems (GPS). The study area for this project was the east basin of Lake Winona, a small Mississippi River floodplain lake in Winona, Minnesota USA. Lake Winona was the site of recent dredging operations aimed at decreasing littoral zone areas to reduce plant growth and stunted fish populations. To assess potential effectiveness of dredging operations, bathymetric data were collected with a Garmin sonar and GPS unit, and interpolation techniques to produce lake morphometric characteristics (splining, kriging, and inverse distance weighting) were compared within ESRIs ArcMap 9.0. All interpolation methods produced similar outputs for cross validation statistical comparisons, although kriging produced the best predictive output of actual bathymetric contouring for Lake Winona. Calculation of morphometric characteristics from derived bathymetric information showed significant changes in Lake Winona compared to historic accounts. Lake dredging was successful in reducing littoral zone areas by 30 percent and increasing lake volume by 28 percent, while increasing the mean depth by 60 percent (from 2.6 feet to 4.3 feet). Habitat for stunted fish populations was substantially reduced. Today, information from this project is being used to assess the feasibility of further bathymetric studies and to refine management approaches to improve the Lake Winona fishery.

Nair, Shadananan K., Centre for Earth Research and Environment Management, Kerala, India

P-43 Influence of Major Rivers on Religious and Spiritual Developments in India. *(Theme 1)*

Abstract: Rivers always have a sacred position in the Hindu beliefs and customs. The centuries' old civilization of India originated and flourished on the banks of the sacred rivers, and the rivers played an important role in the religious practices, social and economic developments and in the art, literature and architecture. Importance of water is often highlighted in the epics and the great works of Vedic scholars. In all religious practices, especially in the temples, sprinkling of divine water is an inevitable part. The water is purified with 'mantras,' inviting the presence of the seven sacred rivers – the Ganga, the Jamuna, the Godavari, the Saraswathi, the Narmada, the Sindhu and the Cauvery. It is a popular belief that bathing in holy rivers removes the sins acquired from the evil deeds during the lifetime and through the generations. The 'Great Kumbhmela' conducted once in every twelve years in the holy sites in the sacred River Ganga attracts one of the largest gathering in the World itself. Similar festivals are celebrated in many other rivers in the different states of India. There are several legends and references about the major rivers in the ancient books. The

epic Ramayana refers a lot about the sacred river Sarayu in which Lord Sri Rama disappeared, on the way to heaven. Similar points can be observed in the epic Mahabhatrata. Saints of ancient India always lived in the vicinity of rivers, as physical purity associated with mental purity was believed a must in realising eternal truth. This paper is a review of the role of the major rivers in the Indian civilization, the beliefs passed through generations and the festivals celebrated, related to water.

Neumann, Klaus, Ball State University, Muncie, Indiana, USA, Bonzongo, Jean-Claude, University of Florida, Gainesville, Florida, USA

P-44 Mercury and Trace Metals in Water and Fish of the Wabash River, Indiana: Preliminary Trends. *(Theme 3)*

Abstract: The Wabash River in Indiana is the longest free-flowing river (661 km) east of the Mississippi. Nonetheless, very few studies have focused on mercury (Hg) and other trace metals (e.g., Co, Ni, Cu) in this stream. Published research has focused mainly on the industrialized northern part of the State, close to Chicago, and on the Ohio River valley at the southern end of the State. For rivers draining Indiana, including the Wabash River, numerous Hg-based fish advisories are posted; yet very little to no data on Hg and trace metals in water or sediments exists. We present some new Hg and trace metal data for the Wabash River as it flows through central Indiana. Water and surface sediment samples were collected in the summers of 2004 and 2005 and in spring 2006 from the river section that extends from upstream of Lafayette to Terre Haute. In contrast to the Wabash River upstream reaches, this section of the river has no water inputs from tributaries that drain reservoirs, and the above two cities as well as a power plant located upstream of Terre Haute are potential sources for Hg and trace metals to the river. Total-Hg concentrations determined on filtered water samples ranged from 0.57 to 1.7/ng /L, while total Hg levels in non-filtered samples ranged from ~1.6 to 5.0/ng /L. These values compare to those reported for rivers and streams in neighboring states. Dissolved trace metal concentrations are generally low (e.g., Co, Ni, Cu less than 2M>g/L) and show only small increases as the Wabash River passes through Lafayette. We will present preliminary Hg concentration for fish tissue and compare those to aqueous and sedimentary Hg as well as with trends/levels reported for other Midwestern rivers with similar land use types within watersheds.

Northwick, Reid, River Studies Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Richardson, William, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Bartsch, Lynn, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Cavanaugh, Jennifer, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, USA, Haro, Roger, River Studies Center, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

P-45 Effects of Pool Drawdown and Plant Growth on Nitrogen Cycling in the Upper Mississippi River. *(Theme 3)*

Abstract: Nutrient cycling in river systems is a complex series of processes that are strongly affected by flow regime. Anthropogenic contributions to these cycles have severely impaired many large ecosystems (e.g., costal hypoxia in the Gulf of Mexico). The Upper Mississippi River (UMR), while being a conduit for water and nutrients, is also managed for transportation, recreation, biodiversity and the maintenance of ecosystem services. Management actions directed towards ecosystem services include river pool “drawdowns” (depth reduction) to mimic historic summer flow regimes, resulting in increased growth of rooted aquatic plants and the stabilization of sediments. We assessed the effects of plant growth on nitrogen cycling in Pool 5 (UMR) during a drawdown. Sediment nitrogen dynamics were examined in both a normal and a dewatered backwater location, at points with and without aquatic vegetation. Sediment cores were analyzed for total nitrogen (N), ammonium (NH_4^+), nitrate (NO_3^-), and denitrification and nitrification rates. Significantly less NH_4^+ and nitrification were observed at the dry sites compared to the wet sites. We were unable to detect significant differences in nitrogen variables among locations with and without vegetation. However, greater plant biomass at the dry sites suggests vegetation was responsible for the decrease in NH_4^+ and, consequently, lower nitrification. Plant biomass was significantly greater at both the vegetated and the dry sites; high variance within treatments obscured our ability to detect strong differences between the nitrogen variables and plant biomass. The ability to detect N-cycling processes for plant species with deeper rooting depths may have been limited by sampling only the top 5 cm of sediment. Increased plant biomass, resulting from drawdowns, may not significantly affect sediment N-cycling, or the pool of sediment NH_4^+ is so large that plant-induced changes in sediment N concentrations are small and difficult to detect.

Ogorek, Jacob, M., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Haro, Roger, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA, Rolfhus, Kristofer, University of Wisconsin-La Crosse, La

Crosse, Wisconsin, USA, Wiener, James, University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

P-46 Methylmercury Relationships Between Sediments and Resident Benthic Macroinvertebrates in Chequamegon Bay (Wisconsin), Lake Superior. *(Theme 3)*

Abstract: Substantial contributions of methylmercury to aquatic systems may originate from *in situ* sedimentary formation and watershed sources. The overall conditions of Lake Superior (cold, oligotrophic, and little shoreline influence) and its basin (relatively unpolluted and small watershed) are unfavorable for methylmercury contamination. However, hazardous levels of methylmercury in Walleye and Lake Trout have been measured. The greatest exposure of biota to methylmercury is likely in riverine influenced coastal wetlands. Conditions in wetland environments favor microbial methylmercury formation in sediments, while lotic systems transport methylmercury from upstream wetlands and the watershed. Further, riverine influenced coastal wetlands are shallow and warm, relatively productive, provide substantial habitat for many organisms, and function as an interface between lentic and lotic systems. We examined sediment-benthic macroinvertebrate methylmercury coupling in Chequamegon Bay, Lake Superior (Wisconsin). Sampling areas included an open water reference site and coastal wetlands with and without lotic influences. Sediment cores, pore water, and resident benthic macroinvertebrates were collected in the summer of 2005, with the top 5-20 centimeters of intact cores (homogenized or sectioned) analyzed for methylmercury concentration. Methylmercury concentrations in homogenized sediments (0.016 – 0.607 ng/gdw) were greatest near coastal wetlands with riverine influence, intermediate in the coastal wetland without riverine influence, and lowest near the center of the bay. Results from recent sampling suggest that methylmercury concentrations of select benthic macroinvertebrates follow similar trends. Sediment core methylmercury variations with depth were as high as 28-fold, with maximum concentrations occurring at a variety of depths due to distribution of organic matter. Ancillary variables, such as pore water concentrations of sulfate, sulfide, and dissolved organic carbon, as well as sediment organic carbon and total mercury concentrations were also measured. Sediment methylmercury concentrations were correlated with several ancillary variables. We suggest that Lake Superior methylmercury is the result of both watershed exportation as well as *in situ* formation.

Osmachko, Marina, The "Dubna" International University for Nature, Society, and Man, Dubna, Moskow Region, Russia, Morzhukhina Svetlana, The "Dubna" International University for Nature, Society, and Man, Dubna, Moskow Region, Russia, Rogovaya Irina,The "Dubna" International University for Nature, Society, and Man, Dubna, Moskow Region, Russia

P-46a The Estimation of Volga River Quality in the Upper Volga Basin. *(Theme 3)*

Abstract: The aim of our research is to estimate the quality of the Volga River in the Upper Volga basin. The objects of the research are (1) Ecological situation in the Upper Volga basin, Ivankovskoe reservoir, Volga river, Ivankovskoe reservoir's tributaries and Volga river's tributaries (small rivers of Tverskaya and Moscow Oblasts); and (2) the quality of drinking water. Our research involves water quality, the bottom sediment quality, distribution of element forms in water, saprobiological factor and toxicity of water. Results of water quality estimation by methods of hydrochemistry, bioassays and biotoxicity are given. The estimation of drinking water sources (supply of Dubna and of Moscow City) Ivankovskoe reservoir and river Volga carried out on complex and individual parameters of quality. The correlation between water condition in a source and drinking water, and also transformation of drinking water quality due to movement inside the distribution system are presented so ecological risk estimation could be carried out. On the basis of received results, we created a database. Also we attempted to give recommendations for ecological situation improvement in the Upper Volga basin and recommendations for drinking water purification. The results of some of our research are presented on the Internet site: www.ecodubna.ru that was developed for the three groups of users: experts, managers and habitants. (But our abilities for realizing such recommendations are limited.

Paddock, Todd W., Winona State University, Winona, Minnesota, USA

P-47 I Can Survive a Flood, But Not FEMA: Low-Income Rivertown Residents Are Forced to Move. *(Theme 2)*

Abstract: This poster is based on an ethnographic study of a Midwest county with a large river on one border and a small city on that river, which I will call Rivertown. The river flooded periodically and Rivertown had no levee; about once a decade, a substantial area of the city's homes and businesses were invaded by floodwater. A portion of the city's citizens sought and received FEMA reimbursement after each damaging flood. During my study, FEMA ruled that new buildings and mobile homes had to be raised above the 100-year flood level. In addition, the city mayor and council used the new FEMA rule to discourage businesses from operating in existing buildings close to the riverfront. Through interviews with the mayor, city

residents, and FEMA officials, I learned that: (1) It was not feasible for many of the residents in mobile homes to raise their dwellings above flood level (through being placed on pylons, for example). The homes were not structurally suitable; such work would cost more than the home; or the resident simply could not afford to do it. As a result, they had no choice but to move. (2) Many of the residents being forced to move and business owners being discouraged from operating had never asked for FEMA assistance nor would they; they were philosophically opposed to government aid. (3) The mayor was delighted that the new rule provided her with a tool for ridding the city of mobile homes and older waterfront buildings. The tool fit with her plans for a better-looking city and waterfront. I will draw on several sociological theories to provide an analysis of the above.

Peelman, Leah M., Hanover College, Hanover, Indiana, USA, Bevis, Kenneth A., Rivers Institute, Hanover College, Hanover, Indiana, USA, Worcester, Pete, Hanover College, Hanover, Indiana, USA

P-48 Characterization of Storm-water Runoff Within a Small, Partially-urbanized Watershed in Southern Indiana. *(Theme 5)*

Abstract: Urbanization has greatly increased direct storm-water runoff from impervious surfaces (driveways, sidewalks, roadways, parking lots, and buildings). These impervious surfaces interfere with the natural absorption of rainwater and snowmelt, resulting in increased flooding, water pollution, erosion, and loss of natural habits in urbanized areas. Predicting and managing storm-water runoff volume and content is extremely difficult because of the numerous variables that influence it, including type of land use, geomorphic and climatic characteristics, and type and amount of pollutants. A necessary first step is accurately assessing storm-water runoff drainage features and discharge. The campus of Hanover College within the watershed of Happy Valley Creek in Jefferson County, Indiana served as our study area. We first subdivided the campus into land-use areas representing impermeable, intensively managed (compacted soil), and low impact (natural soil) surfaces. Next, we created a GIS of the campus, combining aerial photographic, topographic, soil, land-use, and drainage elements. We estimated infiltration rates for each land-use area: (1) by using an infiltration rate of zero for impermeable surfaces; (2) by using the infiltration rates indicated in the Jefferson County Soil Survey manual for natural soils on low impact surfaces; and (3) by directly measuring infiltration rates for compacted soils of intensively managed surfaces. Using the GIS, we segmented the campus into drainages based on topography and artificial routing of runoff. The total area of each land-use type was measured for each drainage zone and multiplied by infiltration rates to calculate runoff volume. Preliminary conclusions indicate that large volumes of runoff generated from impervious surfaces, combined with improper design of storm-water drainage systems, have resulted in significant standing water problems in some areas, development of large gullies on steep slopes adjacent to campus, and extensive changes to valley floor and channel morphology within the watershed of Happy Valley Creek.

Porter, Karen A., Hanover College, Hanover, Indiana, USA

P-49 Harnessing River Power: Irrigation, Gender, Social Continuity, and Social Change in South Pare, Tanzania. *(Theme 2)*

Abstract: Do indigenous people harness river resources and if so, how? This poster project offers a longitudinal analysis of how the Pare of the Gonja area of the South Pare Mountains, Tanzania, conceptualize and utilize the Hingilili river to provide economic benefits, sustain ecological balance, and create and re-create a sociological, ideological, and religious order through careful construction and management of irrigation canals. Pare harnessed the river prior to colonial contact, extended cultivation to a third growing season, and used surplus production to engage in long-distance trade during the 19th century, thereby extending their influence and power over people. Irrigation continues to support intensive agricultural production in the contemporary period and involves a complex system of use rights rooted in concepts of gender, religion, and hierarchy. With the recent introduction of modern irrigation development schemes in the lowlands, Pare management of river resources has been contested, leading to struggles over access, meaning, and ecological sustainability.

Pyron, Mark, Aquatic Biology and Fisheries Center, Department of Biology, Ball State University, Muncie, Indiana, USA, Lauer, Tom E., Aquatic Biology and Fisheries Center, Department of Biology, Ball State University, Muncie, Indiana, USA, Gammon, James R., Department of Biological Science, DePauw University, Greencastle, Indiana, USA

P-50 The Long-term Fish Assemblage of the Wabash River. *(Theme 6)*

Abstract: We measured temporal variability of the fish assemblage in the Wabash River using a 25-year electrofishing dataset through a combination of a time-lag analysis and multivariate analysis. The fish

assemblage had substantial year-to-year variation, but the overall abundance pattern of the common species did not change. There was no predictable directional change at 29 individual sites based on time-lag analyses and ordinations. Although the overall combined data had a statistically significant directionality with the time-lag analysis, there was little explanatory power for this relationship. These results support the hypothesis that the Wabash River stream fish assemblage has changed relatively little over a time period of 25 years.

Ridenour, Clayton, J., University of Missouri-Columbia Cooperative Fish and Wildlife Research Unit, Columbia, Missouri, USA, Galat, David, L., University of Missouri-Columbia Cooperative Fish and Wildlife Research Unit, Columbia, Missouri, USA

P-51 Species Composition, Distribution, and Habitat Use of Small-bodied Fishes in Relation to Shallow-water Areas at Lower Missouri River Sandbars. *(Theme 6)*

Abstract: Juvenile and small-bodied fishes are an important entity in the ecology of large rivers because they interact in trophic dynamics by consuming invertebrates and in turn may be consumed by larger predators. Channelization and flow regulation have contributed to reduced availability of shallow, low-velocity areas in the lower Missouri River important as habitat for small and young fishes. Shallow-waters adjacent to inside-bend (IB) and wingdike (WD) sandbars (n=8) were sampled under a hierarchical spatial design using quantitative microhabitat electrofishing gear to determine species composition, abundance and distribution, and habitat use of small fishes on the Missouri River in central Missouri. Environmental variables measured for each sample included water depth, temperature, velocity, turbidity, substrate composition, and bottom slope. Forty-one species have been identified thus far from collections made during 03 August - 21 October 2004, and 29 June - 11 November 2005 in water depths ranging from 0.0 to 0.5 m; seven species are federal or state listed as imperiled. Preliminary results indicate species composition differs between IB and WD sandbars, and within sandbar type based on environmental variables. Fish abundance was greater at shallower (0.1 m) than deeper (0.5 m) depths for both sandbar types. Much effort is currently focused to benefit high profile endangered species, such as the pallid sturgeon (*Scaphirhynchus albus*), whereas other ecologically important native fishes receive little attention. Determining what environmental variables are most associated with small-fish refugia and nursery habitat use will improve the ecological value of sandbar rehabilitation efforts and improve management at existing sandbars for early life stages of a diversity of native fluvial dependant fishes.

Rohweder, Jason J., U.S. Geological Survey, La Crosse, Wisconsin, USA, Gallagher, Maureen, U.S. Geological Survey, La Crosse, Wisconsin, USA, Young, Neal, U.S. Geological Survey, La Crosse, Wisconsin, USA, Thogmartin, Wayne, E., U.S. Geological Survey La Crosse, Wisconsin, USA, Knutson, Melinda G., U.S. Geological Survey Upper Midwest Environmental Services Center, La Crosse, Wisconsin, USA

P-52 Bird Habitat Associations in the Lower Missouri River Floodplain. *(Theme 6)*

Abstract: Floodplain forests provide some of the most dense and diverse assemblages of birds in North America; unfortunately, because of floodplain protection projects, the ecology of many rivers, including the lower Missouri River, have changed, potentially influencing avian floodplain abundance and diversity. We examined avian community composition associated with the floodplain of the lower Missouri River. We found avian assemblages along the lower Missouri River to be among the most diverse in North America, comprising >15% of all species occurring on the continent. One-hundred-twenty-one species were identified in early successional forest, 131 species in wet prairie, and 140 species in mature floodplain forest, representing sampling during the breeding and migration seasons. We examined environmental factors differentiating wet prairie and early successional forest site, important habitat for floodplain birds. We found early successional forest sites were closer to the river and on lower elevation, but occurred on drier soils than wet prairie. In a regulated river such as the lower Missouri River, wet prairie sites are relatively isolated from the main channel as compared to early successional forest, despite occurring on relatively moister soils. We found power to detect trends in bird abundance was a function of trend magnitude, sample size, and species-specific sampling variance. We found for nine representative species that most individual management sites were too poorly sampled to allow for site-level estimation of trends in abundance. In general, to detect trends of 3% per annum or greater at 80% power required an annual sample size of >50. Confounding our ability to calculate power to estimate trends was the imperfect detectability of species. This ability to detect species varied among species by habitat, time, and observer. In general, approximately half of birds were estimated to have been observed (i.e., half the individuals of a species were not observed during surveys).

Romano, Susan P., Western Illinois University, Macomb, Illinois, USA, Zaczek, James J., Southern Illinois

University, Carbondale, Illinois, USA, Gibson, David J., Southern Illinois University, Carbondale, Illinois, USA, Baer, Sara G., Southern Illinois University, Carbondale, Illinois, USA, Battaglia, Loretta L., Southern Illinois University, Carbondale, Illinois, USA

P-53 Implications of Succession, Flood Duration, Flood Frequency, and Soil Texture for Overstory, Midstory Communities of a Central Floodplain Forest, Southern Illinois, USA. *(Theme 6)*

Abstract: Succession, flood and soil texture variables were studied by sampling 85 plots at 3 floodplain forest sites along the Lower Kaskaskia River, a tributary of the Mississippi River in southern Illinois. Successional trends were interpreted using vectors positioned on the overstory plot, and directed towards the midstory plot within the MDS ordination. Flood frequency and flood duration during the growing season (April 1 – October 30) were modeled with data from wells at each site, and historic river gage data. Plot elevation was determined using a geographic positioning system (Garmin 12XL), geographic information system (ArcMap 9), and USGS National Elevation Data. Plot elevation was then incorporated into the model to predict flood frequency and duration at each plot. Percent sand, silt, and clay were determined using the hydrometer method. Cluster analysis revealed five overstory floodplain forest communities and three midstory communities. Five overstory communities identified were *Acer saccharinum*, *Acer saccharinum*, *Fraxinus pennsylvanica*, *Acer negundo*, *Acer saccharinum*, *Celtis occidentalis*, and *Betula nigra*, *Ulmus americana*. Midstory communities identified were *Acer negundo*, *Celtis occidentalis*, and *Ulmus americana*. The most important environmental factors related to forest community groups within the overstory strata in the Lower Kaskaskia River floodplain forests were flood frequency, flood duration, and soil texture. Successional trend analysis revealed succession from overstory forest community groups of *Acer saccharinum* and *Acer saccharinum*, *Fraxinus pennsylvania* to *Ulmus americana* and *Celtis occidentalis* midstory groups. Midstory strata forest communities were not significantly related to flooding or soil texture. Further research is needed to identify environmental factors related to midstory stratum development and environmental factors related to *Quercus* spp. in all strata.

Romanovskaya, Maria A., Moscow State University, Moscow, Russia

P-54 Recent Ecological Condition of the Upper Volga River Basin Area. *Theme 2)*

Abstract: The ecological condition of the Upper Volga basin area is a question of a great importance because the most considerable part of water recourses of Russia are formed here. Recent regional natural withdrawal is more than 2.9 km^3. Irreversible consumption is about 77.3 million m^3. Annually about 1.5 km^3 of waste water pour out into surface natural objects. Approximately 108 million m^3 of polluted water are wasted to the Volga river system; 83 million m^3 are directly wasted in the Volga river, including about 0.1 million m^3 without any purification. As before, many rivers and water reservoirs belonging to the Upper Volga basin area are considerably polluted. Their Index of Water-body Pollution (IWP) reaches 3-4. Some pollutants have reached magnitudes that are 5-15 times higher than maximum allowable concentration (MAC) in rivers of Klyazma, Oka, Sestra, Dubna, Kunya and others. Using region flood-lands has caused annual washing off of 40-60 tons of soil materials a hectare. Ninety percent of this mass is accumulated into river channels of 1-2 orders. The problem of the ecological conditions of the Ivankovskoe reservoir is sharply urgent, Namely because the Ivankovskoe reservoir supplies water to the Moscow region. Nevertheless, 26 industrial and agricultural enterprises realize wasting to the reservoir (annually approximately 33.5 million m^3 of waste water). The reservoir belongs in the moderate polluted and polluted water category (IWP 2-3). Underground water is exhausted and polluted intensively as a result of uncontrolled withdrawal within private territories, technical imperfection of drilling water-pipes, illegal waste disposals, and livestock farms. In addition, the region has about 9000 permanent sources of polluting atmospheric air. There are about 1.1 million tons of industrial hard waste in places of long-term preservation. The modern geological processes also damage the environment considerably. About 60% of them are caused by anthropogenous influences upon nature.

Ruter, Anthony, University of Wisconsin- Madison, Madison, Wisconsin, USA, Bryson, Reid A., University of Wisconsin- Madison, Madison, Wisconsin, USA

P-55 Holocene River Discharge and Cultural History Along the Danube. *(Theme 5)*

Abstract: 2002 witnessed the Danube's third largest flood since gauging began in 1877 (costing over 431,000 Euros in Slovakia alone). Total costs of the floods on the Elbe, Danube and all tributaries were in excess of 15 billion Euros. In the summer of 2005, the rivers flooded again taxing the infrastructure of one of the most industrialized regions of the planet. Floods during the historic and prehistoric periods were probably also traumatic. We have compiled several Archaeoclimatic (Macrophysical) models of the Danube's discharge to hypothesize about the potential impacts of paleo-floods along Central Europe's most important ecological and economic artery during the Holocene.

Sadgir, Parag A., Government College of Engineering, Aurangabad, (M.S.) India, Bhalge, Pradeep A., Irrigation Department, Aurangabad (M.S.) India, Ithape, Ashok W., Sangamner, India

P-56 Inter Relationship Between River and Culture in India. *(Theme 1)*

Abstract: Life without water and culture without life are next to impossible. Over the centuries, water becomes the sacred commodity of the society and commends utmost respect. Because of the repeated frequency of the famine, its position from common commodity is enhanced to terrestrial deity. It is allotted a place among the group of earthly gods and goddesses. It is revealed from the Sanskrit literature that water was honoured as 'Brahma' (i.e. ultimate truth in life). India is the only country where rivers are honoured as 'lokanam mataram' (i.e. mothers of the people). They are also worshipped as goddesses. Water of rivers and of sacred hydraulic bodies were given the status of 'tirtha' (i.e. holiest of all). Tirtha has a great respect in the society. Every smallest stream is honoured as Ganga. They satisfy spiritual needs of the society. 'Kalash' (pot) full of water enclosed in the eight cultural holy motives "Astamanga.l" On the third day of Vaishakh, a ritual of Akshaya Tritiya is observed throughout the country. Rivers like Ganga, Yamuna, Sarswati, etc., and hydraulic bodies like lakes and reservoirs, step wells and hot water springs were honoured throughout the country. The tradition is still vougue. Special melas (festivals) were organized in honour of them. River "parikrama" to walk across the river course, especially the Narmada parikrama, is still popular among the orthodox hindus. As far as the water bodies are concerned, Ganga is respected throughout the subcontinent as mother. Bath in Ganga is supposed to be the most sacred achievement, hence every smallest river is honoured as Ganga. All case studies related with 'water and culture in India' are discussed in depth in this paper.

Sandheinrich, Mark B., University of Wisconsin-La Crosse, La Crosse, Wisconsin, USA

P-57 The River Studies Center: Partnerships in Science Research and Education. *(Theme 7)*

Abstract: The River Studies Center (Center) at the University of Wisconsin-La Crosse was established in 1972 as a non-curricular unit to focus on research and informational programs pertinent to the Upper Mississippi River and its related resources. During the past 30 years, the Center has expanded its research program to other aquatic resources across Wisconsin, the Upper Midwest, and the Nation. Faculty with the Center teach aquatic and environmental science courses in biology, microbiology, chemistry and geography & earth science. Scholarly investigations by the Center have provided research opportunities to nearly 100 graduate students and more than 250 undergraduates. The research of Center faculty addresses resource issues and environmental problems of pressing, regional and national concern, such as environmental pollutants and contaminants that have caused widespread degradation of our aquatic resources. A strength of the Center is developing partnerships with state and federal natural resource agencies. One of the most rewarding accomplishments of the past decade has been the establishment of a formal Cooperative Education Agreement with the Upper Midwest Environmental Sciences Center, a research laboratory with the Biological Resources Division of the U.S. Geological Survey. This partnership was established to promote internships and research opportunities for our students and to encourage professional collaboration among scientists of the two institutions. Scientists from U.S. Geological Survey serve as adjunct faculty to the University and, with Center faculty, co-write research proposals, advise students, and publish the results of their research. The strength of our partnership is based on the guiding principles that guide our cooperative education agreement. Both the University and the USGS must benefit from any project that we jointly undertake. This synergistic partnership, which is a national model for collaboration between federal agencies and state universities, creates new research and learning opportunities that would not be possible without this unique relationship.

Schrieve, Tiffany, Winona State University, Winona, Minnesota, USA, Delong, Michael, Winona State University, Winona, Minnesota, USA

P-58 Comparing Fish Trophic Dynamics in Three Floodplain Rivers: the Mississippi, Ohio, and Missouri. *(Theme 6)*

Abstract: Individual river systems offer commonalities and differences among other rivers with respect to geomorphology, natural and anthropogenic impacts, and food web dynamics. The Upper Mississippi, lower Ohio, and lower Missouri Rivers indicate similarities within regional constraints; however, the addition of dams, levees, and navigational pathways has impacted these rivers on different levels. This study was undertaken to define and compare the nature of higher trophic levels of river-floodplain ecosystems. Trophic position, which defines the location of higher consumers in a food web, was calculated for a range of fish species using stable isotope ratios of carbon and nitrogen. Fish representing piscivores, invertivores, omnivores, and planktivores were examined in this study. Trophic position models revealed seasonal shifts

as well as differences in complexity among the three rivers. Trophic positions of fish in the Mississippi and Ohio Rivers correlated well with expected trophic level-specific locations. Trophic positions of fish from the Missouri River, however, differed considerably and often diverged markedly from expected trophic status. We suggest that similarities in trophic position of fishes in the Upper Mississippi and Ohio Rivers indicate that functional dynamics of these two rivers are comparable, despite obvious differences in overall basin morphology. Marked differences in system dynamics of the Missouri, relative to the other rivers, may be attributed to the pronounced alteration and degradation of this formerly braided and hydrologically dynamic river-floodplain ecosystem.

Scott Cummings, Linda, Paleo Research Institute, Bryson, Reid A., University of Wisconsin – Madison, Madison, Wisconsin, USA

P58a Colorado Rivers: Comparison of Modeled Holocene Discharge Beginning in the Rocky Mountain Backbone. *(Theme 5)*

Abstract: Changes in annual stream discharge, as modeled using Archaeoclimatic modeling, in arid and semi-arid environments of Colorado must have had an effect on local plant, animal, and human populations. Water is a critical resource in the American West -- one around which people organized their activities and lives. The five major drainage systems of Colorado (Platte, Arkansas, Northern Colorado, Southern Colorado, and Rio Grande) are considered key to understanding prehistoric occupation of this area. Understanding temporal changes in discharge of streams and rivers in these drainage basins has not yet been given consideration by the archaeological community when studying prehistoric populations, including their movements. This presentation presents models of stream discharge in each of the five major basins and discusses highlights of prehistoric human occupation of the areas.

Singh, Ram, University of Mumbai, India, Phadke, V.S., University of Mumbai, India

P-59 Assessing Soil Loss by Water Erosion in Jamni River Basin, Bundelkhand Region, India Adopting Universal Soil Loss Equation (USLEo Using GIS). *(Theme 5)*

Abstract: The present study uses the Universal Soil Loss Equation (USLE) developed by the United States Department of Agriculture, Agriculture Research Service, to predict soil erosion from a watershed. The land cover/land use data at village level is collected from the revenue department, and detailed soil data (All India Soil and Landuse Survey, New Delhi), are used in USLE for determining soil erosion rate. MapInfo Professional Version 5.5 GIS Software has been used as a platform for spatial data analysis required in the USLE. The potential soil loss has been estimated and mapped. Maps covering each parameter (R, K, L, S, C and P) were integrated to generate a composite map of erosion intensity based on the advanced GIS functionality. The map is expected to assist identification of priority areas of the basin and would thus help in future planning for watershed and its sustainable development of Mumbai.

Slattery, Kelly, Winona State University, Winona, Minnesota, USA, Delong, Michael, Winona State University, Winona, Minnesota, USA

P-60 Food Web Dynamics of Large Floodplain Rivers: Assessment Through Stable Isotope Analysis. *(Theme 6)*

Abstract: Food web ecology has become increasingly important for addressing ecological questions because trophic dynamics emphasize functional aspects that may be more sensitive to fluctuations than structural measures. The objective of this study was to use stable isotope ratios of carbon and nitrogen to build food web models for a quantitative comparison of trophic dynamics of the Upper Mississippi, Ohio, and Missouri rivers. This comparative approach may make it possible to establish common threads in the functioning of river-floodplain ecosystems and to assess the impact of human alterations to structural and functional attributes. Samples were collected for the following components: organic matter within the water column, benthic algae, terrestrial vegetation within the riparian zone, and invertebrate and fish consumers from representative functional feeding groups. A combination of trophic position models and a dual-isotope, multiple-source mixing model were used to establish linkages from basal sources through higher consumers. Energy driving the food web of the Missouri River is dissolved organic matter (DOM) and terrestrial organic matter. Ultrafine transported organic matter and DOM were the major food sources in the Ohio River, whereas DOM, fine transported organic matter, and benthic algae were the primary food web drivers in the Upper Mississippi. Flow of organic matter to higher trophic levels supports the conclusion that there are clear differences in the functional dynamics of the Missouri River when compared to the other two rivers. While natural structural differences could be responsible, obvious differences in the basin characteristics of the Ohio and Upper Mississippi should lead to greater differences here. We propose that extensive anthropogenic changes in the Missouri River are the primary causal mechanism for differences observed in

trophic dynamics.

Stark, James R., U.S. Geological Survey, Mounds View, Minnesota, USA

P-61 Causes of Variations in Water Quality and Aquatic Ecology in Rivers of the Upper Mississippi River Basin, Minnesota and Wisconsin. *(Theme 3)*

Abstract: The Upper Mississippi River Basin (basin) in Minnesota and Wisconsin includes the Mississippi River basin from its source at Lake Itasca to Lake Pepin, as well as the Minnesota and St. Croix River basins. Analysis of the environmental framework of the basin and water-quality and ecological information, by the U. S. Geological Survey National Water-Quality Assessment (NAWQA) Program, shows that conditions in the rivers are a product of a combination of factors including climate, hydrology, geology, soils, land use, land cover, water management, and water use. Natural differences among the major tributaries have always been reflected in differences in water quality and ecological conditions of rivers in the basin. Our use of the land has accentuated natural differences in water quality and ecological conditions in each of the three major rivers in the basin. The quality of surface water and the ecological condition of rivers affect the ways in which we use them. The St. Croix River is used for recreation; the Mississippi River is used for recreation and is a corridor for commerce; and the Minnesota River primarily drains agricultural lands.

Ström, Lotta, Umeå University, Umeå, Sweden, Jansson, Roland, Umeå University, Umeå, Sweden, Johansson, Mats E., County Administration, Umeå, Sweden, Nilsson, Christer, Umeå University, Umeå, Sweden, Xiong, Shaojun, Swedish University of Agricultural Sciences, Umeå, Sweden

P-62 Responses of Riparian Vegetation to Climate Change in a Northern Swedish River. *(Theme 5)*

Abstract: According to most climate change scenarios, the world is getting warmer. Plant communities will be affected directly by increased temperatures, but also indirectly through changes in precipitation and hydrology. In boreal regions, increased and more variable precipitation and runoff events, and a reduction of the riparian area will likely pose a threat to species-rich riparian vegetation. Plant growth will be disturbed and riparian production reduced. We simulated changes in runoff dynamics in a large boreal river by relocating 1 x 0.7 m turfs of intact vegetation communities across the lateral riparian gradient. The short-term response of relocated vegetation turfs was that species composition remained more or less intact, but productivity changed drastically, adapting to local conditions. During four years, the new elevation successively increased in importance for species composition. Vegetation communities relocated to the lowest levels, simulating increased duration of summer flooding, lost most species, and plots were dominated by species-poor Carex communities. Biomass production was mainly determined by the new elevation, with the highest production at the lowest levels. More frequent floods may distribute higher abundances of litter. Therefore, we also simulated increased litter-fall by adding riverborne litter to the ground. This generally suppressed plant growth but did not affect species numbers. We also study how reductions of riparian area would affect species richness and composition. This is done by recording the elevational positions of different species and by combining this information with the predicted future hydrologic conditions along the same elevational gradients. Our studies are expected to improve the ability of predicting directions and rates of vegetation succession and future community conditions in riparian areas, following climatic and hydrologic alterations.

Stroom, Kevin T., Wilson Environmental Laboratories, Duluth, Minnesota, USA, Sandberg, John J. G., Wilson Environmental Laboratories, Duluth, Minnesota, USA, Angradi, Theodore, U.S. Environmental Protection Agency, Mid-Continent Ecology Division, Duluth, Minnesota, USA

P-63 Macroinvertebrate Community Structure in Large Rivers of the U.S. Central Basin and Implications for Field and Laboratory Approaches. *(Theme 6)*

Abstract: Benthic macroinvertebrates were collected at randomly selected sites with identical protocols from main channel edges (kick net) and from snags (brush and net) in the Missouri, Upper Mississippi (above Cairo, Illinois), and Ohio Rivers. Samples were sorted to 400 organisms, and all taxa were identified, primarily to the genus level. General community characteristics are discussed. Relative abundance and taxa richness were calculated to assess communities on two habitats without regard to human disturbance influences. For habitat-composited data, kick samples had greater richness than snags in all three rivers, though snags were similar in the Ohio. Chironomidae, Ephemeroptera, Oligochaeta, and Trichoptera contributed most heavily to the overall richness in each river, with chironomids being far the most significant in both habitats in all rivers. Further identification of Oligochaeta to species level may be of additional benefit by increasing richness potential as multiple species were observed in many genera. Chironomidae and Oligochaeta were numerically dominant in all three rivers, though it should be noted that Amphipoda and Hemiptera (Corixidae) were also quite abundant in kick samples from the Mississippi. In

contrast, these two groups (Chironomids and Oligochaetes) are often neglected in bioassessment studies of small wadeable streams. Thus, analysis of benthic communities from large rivers will require taxonomists experienced in chironomid and oligochaete identification, as well as lab support trained in the slide-mounting of these organisms. These factors, along with the copious amounts of detritus and sediment typically encountered with these samples, may significantly increase laboratory processing time. Some of this work was completed under Environmental Protection Agency (EPA) contract 68-D-03-060. This abstract does not necessarily reflect EPA Policy.

Thiemeyer, Heinrich, University of Frankfurt, Frankfurt, Hessen, Germany, Dambeck, Rainer, University of Frankfurt, Frankfurt, Hessen, Germany

P-64 The Northern Upper Rhine Valley - Changes in Fluvial Morphology, Sediments and Soils. *(Theme 5)*

Abstract: The fluvial history of the northern Upper Rhine River since the Lateglacial is characterised by several rapid changes in fluvial morphology and sedimentation conditions. The river floodplain, thus, can be divided into three meander generations, which show differences in morphology, lithology and soils. A more detailed chronology could be established by using OSL, Pollen and Radiocarbon datings. The Neckar River, a tributary to the Rhine, changed its way during the Younger Dryas period. At that time, the old course parallel to the Rhine was abandoned and serves since then as bed only for minor streams from the Odin's Forest.The investigations were focused on the interaction of climate causes and human impact on the fluvial system within the DFG-funded project "Fluvial History of the Northern Upper Rhine-Rift-Valley: Climatic and Anthropogenic Causes and Impacts since the Lateglacial up to Modern Times." Under glacial conditions, River Rhine was a braided river system. River Rhine started meandering with the onset of the Allerod period and continued meandering since the Lateglacial. The change from the so-called "Oldest meander generation" with loamy overbank deposits and Chernozem-like soils to the "Older meander generation" with black clays and Vertisols took place at the end of the Atlantic period. The onset of the "Younger meander generation" with silty deposits and Calcaric Fluvisols is not well dated yet. It started either in the late Subboreal or at the transition from Subboreal to Subatlantic. Most likely, these changes in river dynamic were triggered by climate changes. On the other hand, human presence has been recorded for the last 6000 years and the Younger meander generation is certainly influenced by human impact, due to increasing land use in the river catchment. Whether or not neotectonic movements influenced the sedimentation processes is still under debate.

VandeCreek, Drew E., Northern Illinois University Libraries, DeKalb, Illinois, USA

P-65 Humanities Computing and the Geographical Imagination: The Mark Twain's Mississippi Project. *(Theme 1)*

Abstract: The Mark Twain's Mississippi Project World Wide Web site (http://dig.lib.niu.edu/twain) presents users with a digital library featuring humanities materials shedding light upon the historical milieu in which Samuel Clemens grew to maturity, and which he remembered and imagined as Mark Twain in a series of celebrated works based in the Mississippi River Valley of the mid-nineteenth century. The site will present Twain's Mississippi works (The Adventures of Tom Sawyer, The Adventures of Huckleberry Finn, and Life on the Mississippi) online in a fully searchable digital format, along with other contemporary authors' descriptions, accounts, and definitions of that region. Project staff members have gathered and digitized over 100 primary source texts, including travel accounts, immigrants' guides, gazetteers, and reminiscences, from participating libraries and are at work presenting them on the project web site. They have also gathered nearly 1000 images from these texts, as well as participating institutions' collections of visual materials and are mounting these materials in a parallel database. Project staff have identified and gathered mid-nineteenth century sheet music totaling some twenty songs describing and mythologizing the Mississippi River, its valley, and its culture. Musicians have recorded versions of these songs, which will be featured in a database of sound recordings. Finally, the project World Wide Web site presents spatial data via Geographic Information Systems technology, including geographical features and data sets depicting the changing demographic, economic, and political contours of the region in this period. Using these online tools, project users may compare Mark Twain's accounts of the Mississippi Valley of the nineteenth century with those produced by other observers, thereby exploring and analyzing significant themes in American literature and history.

You, Jinsheng, Hydrology Observation Center of Tianjin, Tianjin, Tianjin, China

P-66 Discussion on Irrigation and Drainage Environment Protection Project. *(Theme 2)*

Abstract: This article sets forth the importance of instituting systems in water resource management. Taking

Exhibits

Exhibits

Big River Magazine, Reggie McLeod, Winona, Minnesota USA

E-01 – Big River Magazine, Exploring the Upper Mississippi River from the Twin Cities to the Quad Cities

Description: Big River started in January 1993. It is the only independent magazine in the world about a river. We cover anything and everything connected to our 412-mile stretch of the river: wildlife, people, history, development, recreation, invasive species, science, art, and business.

Minnesota Marine Art Museum, Danielle Benden, Winona, Minnesota USA

E-02 - The Minnesota Marine Art Museum: A New Art Museum Along the Banks of the Mississippi River

Description: The Minnesota Marine Art Museum is a new museum in Winona, MN that exhibits maritime and river art and history objects. We will exhibit images, text about our institution, brochures, multimedia, and have examples of work from our collection.

Mississippi Valley Archaeology Center (MVAC), Joseph Tiffany, University of Wisconsin-La Crosse, La Crosse, Wisconsin USA

E-03 - Exploring Upper Mississippi Valley Archaeology

Description: The Mississippi Valley Archaeology Center (MVAC) is an academic, research, and educational unit of the University of Wisconsin-La Crosse. MVAC educates precollegiate and university students, teachers, and the general public about past cultures, conducts archaeological and historical research regionally, and promotes site preservation and interpretation.

Mississippi River Sculpture Park, Florence Bird, Prairie du Chien, Wisconsin USA

E-04 – Mississippi River Sculpture Park

Description: This exhibit will show maquettes and visual material for the Mississippi River Sculpture Park at Prairie du Chien, Wisconsin. Plans for the park include 26 over-life-size bronze figures from history and prehistory who have come to this river confluence. Two of the bronze historical figures, Black Hawk, Sauk warrior, and Dr. Beaumont, a famous 19th century doctor, are already installed in the park.

Mississippi Valley Conservancy, James Falvey, La Crosse, Wisconsin USA

E-05 Blufflands Alliance - A Unique Partnership for Land Conservation in the Driftless Region

Description: This exhibit will showcase the unique collaboration of five land trust organizations operating in four states.

Murphy Library Special Collections, Paul Beck, University of Wisconsin–La Crosse, La Crosse, Wisconsin USA

E-06 SteamBoat A'Coming: Photographic History of Steamboats on the Upper Mississippi River

Description: Steamboats played a crucial role in the settlement and development of the upper Mississippi River in the 19th century. Images from the renowned Steamboat Collection at Murphy Library, one of the largest collections of steamboat photographs in the world, visually document this history. Subject matter on display will include immigration, Civil War, lumbering, and tourism with photographs of a variety of steamboats featuring packets, rafters, and excursion boats.iversity but also potentially reduce the impacts of non-native species in large river systems.

National Great Rivers Research and Education Center, Jessica Pascoe, Godfrey, Illinois USA

E-07 Partnering to Recover and Sustain the Great Rivers of the Upper Midwest

The National Great Rivers Research and Education Center is a joint undertaking of the University of Illinois at Urbana-Champaign, Lewis and Clark Community College and the Illinois Natural History. NGRREC is committed to scholarly research, education and outreach on the interconnectedness of large rivers, their floodplains and watersheds, and their associated plant, animal and human communities.

National Mississippi River Museum & Aquarium, Dubuque, Iowa USA

E-08 Lewis and Clark's Excellent Adventure

Journey with Lewis and Clark on their epic trek up the Missouri and down the Snake and Columbia rivers from 1804 to 1806. This exhibit presents selected portions of the Lewis and Clark's Excellent Adventure exhibit which was created by the National Mississippi River Museum & Aquarium in 2004.

National Mississippi River Museum & Aquarium, Dubuque, Iowa USA
E-09 Films
River of Dreams – The full-size version of this award winning film was dubbed "15 minutes you'll never forget" by the *Des Moines Register*. This multi-media orientation experience paints a portrait of the Upper Mississippi River gives viewers a new perspective on the Mississippi, touching on cultural history and showing how the river has shaped people's lives and how people have shaped the river. (18 minutes)
John Fitch Invents the Steamboat - the trials and tribulations of the acknowledged inventor of the steamboat. (3 minutes)
The 1st Steamboat on the Ohio & Mississippi – the story of Nicholas Roosevelt and his wife Lydia, and their journey on the Ohio and lower Mississippi in 1811 and 1812, amidst the new Madrid earthquake. (3 minutes)
The Golden Age of Steamboating - the days of steamboat prosperity on the mighty Mississippi including the settlement of the Mississippi River Valley, Mark Twain, and life on board. (3 minutes)
Barging Ahead - a fascinating journey down the Mississippi River with grain bound for foreign markets. Meet the pilots and deckhands and understand the impact of this massive transportation system. (6 minutes)

National Mississippi River Museum & Aquarium, Dubuque, Iowa USA
E-10 River of Choices
Description: Explore choices we make and continue to make for water quality, the lock and dam system, structural versus non structural approaches to flood control, and the dead zone. You can listen to experts weigh in with their opinions, pro and con, and then make your own decisions. Interactive – choose between – Flood, Locked in Controversy, and the Dead Zone.

National Center for Earth-surface Dynamics, Karen Campbell, Minneapolis, Minnesota USA
E-11 River on the Road: Modeling Dam Removal on the Elwha River
Description: The National Center for Earth-surface Dynamics and Science Museum of Minnesota's river restoration model introduces students to river research. The model allows students to explore the complex social and scientific issues surrounding an impending dam removal. Exhibit visitors can experiment with removing the model dam and learn more about this fascinating case study using the model and 3D maps.

The Nature Conservancy, Peter Bryant, Peoria, Illinois USA
E-12 Working Together, We Can Protect the World's Great Rivers
Description: The Nature Conservancy, a global leader in freshwater conservation, recently launched the Great Rivers Partnership, an ambitious effort to guide protection of the world's imperiled freshwater systems and transform how rivers are managed. It is bringing together people to develop and share new economic and scientific strategies and information, shedding light on the many challenges facing the world's great rivers.

The Nature Conservancy, Nicole Silk, Boulder, Colorado USA
E-13 The Nature Conservancy - Managing Water for People and Nature
Description: The natural rising and falling of water levels in our rivers, lakes, and wetlands supports a symphony of life. Too often we have disrupted these natural patterns at great cost. This display explains The Nature Conservancy's efforts to manage water for people and nature by advancing policies and conservation approaches that meet human needs for water and sustain healthy ecosystems.

Office of International Education, Jay Lokken, University of Wisconsin-La Crosse, La Crosse, Wisconsin USA
E-14 The View from the Bluff is Global
Description: Established in 1909, the University of Wisconsin-La Crosse (UW-L) is a fully accredited comprehensive four-year university in the University of Wisconsin System. UW-L enrolls 9,100 students. Students currently come from 38 states and 44 foreign countries. The university offers a wide variety of undergraduate and graduate majors including a wide array of minors and emphases. UW-L offers undergraduate degrees in international business, French, German Studies, and Spanish, as well as an International Studies Minor. The English as a Second Language Institute offers various levels of courses to students and visiting scholars from around the world. In addition, UW-L offers exceptional study abroad opportunities for students worldwide. Two national U.S. magazines, Kiplinger's and U.S. News & World Report, recently ranked UW-L as one of the best universities in the United States.

Rivers Institute at Hanover College, Michelle Gammon Purvis, Hanover, Indiana USA

E-15 Rivers Institute at Hanover College: A Liberal Arts Approach to Environmental Education
Description: The Rivers Institute enhances understanding of the culture, economics and science of river systems around the world. We achieve our goals through three primary activities: education, convening and consulting. Each activity provides educational opportunities for Hanover College faculty, staff, and students, K-12 teachers and students, academicians, technical specialists, public agencies, representatives of commerce, industry, non-profit organizations and the general public.

Rivers Institute at Hanover College, Molly Dodge, Hanover, Indiana USA
E-16 Highlighted Programs of the Rivers Institute at Hanover College
Description: We will showcase a variety of our upcoming programs, including a major conference "Innovations in Reducing Nonpoint Source Pollution."

Upper Mississippi River Conservation, Scott Yess, Onalaska, Wisconsin USA
E-17 The Upper Mississippi River Conservation Committee Working for the Resource
Description: The Upper Mississippi River Conservation Committee (UMRCC) was formed in 1943 to determine factors influencing fish and wildlife abundance and to collect data which to base recommendations for uniform fishing regulations. Today the goal of the UMRCC is to promote the preservation and wise utilization of the natural and recreational resources of the Upper Mississippi River and to formulate policies, plans and programs for conducting cooperative studies.

U.S. Army Corps of Engineers, Kurt Brownell, La Crescent, Minnesota USA
E-18 St. Paul District Army Corps of Engineers
Description: The exhibit will highlight St. Paul activities on the Mississippi River having to do with the Navigation and Ecosystem Sustainability Program, Water Level Management, Environmental Management Program, Channel Maintenance, and Environmental Stewardship.

U.S. Army Corps of Engineers, Daniel Wilcox, St. Paul, Minnesota USA
E-19 U.S. Army Corps of Engineers
Description: Mississippi Valley Division with the St. Paul, Rock Island, and St. Louis District offices share examples of planned and completed projects on the Upper Mississippi River. We emphasize 20 years of accomplishments with the Environmental Management Program and other Corps of Engineers Mississippi River ecosystem restoration and navigation system operations and maintenance projects.

U.S. Fish and Wildlife Service, Jeff Finley and Jennifer Johnson, Columbia, Missouri USA
E-20 U.S. Fish and Wildlife Service Big Rivers Fisheries Program
Description: The Service's Fisheries Program works with others to conserve, protect, and enhance fish and aquatic habitats for the continuing benefit of the American people. Program employees at eight offices in the Big Rivers region work with partners in the Ohio, Missouri, and Mississippi River basins to recover endangered fauna, control aquatic nuisance species, manage interjurisdictional fisheries, and restore lotic habitats.

U.S. Fish & Wildlife Service, Cindy Samples, Winona, Minnesota USA
E-21 Upper Mississippi River National Wildlife and Fish Refuge
Description: Welcome to the International Conference in the heart of the Upper Mississippi River National Wildlife and Fish Refuge. The Refuge encompasses approximately 240,000 acres of floodplain in a more-or-less continuous stretch of 261 river-miles. The Refuge is an invaluable natural legacy in a complex geopolitical landscape with up to 40% of the continent's waterfowl; 50% of the world's Canvasback ducks; and up to 20% of the eastern United States Tundra Swans visiting in the fall. Stop by the exhibit to learn more about this natural legacy.

U.S. Fish and Wildlife Service, Mark Steingraeber, Onalaska, Wisconsin USA
E-22 U.S. Fish and Wildlife Service Big Rivers Fisheries Program
Description: The Service's Fisheries Program works with others to conserve, protect, and enhance fish and aquatic habitats for the continuing benefit of the American people. Program employees at eight offices in the Big Rivers region work with partners in the Ohio, Missouri, and Mississippi River basins to recover endangered fauna, control aquatic nuisance species, manage interjurisdictional fisheries, and restore lotic habitats

U.S. Geological Survey, Jennifer Sauer, La Crosse, Wisconsin USA
E-23 Upper Mississippi River System Environmental Management Program 20th Anniversary (Portion of the LTRMP exhibit being coordinated by Terry Dukerschein, WDNR)
Description: In 1986, Congress recognized the Upper Mississippi River System as both a nationally significant ecosystem and a nationally significant commercial navigation system. The Environmental Management Program provides a well-balanced combination of monitoring, research, and habitat restoration through the Long Term Resource Monitoring Program and the Habitat Rehabilitation and Enhancement Program. Come explore the highlights, discoveries, and interactive displays.

U.S. Geological Survey, Hines, Randy, La Crosse, Wisconsin USA
E-24 USGS Upper Midwest Environmental Sciences Center
Description: The U.S. Geological Survey is a research agency that serves the Nation and world by providing reliable scientific information to understand the Earth, and manage water, biological, energy, and mineral resources. The Upper Midwest Environmental Sciences Center is a USGS biological center responsible for understanding the Mississippi River, and providing sound science for the wise management of this river resource.

Winona State University (E--) Drake Hokanson, Winona State University, Winona, Minnesota USA
E-25 Winona State University Center for Mississippi River Studies
Description: The Center for Mississippi River Studies is dedicated to creating greater understanding of the broad multi-faceted nature of the Mississippi River and the people and places it touches. We seek a greater understanding of all aspects of the river via all disciplines through research, teaching and outreach. Our hope is to transform both the meaning of the river and our relationship to it.

Wisconsin Department of Natural Resources, Kraig Hoff, La Crosse, Wisconsin USA
E-26 Upper Mississippi River System Environmental Management Program 20th Anniversary.
Description: In 1986, Congress recognized the Upper Mississippi River System as both a nationally significant ecosystem and a nationally significant commercial navigation system. The Environmental Management Program provides a well-balanced combination of monitoring, research, and habitat restoration through the Long Term Resource Monitoring Program and the Habitat Rehabilitation and Enhancement Program. Come explore the highlights, discoveries, and interactive displays.

Wisconsin Department of Natural Resources, Jeanne Dukerschein, La Crosse, Wisconsin USA
E-27 Upper Mississippi River System Environmental Management Program 20th Anniversary.
Description: In 1986, Congress recognized the Upper Mississippi River System as both a nationally significant ecosystem and a nationally significant commercial navigation system. The Environmental Management Program provides a well-balanced combination of monitoring, research, and habitat restoration through the Long Term Resource Monitoring Program and the Habitat Rehabilitation and Enhancement Program. Come explore the highlights, discoveries, and interactive displays. Resource Monitoring Program and the Habitat Rehabilitation and Enhancement Program. Come explore the highlights, discoveries, and interactive displays.

Wisconsin Humanities Council, Dena Wortzel, Madison, Wisconsin USA
E-28 Wisconsin Humanities Council Community Through Conversation
Description: The Wisconsin Humanities Council is an independent affiliate of the National Endowment of the Humanities that supports public programs that engage the people of Wisconsin in the exploration of human cultures, ideas, and values. Its programs include the Wisconsin Book Festival, a speakers bureau, a literacy program, and a statewide grants program (www.wisconsinhumanities.org).

Performances

Performance/Presentations

Campbell, Joe, Welch, Minnesota, USA

PF 1 Native American Storytelling

Abstract: This session focuses on Native American Storytelling as presented by Joe Campbell, a Dakota Elder and cultural educator.

Chubaryan, Gevork, New York, New York, USA

PF 2 Narrated Painting Exhibit: Landscapes of Russian Rivers

Abstract: Born in Moscow, abstract-expressionist Gevork Chubaryan has lived near three major rivers in Russia, Texa, and New York. His paintings for this exhibit take the shapes of riverine landscape and interpret them in a language of drips, scratches, and vibrant color, with a goal of entertaining the eye. Chubaryan, the son of a nuclear scientist, views science as an art form and brings that sensibility to his work.

Cohenour, Gretchen, Winona State University, Winona, Minnesota, USA

PF 3 Choreographic Presentation on the Science of Water Flow

Abstract: This dance piece is based o the science of water flow in reviers. The presentation will describe the process of developing the dance and the results.

Dubna Trio, Dubna, Russia

PF 4 International Friendship Concert

Abstract: This internationally acclaimed Dubna Trioi, in collaboration with La Crosse musicians, will present a concert of music reflecting themes of water by Handel, Schubert, Tchaikovsky, and other composers. The Dubna Trio was formed in the 1970s and was chosen to visit La Crosse, bringing Russian culture to the area right after the Cold War ended in October of 1989. The visit was a great success, and the trio was invited to play a concert in "Bright Star Season" at Viterbo University in 1991. The universal language of music played a great role in developing understanding between two cultures and resulted in a sister-city relationship between La Crosse, Wisconsin, USA, and Dubna, Russia. This concert continues the tradition of friendship, combining musicians from La Crosse and Dubna, Russia for the International Water and Civilization conference.

Faust, Chrisopher, St. Paul, Minnesota, USA

PF 5 Narrated Photography Exhibit: Rivrs of the Upper Midwest, A Survey of River Environs of the Region

Abstract: Living and working along the Mississippi River in St. Paul, Minnesota, Christopher Faust's body of work investigates the interface of human landscape and the natural landscape. His images are an exploration of the tension that exists between these two observable extremes. This show will review some of the varied river environments of Iowa, Minnesota, South Dakota, and Wisconsin—from the great glacial Missouri, Minnesota, and Mississippi rivers to the little known rivers that feed them. He has been recognized with awards from the Graham Foundation, the McKnight Foundation, the Minnesota State Arts Board and the Bush Foundation. His work appears in the collections fo the Minnesota Historical Society, Federal Reserve Bank, Minneapolis, Cray Research, ConAgra, San Francisco Museum of Art, etc. He is included in the recent text "Placing Nature," published by Island Press, edited by Joan Nassauer.

Howard, Erica, A., Kanopy Dance Company, Madison, Wisconsin, USA

PF 6 "Along those shores, astir with life and motion…heavily was [the river] breathing" - an invocation through dance.

Abstract: Traditional arts, stories, and mythologies are rich in ideas and imagery that reflect how natural resource-dependent peoples live in and perceive the world. These sources have much to teach us about local people's awareness of their dependence on rivers, and their gratitude for the services that rivers provide. In this modern dance piece, I will draw on the tradition of Thailand's Loi Kratong Festival as an opportunity to raise awareness of our dependence on ecosystem goods and services associated with rivers. The festival traditionally honors Phra Mae Khongkha, the goddess of water, and asks the goddess to forgive the people for using and polluting the river waters throughout the year. This choreography, performed by members of Madison, Wisconsin's Kanopy Dance Company, will combine abstract movement and gesture from the Western modern dance tradition with elements borrowed from traditional dances of Southeast and/or South Asia to evoke a spirit of mindfulness for how rivers have shaped and sustained human civilization in tangible and intangible ways. Rather than imitating (and doing injustice to) the beautiful and complex traditional

dance forms, the choreography will attempt to weave Asian movement vocabulary into Western-style modern dance in a way that honors the essence of the forms, and is accessible to audiences. (Title adapted from Oliver Elton's translation of Pushkin's poem, "The Bronze Horseman.")

Salamun, Betty A., DanceCircus, Milwaukee Wisconsin, USA

PF 7 Anthropomorphism, Personification and Environmentalism in Environmental Arts: A Viewing and Doing Seminar.

Abstract: From Native American's animal totems to Aesop's fables, the natural world is an important factor in the cultural and intellectual development of humans. All arts result from the conscious use of skills acquired by experience, study or observation combined with creative imagination. And, while environment is scientifically interpreted as the circumstances, objects or conditions by which one is surrounded, it is also an artistic or theatrical work that involves or encompasses the performers and spectators. Bring your experiences, studies and observations of rivers, waterways and civilization to this inter-disciplinary workshop to view eco-dance and exercise your creativity. Betty Salamun, dancer, director, eco-artist shows short video segments of her dances reflecting environmental concerns and illustrating her process of mixing dry facts with creative juices. Then, join the fun! Hands-on exercises blend arts and sciences. Using RIVER as a metaphor, we'll explore expressive, free form writing (haikus, dramatic/comedic fables, short stories), create simple visual art forms (posters, illustrating poems, impromptu murals), and develop creative movement actions (moving from poetry, nature images, scientific theory). Collectively, we'll create an instant Eco-Happening that, like a river, flows through many forms, ideas and images interconnecting and integrating our diverse points of view and forms of expression. Betty Salamun, dancer, chorographer, writer, director, artist-educator, eco-artist, is Artistic Director of DanceCircus, a modern dance company celebrating 30 years of dance, music and storytelling with a topical edge.

Artists

Artists' Statements
(at time of printing)

Curmano, Billy, Art Works, USA, Rushford, Minnesota (Video, Mixed Media)
A-01 Painters Paint Fantasies; in Performance, I Live Mine." Swimmin' the River

Beginning in July of 1987, Billy Curmano will attempt a leisurely swim from the headwaters of the Mississippi River at Lake Itasca, over 2,000 miles to the Gulf of Mexico in an extended performance, Swimmin' the River. This is not an athletic event, but rather a multilevel performance exploring the intermix of art and life, while expressing an ecological imperative. This activity, open to observation and media manipulation, becomes a broad-based public art. The casual observer views it as spectacle, focusing on the singular act of swimming from Lake Itasca to the Gulf, while the actual observer finds the feat is accomplished only one stroke after another over an excruciatingly tedious time and distance. On a more personal level, the performer and crew carry on the daily activities for a changing audience of both people and wildlife. The single-minded performance shapes their lives, as art becomes life; life becomes art and art becomes bigger than life, taking on almost heroic proportions. On the most intimate level, it becomes a meditation as minutes turn to hours, days, weeks, and months of traveling with the river's flow. And finally, it stresses the fragility of the human species in a tenuous environment often callously manipulated. Water is a source of life spanning most of the planet's surface and composing most of the human body. And yet, as a people, as a nation, and as a planet, we have shown a continual lack of respect for it. As the "Father of Waters," the Mississippi symbolizes all water. Its problems are mirrored, to some degree, in all the planet's waterways right down to the smallest creek or stream. Creeks and streams that can no longer be deemed pure or clean, at best, they are labeled merely safe or acceptable. Americans enjoy waving the Bill of Rights, those cherished liberties an freedoms, but Swimmin' the River suggests adding a most basic freedom: Freedom from Toxicity. It becomes a rallying point demanding a return to sanity and the freedom to enjoy safe water, air, and soil for this and future generations.

Egan, Marion (Watercolor Paintings)
A-02

Greenwald, Martha, Winona, Minnesota (Paintings)
A-03

The elements of a river landscape can be very simple: shoreline, water and sky. Nature is endlessly inventive in the patterns it creates within this simple system. I brought my human sense of inventiveness to Mississippi River landscapes in and around Winona, Minnesota. The paintings in this group emerged after I completed a large number of very small abstract pieces exploring color and pattern. I decided to bring some of these pattern experiments into my river landscapes.

I got my start as an artist 15 years ago by doing silk paintings. The media in which I work has changed over the years, but my love of color, a somewhat whimsical sense of humor, and an imaginative visionary outlook have remained constant. In these paintings, I enjoyed the effects achievable through overlapping layers of wash, using acrylic paints in a watercolor-like manner.

Art can make the world more bearable, because it celebrates and re-imagines the beauty that still remains in many places. River images are those of a world in a state of unfolding flow. We need such images to help us see the world through new eyes, as an antidote to despair and pessimism. Any visual image that moves us helps us to wake ourselves up.

I grew up in Neenah, Wisconsin, studied art history in Madrid, Spain, received a Masters Degree from Hamline University, and pursued additional art studies through the Minneapolis College of Art and Design, Anderson Ranch Art Center, Split Rock Art program, and Arrowmont School of Arts and Crafts.

Gundersen, Joan (Paintings)
A-04

Hurt, Robert J.(Photography)
A-05

I have been engaged in the art of landscape photography for more than 38 years. My strong love for the land along with my architectural background have captivated my creative spirit and inspired me to record the

beauty of special places on film, and digitally, with precision camera systems. My photo collection centers on the natural environment and rural landscapes a well as some of the more unique and intriguing aspects of the built environment. Over the past 12 years, I have taken to the air to capture artistic aerial landscape images of locations such as the Upper Mississippi River, blufflands landscapes of Wisconsin, Minnesota and Iowa, Boundary Waters Canoe Area; North Shore of Lake Superior, Minnesota state parks, Florida Keys, Vermont, and Hawaii.

Klinkner, Marilyn (Pottery)
A-06
I practice in diverse media as a ceramist, a poet and a fiber collage artist and have participated in Wisconsin as an Artist in Residence and in regional exhibits. I have lived along the Mississippi most of my life, both as a child and as an adult. The images of fish, birds, and mammals often enter into my work. My concern is with color relationships, form and articulating or defining the edges of forms, where the form shifts, like where the rim meets the belly of a plate. I enjoy creating compositions from objects with similar and varied texture and color. I live on an oak savanna/prairie and spend vast amounts of time studying informally the structures and textures of plants in all seasons. That information also influences my work in subtle ways. Firing the work creates nuances of color brought out by the way the kiln is packed and small degrees of temperature variance. The challenge of working with fluid glaze compositions, temperature and ceramic pigments interests me much the way the unpredictability of watercolor interests painters. Nature herself is changeable and presents us with infinite variety from moment to moment.

Lubinski, Sara (Paintings)
A-07
I paint landscapes to capture a sense of place, particularly within the upper Midwest states of Minnesota, Wisconsin, and Iowa. The upper Midwest is a wonderful place to be an artist with my interests; the rivers, forests, and farmlands provide endless materials to explore the amazing patterns of nature.

I believe there is a strong connection between interpreting the landscape artistically and understanding and respecting the environment. My backaground as an ecologist and botanist heightens my awareness and appreciation of the natural world that enhances and compliments my artistic perspectives. I paint familiar, ordinary scenes at different times of day, or in different seasons to capture a moment in time.

My favorite approach is to paint outdoor or "en plein air." Painting en plein air is compelling because I reach a deep level of awareness and connection to my surroundings as I stand at my easel. The intense focus brings satisfaction of living completely as I unravel nature's patterns through my paintings. By capturing a particular scene before the light changes, I'm forced to recognize the ephemeral nature of life, that all is fleeting and transient and no other moment will exactly be as another. I seek not just the creation of beauty, but the essential functions of art: exploring the mysteries of the world, searching for *meaning*, becoming enlightened and wise, and in turn, sharing my sense of awe and my place in the world with others.

Martino, Phyllis (Watercolor Paintings)
A-08
There are three influences in my art; the countryside, neighborhoods and the Mississippi River. I am most interested in painting the quality of light and how it falls on a particular landscape or subject. I am drawn to quiet landscapes that I can lead my viewers into and enjoy combining natural and architectural forms.

Miller, Eric (Ink Drawings, Paintings)
A-09

Schwenker, Michael (Photography)
A-10
As an illustrator, calligrapher, and serigrapher, I approached photography as a method to record scenes to later draw and paint. I then became aware of the camera's ability to capture images in its own way. Photography is a dynamic medium, pulling me outdoors to interact with nature.

Steine, Linda (Paintings)
A-11
I wish to share my love of nature through art. As a child, my parents taught me how to appreciate the world

around me and enjoy the gifts nature has to offer. This love of the natural world has enabled me to capture the beauty of the environment as it unfolds before me each day.

My paintings are in oil, acrylic and watercolor, and I work on canvas, masonite, plywood, and various papers. Techniques that I am exploring include a combination of acrylic, charcoal and oils, with glazing techniques of the Renaissance. My current works reflect the use of a limited palette and introducing different colors into my landscapes. If I am not painting outdoors "en plein air," I am working from photographs I have taken of the area I want to paint. My work continues to reflect my environment. From my travels to State and National Parks, to capturing the beauty of my hometown, my greatest influences are just beyond the viewfinder.

In addition, my painting goes outside the landscape and encompasses wildlife, the figure, portraiture, still life, collage, and mixed media. Around every corner I find a subject worthy of being captured in paint.

Over and above painting, I have committed myself to the arts by being active in several art organizations in my community. As an artist, I continue to grow through the eyes of the students I teach painting classes to. Everyday is an adventure, and every moment is a possible painting.

Thompson, Mary Louise (Pastels)
A-12
I paint to share my thoughts and express my feelings about our natural world. The deep love and connection I have for the land and its inhabitants is directly related to my painting. As a child I was forever exploring nearby fields and woodlands and by doing so, acquired an early love for nature.

I enjoy expressing the beauty I see around me through painting and hope to convey my passion for nature so others may feel the same wonder I do when seeing a simple bud in bloom. I believe at a deeper level, the magnificence of the natural word strikes a similar chord in all of us. For instance, the vibrant colors and shapes of flowers, the things that attract the pollinators, are the very same things that we regard as beautiful. On a larger scale, landscapes evoke powerful emotions and emphasize our connection to the planet. The rich natural and cultural settings found in Wisconsin offer a wealth of artistic opportunities.

I enjoy the more traditional aspect of painting with oils. They allow me to work on a larger scale, giving me the freedom to be more expressive with my brushstrokes. I also love painting with pastels. Their fresh, bright colors and soft consistency are a job to work with and encourage playfulness reminiscent of my colored crayon days.

Tully, Gene, Dubuque, Iowa (Steel and Rock)
A-13

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Evaluation

International Conference on Rivers and Civilization

Conference Evaluation

June 25-28, 2006

Please take the time to complete the following evaluation rating your satisfaction with the following conference factors.

	Very Much		Satisfied		Not at all	N/A
	5	4	3	2	1	
Overall Quality of the Conference						
Personal and Professional Value of the Conference						
Multidisciplinary Theme						
Keynote Address						
Plenary Sessions						
Concurrent Sessions						
Luncheon Speakers						
Poster Sessions						
Exhibits						
Special Performances (e.g. M & Tu Evening Events)						
Tours and Field Trips						
Conference Facilities						
Conference Website						
Registration Process						

Comments relating to the above factors: _____

_____

What were the strengths of this conference?_____

_____

How could this conference be improved?_____

_____

Marketing and Publicity

What was the main reason you attended this conference?_____

_____

Please indicate how you registered for this conference:

□ Phone □ Online □ Walk-In □ Mail/Fax □ Don't Know

How did you hear about this conference? (Please choose one only)

□ Brochure/Flyer/Postcard □ Web site □ Word of Mouth/Friend □ Newspaper □ Radio
□ TV □ Other _____

Additional Comments:

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Forms can be dropped off at the registration desk in the main lobby. We appreciate your feedback.

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