International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

(Click on text to navigate to a specific page or element.)

Table of Contents

"Being able to work alongside people from diverse backgrounds has become a necessity for graduating students entering the global workforce. Where "International Perspectives in Water Resource Planning" excels is in the constant interaction between diverse groups of students. Living beside fellow engineering students from other countries provides a greater understanding of different cultures and perspectives than is possible on a typical short-term study abroad experience."

- *Conclusion, International Perspectives in Water Resource Management: The Paraná River Watershed*

Resources and web pages taken from IIHR – Hydroscience & Engineering

University of Iowa Study Abroad Programs

International Perspectives in Water Resources Planning in Argentina

May 16 - June 2, 2003

An initiative of IIHR-
Hydroscience and Engineering
The University of Iowa College of
Engineering, Iowa City, USA
in collaboration with
the National Institute of Water and
the Technological Institute of
Chascomus, Argentina.

Purpose

The University of Iowa International Perspectives in Water Resources Planning study abroad program is sponsored by *IIHR - Hydroscience & Engineering* (formerly the Iowa Institute of Hydraulic Research). The course focuses on a country or a world region for an intensive and in-depth exposure to historical, cultural, social, economic, ethical, environmental, and political conditions that impact water resources projects in order better to prepare students for careers that are becoming increasingly global. The 2003 program takes place in Argentina, Brazil, and Paraguay.

Academic Program

The course will start with preparatory lectures by experts on the history, culture, and water resources projects of Argentina. Lectures will be held on The University of Iowa campus during March -May 2003, and video taped for viewing by off-campus participants. The course finishes with post-visit reports written by the participants. During the visit abroad, participants will interact with local students and attend seminars that emphasize the planning, socio-economic and environmental impacts, rehabilitation programs, and legal, cultural and institutional aspects of water resources projects. Participants will visit technical, historical, and cultural sites.

Specific Activities Tentatively Planned

Activities are planned to encourage interaction of course participants with local university students and representatives from academia, government agencies and private companies. The technical focus will include field visits to major dams on the Parana River (southern Brazil and Argentina), one of the largest rivers in the world. This includes a visit to Itaipu, the largest hydroelectric power dam in the world (12,600 MW) and Yacyreta dam, the largest dam in Argentina. Other unique sites that will be visited include the Iguazu Falls, one of the natural Seven Wonders of the World, the delta at the lower Parana, the Rio de la Plata (the world's widest river) and some lakes in the Pampas. Cultural tours will include the Jesuit Missions of San Ignacio, the city of Santa Fe (the first Argentinean city founded by the Spaniards) and several sites in and around Buenos Aires- a world-class city that is the capital of Argentina.

Instructors and Credit

Each participant can earn 0-3 semester hours of credit depending on agreement with the instructors regarding assignments and methods of evaluating the student's work. The course will be conducted by Professor Pedro J. Alvarez (Iowa) and Drs. Angel Menendez (INA, Argentina) and Claudio Baigun (IB-INTECH, Argentina). Other IIHR staff members will also participate.

Cost

The estimated cost for the program is $2,500, including fees, round-trip air fare, lodging, meals and travel expenses, and tuition plus administrative costs. *This estimate does not include the cost of obtaining appropriate visas.* Financial aid may be applied toward program costs. Students currently receiving federal, state or institutional aid will remain eligible for most forms of support while participating in this program. In addition, selected students may qualify for financial assistance of up to $1,200.

Eligibility

This course is intended for graduate students who wish to become engineers, economists, planners, legal and management specialists, or environmental, social and political scientists. The course provides preparation for the increasingly international scope of practices and services in the field of water resources planning and management. *Please note that U.S. citizens require a visa only for Brazil. Other nationals may also require visas for Argentina and Paraguay. Only students with the necessary visas will be allowed to make the trip.*

Application Procedure and Deadline

Completed applications, including a non-refundable application fee of $50, must reach The University of Iowa's Office for Study Abroad by February 28, 2003. The complete application includes the application form, available from The University of Iowa Office for Study Abroad, the most current transcript of grades, a letter of recommendation and the $50 application fee. As the number of participants is limited and applications will be reviewed as they

are received, early application is encouraged.

Previous Courses

Some student reactions to the previous courses in India and in Taiwan and Japan are as follow:

"It has made me a better person...The lectures gave us an entirely new outlook on the issues related to water resources in India..."

"Meeting with students was an invaluable experience, one of the most important parts of the trip..."

"This experience will be invaluable to me in my professional career...altogether a worthwhile investment of time and money."

"I hope this class will continue. I thoroughly enjoyed the trip and recommend the course to anyone."

Send completed application and requests for further information to

Office for Study Abroad
28 International Center
The University of Iowa
Iowa City IA 52242
Phone: (319) 335-0353; Fax: (319) 335-2021
E-mail: study-abroad@uiowa.edu

Also visit

IIHR at its Web site:
http://www.iihr.uiowa.edu/

International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

The University of Iowa International Perspectives in Water Resources Planning study abroad program is sponsored by IIHR – Hydroscience & Engineering . The course focuses on a country or a world region for an intensive and in-depth exposure to historical, cultural, social, economic, ethical, environmental, and political conditions that impact water resources projects in order to prepare students for careers that are becoming increasingly global. The 2003 program took place in Argentina, Brazil, Paraguay, and Uruguay.

The course was organized in collaboration with the National Institute of Water (INA) and the Technological Institute of Chascomus in Argentina.

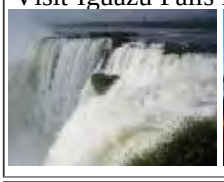
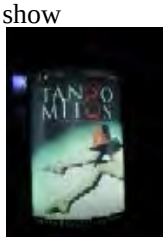
In this page we present an overview of the countries visited as well as the programme of the visits carried out and the contact information for the people we met along the way.

The participants of the course formed teams to work on four different projects. The projects outline is given here; we expect in the near future to have the respective reports available to download.

International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

Date		Event	Meals
May 17	Sat	Arrival at Buenos Aires Walking and bus tour in Buenos Aires  	
May 18	Sun	Tour to Tigre  	
		Visit University of Buenos Aires Bus trip to Parana  	
May 20	Tue	Seminar in the hotel Bus tour around Santa Fe Visit areas damaged by the recent flood in the Salado River May 19 Mon Visit Universidad Nacional del Litoral Dinner show at the hotel  	
May 21	Wed	Seminar in the hotel Parana river cruising tour Visit Santa Fe downtown Bus trip to Yacyreta	

		 	
May 22	Thu	Visit Yacyreta Dam  	
May 23	Fri	Visit "Ruinas jesuiticas", mate factory, amethyst mining site Bus trip to Foz do Iguazu, Brazil  	
May 24	Sat	Visit Iguazu Falls Argentina side  	
May 25	Sun	Visit Iguazu Falls Brazilian side Dinner party with Brazilian students  	
May 26	Mon	Visit Itaipu Dam / Hydropower Station Bus trip to Buenos Aires  	
May 27	Tue	Dinner and tango show  	
May 28	Wed	Visit INA (National Institute of Water)	

		 	
May 29	Thu	Seminar at "Palacio San Martin" 	
May 30	Fri	Visit Colonia, Uruguay  	
May 3	Sat	Visit estancia (Private Hotel in the Pampas)  	
June 1	Sun	Watch a soccer match (Boca Juniors vs River Plate) at the Boca stadium  	
June 2	Mon	Leaving Buenos Aires to the USA  	
June 3	Tue	Arrival in the USA 	

International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

PROJECTS:

PROJECT 1	Paper: A Comparison of the Paraná and Mississippi Rivers
Team	Denise Armbruster, Angela Barsic, Nicholas Campney, and Andrea Rogers
Consultants	Professors Allen Bradley and Pedro Alvarez
Objective	Write a paper comparing and contrasting the main characteristics of these major rivers. Address hydrologic, geologic, morphologic, environmental, historical, cultural, and economic aspects when appropriate. Tables summarizing key information are desired (e.g., drainage area, population, length, flow, major floods, major engineered structures). Appropriate maps and pictures should also be included, as well as appropriate references. Your discussion should consider - What can we learn about one river by studying the other one? Does one river offer a view into the past/future of the other? etc.

PROJECT 2	Research Proposal: A Comparison of the Paraná and Mississippi Rivers
Team	Peter Haug, Andy McCoy, Ceyda Polatel, and Nathan Young
Consultants	Professors Thanos Papanicolau, Larry Weber and Dr. Claudio Baigun
Objective	Write a proposal to do a comparative study of these two major rivers for improved resource management purposes. The focus could be on river morphology, sediment dynamics, environmental effects of building (or deconstructing) hydraulic control structures, ecological engineering, effects of climate change, or whatever you choose. The proposal should not exceed 15 pages, and contain an introduction/background, objectives, hypotheses, approach/methods, expected benefits, and references. The most important aspect of a proposal may be its "hook" (sell the need and expected benefits).

PROJECT 3	Education Paper: A Description of the IPWRP Course in Argentina
Team	Miguel Gaddi, Tim Sexton, Kathryn Muldoon and Isaac Willig
Consultants	Professors Marian Muste and Pedro Alvarez
Objective	Write a paper similar to that described in Appendix B, which was accepted for publication in "World Transactions on Engineering & Technology Education" Vol.2 No.1, UNESCO International Center for Engineering Education. You can use the background information provided in the Appendix (without plagiarizing), including a brief description of the last trip to Easter Europe (which is described in detail therein). Your focus should be on describing the current trip in a similar fashion. Interaction with Team 4 is desirable. Include appropriate Figures, Tables, and Map.

PROJECT 4	Web Page: A Description of the IPWRP Course in Argentina
Team	Lucas Evangelista, Boe Gregson, Yenory Morales and Yoshihiro Katsuhama
Consultants	Professors Marian Muste and Pedro Alvarez
Objective	Create post tour web page

International Perspectives in Water Resource Management:

The Paraná River Watershed

Miguel Gaddi, Tim Sexton, Marian Muste, V.C. Patel, and Pedro J.J. Alvarez*

The University of Iowa

Iowa City, Iowa

*Corresponding author
The University of Iowa
IIHR Hydrosciences and Engineering and
Dept. of Civil & Environ, Engrg., 4119 SC
Iowa City, IA 52242-1527
Tel: (319) 335-5065; Fax: (319) 335-5660; Email: pedro-alvarez@uiowa.edu

ABSTRACT

The University of Iowa's IIHR Hydroscience & Engineering (formerly the Iowa Institute of Hydraulic Research) offers a multi-disciplinary course that focuses on the global nature water resources management. "International Perspectives in Water Resource Planning" is a three-week study abroad course that encourages interdisciplinary participation (including students and faculty from the host region) to study the effects of major mater resources projects on society and the environment. The constant interaction with a diverse group of students, researchers, practitioners, and government officials encourages critical thinking while fulfilling the increasing need for a better understanding of cultural diversity and global situations for decision making. To date, this course has traveled to India (1998), Taiwan & Japan (1999), China (2000), Eastern Europe (2001), and Argentina & Brazil (2003). This paper summarizes overall course organization, activities, and student reactions with emphasis on the 2003 Argentina course.

INTRODUCTION

"¿Querés mate?" Sebastián, a 22 year-old undergraduate hydraulic engineering student from the University of Buenos Aires, asks Yoshihiro Katsuhama, a graduate student from Japan presently attending Colorado State University as he offers him a cup of traditional Argentine tea. Diversity has become the catchword of the modern global marketplace and universities are rapidly developing new tools for increasing students' understanding of and ability to work in diverse situations with people from various cultural and geopolitical backgrounds. Presently, universities throughout the world are being challenged to search for better ways to prepare their students for the new diversity of the global marketplace. Preparing students for the diversity of the contemporary marketplace has garnered new weight as companies seek out employees with the social capital that allows them to distinguish themselves by their ability to work with various groups. This challenge is significant for engineering students who often have very few flexible credit hours or time to diversify their stipulated technical curricula (Durbin et al., 2003).

One way to assess student's intellectual development is that developed by Perry (1970), who conducted open-ended interviews on students following each of their four academic years (Perry, 1970). Perry used the students' responses to construct a nine-stage scale tracing the general sequential development in relation to problem solving skills. The scale begins with students' perceiving learning in terms of dualist absolutes, positions 1 and 2, and ascends to positions 7 through 9 where students' appreciate the relative complexity of life, that multiple solutions can exist for one problem, and make conscious commitments about their choices. Traditionally, engineers have ranked low on Perry's scale due to the absolutist nature of the disciplines upon which engineering is founded. However, a paradigm shift is currently occurring. As society challenges become increasingly complex and global in nature and the workplace diversifies, a broader range of problem solving skills is warranted for today's engineers.

At the University of Iowa, one study abroad program is addressing this need with a unique 0-3 credit, three-week study abroad experience where students and faculty from North American universities live, travel, and work with foreign students, colleagues, and faculty from the given host country. The experience exposes North American and foreign engineering students to their host region "counterparts", which is conducive to a better understanding of professional, economical, social, and cultural similarities and differences that are important to recognize for the planning and management of large projects. Such activities are also important to expose students to new perspectives on international decision making (Nasr et al.; 2002).

PROGRAM OVERVIEW

The University of Iowa course "International Perspectives in Water Resource Planning" was created in 1998 as an initiative of IIHR- Hydroscience and Engineering's director, Dr. V.C. Patel. IIHR is a world-renowned research center in fluid mechanics, water resources engineering, and hydrology. This course seeks to provide in-depth exposure to technical, historical, cultural, social, economic, environmental, and ethical issues and complexities influencing major water resource projects in countries outside of the United States. Since 1998, the course has studied water planning in India (1998), Taiwan & Japan (1999), China (2000), Eastern Europe (2001), and Argentina & Brazil (2003) (Jain, 1998; Shrier et al., 2003). Travel costs are subsidized by the IIHR, which alleviates economic hurdles that face many students interested in study abroad programs. IIHR relies on its extensive international alumni network for logistic support. This year's course was organized and led by Prof. Pedro J. Alvarez (U. of Iowa - IIHR), Dr. Angel Menendez (INA, Argentina), and Dr. Claudio Baigún (IB-INTECH, Argentina). Several other faculty from IIHR and host institutions also participated.

Francis turbines (18 × 715 MW each) generate electricity at Itaipú, the world's largest hydro-power dam

By exposing students to the international and multi-faceted issues surrounding the management of major water resources projects, IIHR seeks to increase student's sensitivity and awareness of global issues and to enhance their understanding of international processes and decisions. By emphasizing the importance of both the technical and cultural aspects of water resource planning, the course gives students technical experiences while helping them to better grasp the cultural context that influences many resource management decisions; an element more common in the liberal arts than in engineering sciences. Thus, to reinforce the interdisciplinary goals of the course, the program itinerary includes technical lectures and site visits, as well as activities meant to present the unique cultural characteristics of the host region. For example, the most recent program to South America included tours of the Itaipú Dam, one of the seven modern wonders of the world, and of Iquazú Falls, one of the seven natural wonders of the world.

1. Buenos Aires: Days 1,2,3,11,12,13,15,16 &17
   Tour Delta del Tigre, Meetings: University of Buenos Aires, Water National Institute (INA), Visits: Palacio San Martin, estancia, Soccer Museum; Attended: tango show and soccer game

2. Santa Fe: Days 4 & 5
   Seminar at Facultad de Ingenieria y Ciencias Hidricas (FICH), View of Parana alluvial valley, Boat tour of the Parana river

3. Posadas: Days 6 & 7
   Visit Yacyreta Dam and "Ruinas Jesuiticas"

4. Iguazu: Days 8, 9 & 10
   Visits: Iguazu Falls and Itaipu Dam

5. Colonia: Day 14
   Boat trip on the Rio de la Plata, Colonia city tour, Visit Plaza de Toros

Itinerary map and activity schedule

Students are assigned group projects that are based on their experiences abroad. This year's projects included (1) a comparative analysis of the Mississippi and Paraná watersheds, (2) a research proposal for further comparative study of the Mississippi and Paraná rivers to support ecological engineering goals and to learn about the future or past of one river by studying the other, (3) the creation of a course website, and (4) the writing of an article presenting the unique aspects of this course. This article is based on information gleaned from a post trip survey of students and faculty from Argentina and US institutions.

One aspect separating the IIHR program from other study abroad courses is the diversity among participants. This year's participants included students and faculty from environmental, civil, and hydraulic engineering at the University of Iowa, the University of Illinois, Colorado State University, Argentina, Brazil, Costa Rica, Japan, Nicaragua, Romania, Turkey, and Venezuela. This year's course also included graduate students in Urban and Regional Planning from both the United States and Argentina. Diversity and soft skills are further emphasized in the University of Iowa program with the sponsoring of a group of hydraulic engineering students from the host country who accompany the group for trip's entirety. The constant interaction allows for an experience similar to longer cultural immersion programs, but with a condensed timeframe more manageable for time-constrained engineering students and faculty.

This experience not only benefits students and faculty from the United States, but can have a dramatic impact on the international students and faculty that interact with the IIHR group. For example, this was the first experience for many of the Argentine and Brazilian students to actually meet a person from the United States. In post trip surveys, Argentine students credited the course for dissipating many of their previously held negative stereotypes regarding people from the United States. One Argentine student wrote, "Without doubt, the best part was the interaction with other students, and the good relationships within the group helped to break down certain prejudices I previously had."

2003 COURSE: THE PARANA RIVER WATERSHED

The 2003 course to the Paraná River watershed of Argentina, Brazil, Paraguay, and Uruguay provided students a unique perspective on international water resource planning along one of the world's great rivers. The Paraná, with average flow similar to the Mississippi River, is 1,600 miles long being the second in size to the Amazon in South America. The course provided a kaleidoscope of experiences with the Paraná by exposing the group to the river from a multitude of perspectives. By foot, the group was given access to the inter-workings of the great dams at Yacyretá and Itaipú. Walking through the massive Itaipu structure and standing inside the dewatered unit at Yacryrta gave the group a new respect for the enormous scale of the two projects. The group was also impressed by the diplomacy involved with the international projects, Yacyretá is shared between Argentina and Paraguay and Itaipú divides the electrical output between Paraguay and Brazil.

Just as the dams emphasized the power of sound engineering and technological advance, Iquazú Falls highlighted the incredible force of nature unbridled. 275 waterfalls spanning 2.7 km-wide arc fall 70 m in a breathtaking spectacle designed as UNESCO World Heritage Site. The majority of the group listed walking throughout the scores of waterfalls at Iquazú as one of the three most enjoyable and valuable experiences of the course.

Spillway at Itaipú, the world's largest hydro-electricity producing dam.

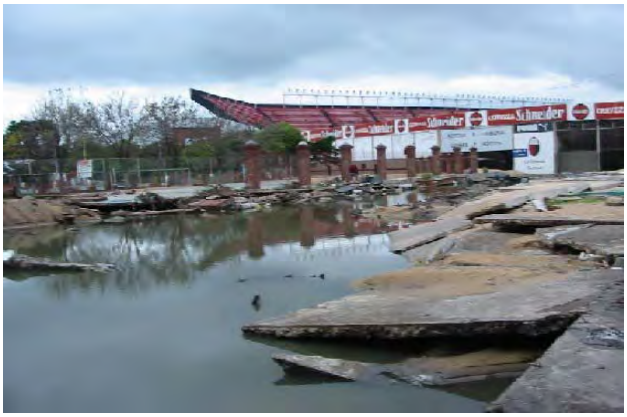
The majestic Iguazú Falls viewed from the Brazilian side

The group noted the admirable regional environmental protection initiatives consisting in the formation of the natural parks on both Argentinean and Brazilian sides of Iguazú falls and of a modern specialized research center at the Itaipú dam focused on environmental actions contemplating the fauna and flora inventories, reforestation, handling and administering the use of the impounded hydraulic resource and its protection belt.

Argentina's capital Buenos Aires, megalopolis of 11 millions inhabitants located at the Rio de la Plata confluence with the ocean, fascinated the group by its elegant and active environment, the warmth of its people, and the variety of attractions. Meetings of the American students at the University of Buenos Aires and INA, facilitated a bidirectional flux of information on water resources management. Lectures were provided by both sides followed by discussions within smaller, specialized groups on focused are of interest that sparkled exchange of publications and ideas for future collaborative plans.

By boat, the group toured the wealthy Buenos Aires suburb of El Tigre, where the river housed the famous Argentine crew teams, and saw firsthand how the river provided the food many people depended upon as well as serving as the kitchen, bathroom, and laundry for many along the river's banks in the city of Paraná. The poorly kept and low quality buildings along the river in Paraná were a stark contrast to many of the grand structures along the Delta del Tigre, these obvious differences raised the issue of the influence of stakeholders in political decisions affecting the river and its inhabitants.

The issue of stakeholders and their political capital in water resource planning in Argentina was made clearer by the recent flooding in Santa Fe, located to the east of the Paraná River. Just before the students' arrival to Argentina, over 50,000 people had been evacuated from the provincial capital of Santa Fe that was inundated by the worst floods in the colonial city's history. A levy that would have prevented the tragedy had not been completed, apparently because it would have obstructed a golf course's view of the river. This tragedy provided students a very real example of the high potential for social impacts and political aspects of water resource management.



Flood aftermath – The soccer stadium of Colón de Santa Fe

Bus travel was the most common form of transportation and long rides, such as the twenty plus hour drive from Iguazu Falls to Buenos Aires, provided students with extensive views of the northern Argentine landscape. Many of the students commented on how similar the terrain was to their own Midwestern vistas. Realizations like this help emphasize the global commonalities among people and places and are unique to the study abroad experience.

CONCLUSIONS

Being able to work alongside people from diverse backgrounds has become a necessity for graduating students entering the global workforce. Where "International Perspectives in Water Resource Planning" excels is in the constant interaction between diverse groups of students. Living beside fellow engineering students from other countries provides a greater understanding of different cultures and perspectives than is possible on a typical short-term study abroad experience.

Group photograph at ruins of Jesuit mission.

In the post trip survey, 98 % of the participants, both Argentine and those from US institutions, listed social interaction as the most valuable element of the course and many credited this interaction with significantly increasing their understanding of key issues. "Both the students and faculty were open, knowledgeable and always available for us. Most of what I learned about environmental issues was gained from discussions with Argentine faculty and students."

"International Perspectives" is valuable in addressing and offsetting the clustering of people with similar backgrounds that is common on university campuses despite "diverse" student populations. The program format is essential to increasing cultural sensitivity about water resource planning and to better the cultural and political contexts influencing resource management decisions. The IIHR course is a successful example of one university's attempt to provide students with the soft skills and real life experiences needed for success in an increasingly global workplace.

REFERENCES

Durbin, D.J., Bowen Franz, S.L. (2003). "The development and Delivery of a Three-Week Study Abroad Programme in Construction Science," *UICEE World Transaction on Engineering and Technology Education*, 2, **1**, 125-128.

Jain S.C. (1998). "Report on a Course on International Perspectives in Water Resources Planning," *IIHR Limited Distribution Report 270*

Nasr K., Berry, J., Taylor, G., Webster, W., Echempati, R., and Chandran, R. (2002). "Global Engineering Education Through Study-Abroad Experience: Assessment and Lessons Learned," *Proceedings* ASEE/SEFI/TUB Colloquium, Berlin, Germany

Perry W.G, Jr.. (1970). "Forms of Intelectual and Ethical Development in The College Years: A Scheme". Holt, Reinhart and Winston. New York.

Shrier, C., Bell, M., Muste, M. and Krajewski, W. (2003). "The University of Iowa's International Perspectives in Water Resources Planning Program." *UICEE World Transaction on Engineering and Technology Education*, 2, **1**, 79-85.

ACKNOWLEGEMENTS

We are very grateful for the gracious hospitality of our local hosts, Dr. Angel Menendez (INA), Dr. Claudio Baigún (IB-INTECH), Professors Carlos Vionnet and Leticia Rodriguez (Universidad Nacional del Litoral), Dr. Rodriguez Fernandez, (Central Hidréletrica de Itaipu) and Dr. Raul Lopardo (INA). Ing. Luis Marcelo Cardinal and Lic. Alfredo Fortuny (Yacyretá Dam), and Prof. Roberto Lotero (Universidade Estadual do Oeste do Parana). Special thanks to Drs. Larry Weber and Allen Bradley (The University of Iowa) for joining the group and for the technical presentations at University of Buenos Aires and INA. This course could not have been conducted efficiently without the logistic support provided by Mercedes Menegazzo of Interfly, Argentina, and Autumn Tallman and Ryan Baumert of the University of Iowa. All photos were taken by Mr. Yoshiro Katsuhama.

International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

NSF-00-000:

Comparison of the Paraná and Mississippi Rivers

A proposal

Submitted to Professor Pedro Alvarez

By

Andrew McCoy (CO-PI)

Graduate Research Assistant, IIHR—Hydroscience & Engineering (IIHR)

Department of Civil and Environmental Engineering

The University of Iowa, Iowa City, IA 52242, USA

Ceyda Polatel (CO-PI)

Graduate Research Assistant, IIHR—Hydroscience & Engineering (IIHR)

Department of Civil and Environmental Engineering

The University of Iowa, Iowa City, IA 52242, USA

Nathan Young (CO-PI)

Graduate Research Assistant, IIHR—Hydroscience & Engineering (IIHR)

Department of Civil and Environmental Engineering

The University of Iowa, Iowa City, IA 52242, USA

June 9, 2003

Comparison of the Paraná and Mississippi Rivers

PROJECT SUMMARY

Restoration of large river systems impacted by anthropogenic stresses is problematic due to challenges associated with identifying reference streams. Apparent similarities between the Mississippi and Paraná Rivers may create a unique opportunity in the restoration and management of large river systems. Correspondence analysis applied to general physical and chemical characteristics of the two rivers indicates they are more similar to one another than any other large rivers of the world. The Mississippi River has been heavily impacted by human activity, while the Paraná has thus far experienced more moderate anthropogenic influences. Therefore, it may be possible to use the reaches of the Paraná as reference streams for restoration efforts on the Mississippi. Additionally, lessons learned through the historical exploitation of the Mississippi basin resources may be useful in guiding the development of the Paraná.

The proposed research efforts will seek to characterize and compare the Mississippi and Paraná rivers. While correspondence analysis indicates broad similarity between the rivers, more detailed information and analyses must be compiled and performed to completely evaluate the feasibility of using the Paraná as a reference stream. This work may not only benefit the ecological health of the subject rivers, but may serve as a proof of concept in the application of conventional restoration methodologies to large river systems of the world.

Research will include compilation of existing data sets from multiple sources describing the physical and chemical characteristics of the Mississippi and Paraná Rivers. Data representative of processes at multiple temporal and spatial scales will be used, as available. Data will be analyzed to assess similarities between the hydrologic and ecological behaviors of the rivers. Based on the results, recommendations will be made identifying specific parameters and river reaches deemed useful in creating restoration and basin management frameworks. Additional data needs will be identified and long term monitoring plans recommended, as necessary.

1. Introduction

Challenges in Restoring Large River Systems

The large river systems of the world are among the most heavily impacted by human activities. However, there are several challenges preventing large rivers from being included major river restoration efforts. In river restoration, it is common practice to identify a reference stream similar in many ways to the subject of the restoration but in a more pristine state. Reference streams provide an estimate of how the impacted system should function under undisturbed conditions, guide restoration efforts, and allow for evaluation of the restoration program.

The need for a reference stream creates a major barrier in the restoration of large rivers. There are very few large rivers in the world. They are situated on different continents with different geologic and climatic conditions. Additionally, all of the world's large rivers are already experiencing anthropogenic impacts and no data are available predating human affects. Finally, the spatial and temporal scales at which processes occur in these systems make collection of representative data problematic.

A unique opportunity in the management and restoration of large rivers is present in the physical similarities between the Mississippi and Paraná Rivers. The Mississippi has been heavily impacted by agricultural and urban development, flood control measures, and navigation improvements. The

Paraná, while not unaffected by human activity, is in many ways unimpaired relative to the Mississippi. And while anthropogenic effects on these rivers are very different, their natural characteristics are very similar. Therefore, it may be possible to use reaches of the Paraná as a reference streams in the restoration of portions of the Mississippi. Additionally, mistakes made during the exploitation of the resources of the Mississippi and its basin may be useful in guiding future management of the Paraná.

The Mississippi River

The Mississippi River has been heavily impacted by anthropogenic changes. Since the onset of European settlement in the Midwestern United States, major changes within the basin and in the river itself have severely deteriorated the health of the Mississippi. In the upper Midwest, large forests were cleared for fuel and building materials, or to make way for agriculture. These changes in land cover have resulted in more rapid runoff rates, increasing flood peaks. They have also increased soil erosion and sediment loads in streams throughout the basin.

Agricultural development also promoted drainage of wetlands and reclamation of lowland areas through channel straightening and levee construction. These activities have exacerbated flooding and sedimentation problems by reducing flood attenuation in off-channel areas and increasing stream bank erosion and bed degradation. They have also eliminated the connection between the river and its floodplain in many areas, altering nutrient dynamics in the river corridor.

Fertilizers and pesticides applied to agricultural lands are the major non-point source pollutants in the Mississippi basin. Excessive nutrient loads caused by runoff of fertilizers result in numerous water quality problems. Eutrophication creates problems at local as well as regional scales. A large anoxic zone has been created at the mouth of the Mississippi in the Gulf of Mexico due to increased nutrient loadings. Pesticides create health risks to humans and wildlife.

Multiple large metropolitan areas are located on the banks of the Mississippi, and act as major point source polluters. Oxygen demand from municipal sewage outfalls; heavy metals, PCBs, and other pollutants from industries, and thermal emissions from power plants all impact the riverine environment.

Navigation projects have one of the most substantial impacts on the Mississippi. River engineering activities have slowed and redirected the flow, altering natural hydrologic regimes at the river scale and changing local flow patterns. Dams create navigation pools, where open river reaches once flowed, reducing flow rates and causing deposition of large volumes of fine sediment. Lower flow rates also reduce the transport of nutrients and oxygen in the river. Wing dams and closing dams direct flow away from the numerous side channels of the braided river system, focusing the erosive power of the river on one primary navigation channel. Wing dams act in combination with navigation projects to decrease current and promote sedimentation in side channels, resulting in more uniform channel cross-sections and reducing habitat diversity.

The Paraná River

The Paraná River, located in Argentina, has experienced anthropogenic effects. However, because Argentina is still a developing country, the effects on the Paraná are currently small relative to those on the Mississippi. Deforestation, agricultural development, and urbanization are all stresses present in the Paraná basin and continue to grow. Like the Mississippi, the Paran á is a major conduit for the transport of goods. Therefore, navigation is important, but it has needed little support from major river engineering works. There are major hydroelectric dams on the Paraná, but they are currently constrained to the upper portion of the river in northern Argentina and Brazil. There is pressure to develop hydropower in the middle Paraná as the country continues to grow. The Paraná has not been extensively channelized and maintains connection with its floodplian over most of its length.

2. Hypothesis

Numerous similarities in physical characteristics exist between the Paraná and Mississippi Rivers. However, the severity of anthropogenic impacts on the two rivers is very different. Therefore, comparison of the rivers will provide information useful in restoring impacted areas of the Mississippi and guidance for planning future development in the Paraná basin.

3. Significance

Scientific

The biggest challenge in large river restoration efforts is the lack of an ideal reference system. This shortcoming is especially evident for the restoration of the Mississippi river. The transformation of pre-settlement landscape conditions in the Upper Mississippi river is one of the most radical in the world, from prairies and wetlands to agriculture. The modifications to incorporate navigation for agricultural and industrial purposes and flood control also have had a profound effect on the natural river state.

It is not clear what constitutes undisturbed conditions on the Mississippi River. Scientific data on pre-settlement hydrologic and ecological conditions is very scarce.

Comparison of the Mississippi and Paraná rivers will be a proof of concept for large river restoration. This research will provide a guide for restoring a disturbed river system when no ideal restoration reference is available. It will help resource managers in developing river basins evolve to a system of sustainable river management.

Educational

Another aspect of this study would be to link academic and scientific communities in US and Argentina. International collaboration can increase the level of international awareness to the ecological problems. The effective communication between the international communities would help both sides to understand the systems, determine resource trends and impacts, develop management alternatives, and manage information.

Scientific collaboration between the countries can open new research opportunities for Argentine faculty and students. The economic status of the government and the academic environment in Argentina currently limit research funding.

4. Justification

Since the Paraná basin has suffered comparatively modest human influence, it can be useful on a comparative basis in the investigation of other large river systems. The undisturbed nature of Paraná makes the river well suited to adopt an ecosystem perspective that will allow understanding patterns in contemporary altered rivers and develop more effective management techniques. However, it is still needed to be justified how appropriate is to take Paraná as a reference river system to Mississippi. Preliminary discussion of similarities between these two rivers is presented next.

As a broad approach, physical parameters can be directly compared. In Table 1, the basic characteristics of Paraná and Mississippi Rivers are given. Even though these basic characteristics are enough to say that there are some similarities, more data is needed to make a sound comparison of the rivers from an ecological and process perspective.

Table 1. Basic characteristics of Paraná and Mississippi Rivers

Characteristics	**Middle Paran River**	**Mississippi**
Mean El. above sea level (m)	980	1200
Drainage area (km^2)	2.8×10^6	3.21×10^6
Length (km)	4000	3750
Mean annual discharge (m^3)	15000	15300

Taking the comparison a step further, selected variables were used for applying correspondence analysis to explore similitude patterns among several large rivers. The variables for the analysis are watershed area, mean maximum elevation, annual discharge, dissolved organic carbon, litter pool, net primary productivity, precipitation, evapotranspiration, and mean temperature.

The results of the analysis are displayed in two-dimensional scaled maps (Figure 1). The objective is

to account for a maximum amount of inertia (variation) along the first and second axis. First axis of Correspondence Analysis accounted for 89 % of the inertia and separated rivers with large watersheds, high litter loads, net primary productivity and precipitation from those exhibiting higher elevations. The second axis accounted for only 11 % of inertia, separating the rivers based on discharge, mean temperature and dissolved organic contents.

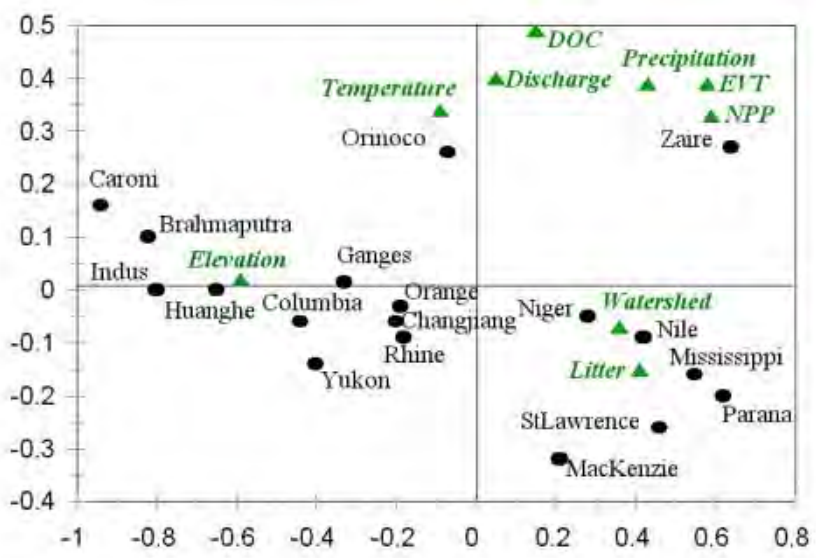


Figure 1: Separation of large rivers as determined by results of correspondence analysis

As Figure 1 shows, based on general climatic, hydrological, chemical and geomorphological characteristics, the Paraná is the most similar river in the world to the Mississippi River, so from a broad perspective it represents a suitable reference for the Mississippi River. Since the Paraná River has only been slightly modified from pre-impact conditions, it can serve as a process level reference for the Mississippi River. Concomitantly, the Mississippi River provides insight into the future condition of the Paraná River if unmanaged development were to continue.

A more in depth examination of water quality, ecological, hydrologic, and sediment data will provide the framework to find out if processes such as nutrient exchange and biodiversity are comparable from the Mississippi to the Parana.

5. Methodology

The differences in the Lower and Middle Paraná River and the Mississippi River will guide the project methodology, allowing the project goals to be met. The Paraná River is still connected extensively to its flood plains while the Mississippi River is separated from its floodplains by levees. The floodplain is an important part of the riparian habitat in maintaining biodiversity and regulating exchanges of nutrients and sediments in the system. Furthermore, navigation considerations keep the Mississippi River channeled and more uniform while the Paraná is a very braided river. Determining guiding principles for large river system restoration the characteristics and benefits of a healthy river system will drive the data collection. The project will consist of two phases, including data collection and data analysis/restoration framework.

Data Collection

Prerequisite to creating framework for guiding restoration efforts in the Mississippi River and development and management decisions in the Paraná River is the compilation of pertinent water quality, hydrologic, sediment, and ecological data in the respective basins.

For the Mississippi River, data from the USGS and from the United States Army Corps of Engineers (USACE) can be obtained from the extensive stream gage network and monitoring programs. Data for the Paraná River will be obtained from agencies within Argentina with guidance from personnel at the National Water Laboratory in Buenos Aires.

Data analysis - Developing a Restoration Framework

Data will be compiled and analyzed with regard to important river processes. Some of the questions that will be answered are:

How does the ecosystem of each river respond after flood events?

Which water quality, ecological, and sediment transport processes depend upon the natural flood cycle of the basin?

Regarding the Paraná as the reference river for Mississippi restoration, the analysis will focus on which processes are present in the Paraná basin due to the more natural hydrological regime, floodplain connectivity, channel geometry, and a less developed basin. These processes will then be extended to restoration efforts in the Mississippi River.

Schedule and Deliverables

The project will take place during a two-year period. The first year will consist of the data collection from respective agencies in Argentina and the USA. The second year will consist of data analysis. During this time the participants in the research will communicate during twice a month conference calls. The researchers will meet face to face at three meetings during the study; at the beginning in Buenos Aires, after the first year in the USA, and at the end of the study, at a site to be determined. Two documents will be produced during the research. One report will detail the findings of the data compilation and be due shortly after the first year and the other will report on the restoration framework developed.

Future Considerations

This first step in collecting data in the basins, determining important processes, and developing a restoration reference will undoubtedly elucidate more research needs. This research will enable researchers in both basins to identify, design, and put in place monitoring sites and programs for future considerations. Reaches of river in both systems will be identified to specifically focus on for unique aspects of river process. Furthermore, once the restoration framework is developed, numerical models, both ecological and hydraulic will be developed to guide restoration design.

6. Personnel

This project will involve research faculty, graduate students, and undergraduate students at multiple universities in multiple countries.

A principal investigator at both University of Iowa and University of Buenos Aires will guide the study and provide assistance to graduate students during the course of the study.

Students at both Universities will be involved in data collection and analysis.

7. Budget

This research program will take place over 2 years and will require $663,500. Table 2 breaks down the costs by category. The cost includes salary for two principal investigators, graduate students, communication, and computer & software. Each investigator will be working half time on the program and the graduate students will be working full time.

Table 2: Budget Summary

Personnel	**Salary**	**Fringe Benefits**	**Indirect Costs**	**Total**
U.S. Principal Investigator**	$75,000	$18,750	$112,500	$206,250
Argentine Principal Investigator**	$75,000	$18,750	$112,500	$206,250
U.S. Graduate Student*	$40,000	$10,000	$60,000	$110,000
Argentine Graduate Student*	$40,000	$10,000	$60,000	$110,000
Personnel Total				$632,500
Communication				$1,000
Travel				$20,000
Computer & Software				$10,000
Total				**$663,500**

*Graduate Students working full-time for a total of two years

** Principal Investigator working half-time for two years

8. References

Bayley, Peter B. 1995. "Understanding Large River-Floodplain Ecosystems, Significant Economic Advantages and Increased Biodiversity and Stability Would Result from Restoration of Impaired Systems," BioScience, Vol. 45, pp. 153-158.

Bonetto, A.A., Wais, J.R., Castello, H.P. 1989. "The Increasing Damming of the Parana Basin and its Effects on the Lower Reaches," Regulated Rivers: Research and Management, Vol. 4, pp. 333-346.

Bonetto, Argentino A. 1975. "Hydrologic Regime of the Paraná River and Its Influence on Ecosystems," Coupling of Land and Water Systems, Springer-Verlag, New York.

Galat, David L. et al. 1998. "Flooding to Restore Connectivity of Regulated, Large-River Wetlands, Natural and Controlled Flooding as Complementary Processes Along the Lower Missouri River," BioScience,Vol. 48, pp. 721-732.

Gottgens, Johan F. et al. 2001. "The Paraguay-Paraná Hydrovía: Protecting the Pantanal with Lessons from the Past," BioScience, Vol. 51, pp. 301-308.

Oldani, N.O. 1994. "General Considerations on Productivity of Fish in the Paraná River," Environmental and Social Dimensions of Reservoir Development and Management in the La Plata River Basin, United Nations Centre for Regional Development, Nagoya, Japan.

Sparks, Richard E., Nelson, John C., and Yin, Yao. 1998. "Naturalization of the Flood Regime in Regulated Rivers, the Case of the Upper Mississippi River," BioScience, Vol. 48, pp. 706-733.

United States Geological Survey. 1999. "Ecological Status and Trends of the Upper Mississippi River System 1998: A Report of the Long Term Resource Monitoring Program," Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin.

9. Biographical Sketches

A. Andrew W. McCoy (CO-PI)

Professional Preparation

• University of Iowa	Civil & Environmental Engineering	B.S. in 1999
• University of Iowa	Civil & Environmental Engineering	M.S. in 2003

Appointments

Graduate Research Assistant and Doctoral Candidate, Civil & Environmental Engineering, The University of Iowa (August 2001 - Present)

Water Resources Engineer, HDR Engineering, Inc., Austin, Texas (June 1999 - May 2001)

Undergraduate Research Assistant, Civil & Environmental Engineering, The University of Iowa, Iowa City, Iowa (August 1998 - May 1999)

Publications

- McCoy, A., "Three Dimensional Hydrodynamic and Total Dissolved Gas Simulations of Rock Island Dam Spillway," International Association of Hydraulic Research Congress XXX, 2003.
- McCoy, A., "Three Dimensional Hydrodynamic and Total Dissolved Gas Simulations of Rock Island Dam Spillway," Master's Thesis, The University of Iowa, May 2003.

Synergistic Activities

- Mr. McCoy has experience utilizing computational fluid dynamics to model hydraulic structures, total dissolved gas modeling, one-dimensional modeling of natural channels for stream gaging, hydrologic modeling, and water rights modeling. As a consulting engineer, Mr. McCoy applied these skills to a variety of projects including developing stream gage sites, performing flood discharge measurements, surface water/groundwater interaction, reservoir operation modeling, and water resources feasibility studies. He has focused his graduate studies on hydrodynamic and total dissolved gas modeling of hydraulic structures in the Columbia River Basin and numerical modeling of Pool 16 in the Mississippi River.

Collaborators & Other Affiliations

(i) Collaborators

- Prof. Larry Weber (IIHR, University of Iowa), Mr. Duncan Hay (Oakwood Engineering, Inc.), Mr. Kelly Payne (HDR Engineering, Inc.), Mr. David Dunn (HDR Engineering, Inc.)

(ii) Graduate and Postdoctoral Advisors

M.S. and Ph.D. Advisor: Prof. Larry Weber, The University of Iowa, Iowa City, Iowa

B. Ceyda Polatel (CO-PI)

Professional Preparation

• Middle East Technical University, Turkey	Civil Engineering	B.S. in 1997
• Middle East Technical University, Turkey	Civil Engineering	M.S. in 2000

Appointments

- Graduate Research Assistant and Doctoral Candidate, Civil & Environmental Engineering, The University of Iowa (August 2001 - Present)
- Graduate Research Assistant, Civil Engineering, The Middle East Technical University, Turkey (July 1997 - August 2001)
- Hydraulic Engineer, ERG Construction Co., Turkey (May 1997 - July 1997)

Publications

C. Polatel, Ş. Tiğrek, A. M. Ger, "Effects of Positioning of Ports on Performance of Diffusers" Medcoast99-Emecs99 Joint Conference, Land-Ocean Interactions: Managing Coastal Ecosystems.

- H. Ünder, C. Polatel, "Unsteady One Dimensional Groundwater Flow in Non-Uniform Aquifer with Various Field Boundary Conditions" Advances in Civil Engineering 2000, 4th International Congress.
- C. Polatel, "Unsteady One Dimensional Groundwater Flow in Non-Uniform Aquifer with Various Field Boundary Conditions", Ms. Thesis, Civil Engineering Dept., METU, Ankara, September 2000.
- I. Aydin, M. Gogus, H. Ünder, C. Polatel, "Hydraulic model of YAMULA Dam and HEPP", Technical Report, METU, Ankara, 2001.
- R. Balachandar, C. Polatel, B-S Hyun, K. Yu, C-L Lin, W. Yue, V. C. Patel, , "LDV, PIV and LES Investigation of Flow Over a Fixed Dune", *Proceeding* ETH Sedimentation and Sediment Transport Symposium, 2002.
- C. Polatel, "Signature of Bed Characteristics on Free Surface Velocity in Open Channel Flows", International Association of Hydraulic Research Congress XXX, 2003.

Synergistic Activities

- Ms. Polatel has experience in numerical and physical groundwater modeling, physical modeling of hydraulic structures, and physical modeling of sea outfalls. As a PhD candidate, she is working on turbulent velocity distributions in open-channel flows. As a research assistant, she has participated in physical model studies of spillways, groundwater systems, and warm water diffusers. As a hydraulic engineer she worked on preliminary structural stability analysis of Catalan Dam, Turkey.

Collaborators & Other Affiliations

(i) Collaborators

- Dr. V. C. Patel (IIHR, University of Iowa), Dr. Marian Muste (IIHR, University of Iowa), Dr. Ram Balachandar (The University of Windsor, Canada)

(ii) Graduate Advisors

M.S. Advisor: Prof. Halil Onder, The Middle East Technical University, Ankara, Turkey

Ph.D. Advisors: Prof. V. C. Patel and Dr. Marian Muste, The University of Iowa, Iowa City, Iowa

C. Nathan C. Young (CO-PI)

Professional Preparation

• University of Iowa	Civil & Environmental Engineering	B.S. in 1998
• University of Iowa	Civil & Environmental Engineering	M.S. in 2000

Appointments

Graduate Research Assistant and Doctoral Candidate, Civil & Environmental Engineering, The University of Iowa (January 2002 - Present)

Water Resources Engineer, HDR Engineering, Inc., Omaha, Nebraska (February 2000 - January 2002)

Hydraulic Engineer, WEST Consultants, Inc., San Diego, California (August 1999 - February 2000)

Undergraduate/Graduate Research Assistant, Civil & Environmental Engineering, The University of Iowa, Iowa City, Iowa (February 1997 - August 1999)

Publications

- Young, N., Weber, L.J., Nakato, T., "Hydrodynamic Characterization of Freshwater Mussel Habitats in the Upper Mississippi River," International Association of Hydraulic Research Congress XXX, 2003.
- Weber, L.J., Young, N., Haug, P., "Hydraulic Model Testing of ESBS Perforated Plate Vibrations", for U.S. Army Corps of Engineers, Walla Walla District Office. Iowa Institute of Hydraulic Research Limited Distribution Report No. 282, 2000.
- Young, N., "Hydraulic Model Study of Extended-Length Submerged Bar Screen Perforated Plate Vibration," Master's Thesis, The University of Iowa, July 2000.

Synergistic Activities

- Mr. Young has experience with physical and numerical modeling of hydraulic structures, one-dimensional modeling of natural channels and drainage systems, hydrologic modeling, and GIS applications in water resources. As a research assistant, he has participated in a number of physical model studies of spillways, pump intakes, and juvenile fish passage facilities. As a consulting engineer, Mr. Young has applied these abilities to a wide variety of projects including FEMA floodplain studies, dam break analyses, bridge hydraulics, municipal storm water master plans, and wetland hydrology. He has focused his graduate studies on experimental methods and field data collection studies along the Mississippi River.

Collaborators & Other Affiliations

(i) Collaborators

- Dr. Tatsuaki Nakato (IIHR, University of Iowa), Prof. Larry Weber (IIHR, University of Iowa), Dr. David Williams (WEST Consultants, Inc.), Mr. Randy Graham (HDR Engineering, Inc.)

(ii) Graduate and Postdoctoral Advisors

- M.S. and Ph.D. Advisor: Prof. Larry Weber, The University of Iowa, Iowa City, Iowa

International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

1. Lucas Rincon, UIUC 2. Nick Campney, IIHR 3. Tim Sexton, UI 4. Isaac Willig, IIHR 5. Pete Haug, IIHR 6. Larry Weber, IIHR 7. Boe Gregson, CSU 8. Nate Young, IIHR 9. Pedro Alvarez, IIHR 10. Vilson, Tour Guide 11. Gaston Gonzalez, UBA 12. Marian Muste, IIHR 13. Kate Muldoon, CSU 14. Angel Menendez, INA 15. Yenory Morales Chaves, IIHR-Delft 16. Miguel Gaddi, UI 17. Yoshi Katsuhama, CSU 18. Mrs. Lotero, UB 19. Roberto Lotero, UB 20. Leslie Sherburne, UI 21. Denise Armbruster, IIHR 22. Ariana Gudewort, UBA 23. Angela Barsic, UI 24. Andrea Rogers, IIHR 25. Ceyda Polatel, IIHR 26. Claudio Baigun, INTECH, USM 27. Pablo Garcia, UBA 28. Sebastian Rigo, UBA 29. Andy McCoy, IIHR 30. Francisco Van Avermaete, UBA. Not Pictured: Allen Bradley, IIHR.

CONTACTS INFORMATION:

Course Organizers:

Dr.Pedro Alvarez University of Iowa, USA pedro-alvarez@uiowa.edu	Dr. Angel N. Menendez Instituto Nacional del Agua and Universidad de Buenos Aires, Argentina	Dr. Claudio Baigun Instituto Tecnologico de Chascomus and Universidad de San Martin, Argentina

	menendez@satlink.com	cbaigun@yahoo.com

IIHR-Staff participating of the course:

Dr.Larry Weber University of Iowa, USA larry-weber@uiowa.edu	Dr. Marian Muste University of Iowa, USA marian-muste@uiowa.edu	Dr. Allen Bradley University of Iowa, USA allen-bradley@uiowa.edu

Students participating of the course:

Denise Armbruster University of Iowa, USA darmbrus@engineering.uiowa.edu	Angela Barsic University of Iowa, USA abarsic@engineering.uiowa.edu	Nicholas Campney University of Iowa,USA ncampney@engineering.uiowa.edu
Miguel Gaddi University of Iowa, USA miguel-gaddi@uiowa.edu	Boe Gregson Colorado Stage University, USA poloboe@hotmail.com	Peter Haug University of Iowa, USA pete-haug@uiowa.edu
Yoshihiro Katsuhama Colorado State University,USA katsuha@gol.com	Andrew McCoy University of Iowa, USA andrew-mccoy@uiowa.edu	Yenory Morales University of Iowa, USA yenory-moraleschaves@uiowa.edu
Kathryn Muldoon Colorado State University, USA katem@engr.colostate.edu	Ceyda Polatel University of Iowa, USA ceyda-polatel@uiowa.edu	Lucas Rincon University of Illinois, USA rincon@uiuc.edu
Andrea Rogers University of Iowa, USA andrea-rogers@uiowa.edu	Tim Sexton University of Iowa, USA tim-sexton@uiowa.edu	Leslie Sherburne University of Iowa,USA leslie-sherburne@yahoo.com
Isaac Willing University of Iowa, USA iwillig@engineering.uiowa.edu	Nathan Young University of Iowa nathan-young@uiowa.edu	

International Perspectives in Water Resources Planning in Argentina

May 16 – June 2, 2003

CONTACTS INFORMATION:

Contacts at Universidad de Buenos Aires:

Dr. Angel N. Menendez Assistant lecturer menendez@satlink.com	Pablo Garcia Student pabloegarcia@hotmail.com	Gaston Gonzalez Student ggonzale@fi.uba.ar
Sebastian Rigo Student Sebastian_rigo@yahoo.com.ar	Ariana Rosseti Student arossem@sinectis.com.ar	Francisco van Avermaete Student fjvanaver@fi.uba.ar

Contacts at Universidad Nacional del Litoral:

Facultad de Ingenieria y Ciencias Hidricas, Universidad Nacional del Litoral Casilla de Correo No 217, 3000 Santa Fe, Argentina. Fax: 54 342 457 52 24. Tel: 54 342 457 52 33 Ext 157 or 164

Leticia Rodriguez Assistant Lecturer and Co-Director of CENEHA leticia@fich1.unl.edu.ar	Carlos Vionnet Assistant lecturer and Director of CENEHA vionnet@fich1.unl.edu.ar	
German Farias Water Resources Engineer gfarias@fich1.unl.edu.ar	Gustavo Ferreira Water Resources Engineer cgf@fich1.unl.edu.ar	Romine Giampieri Graduate Student rgiamp@fich1.unl.edu.ar
Diego Maletti Undergraduate Student dgmaletti@hotmail.com	Silvina Serra Graduate Student sserra@fich1.unl.edu.ar	Pablo Adrian Tassi Graduate Student ptassi@fich1.unl.edu.ar

Contacts at Yacyreta:

Ing. Luis Marcelo Cardinal Hydrology Section	Lic. Alfredo Fortuny Section of Environment	Entidad Binacional Yacyreta Departamento Tecnico

mcardinal@eby.org.ar	afortuny@eby.org.ar	Tel: 03786-490027 Fax: 03786-490029

Contacts at Universidade Estadual do Oeste do Parana, Foz do Iguazu:

	Students:	*email:*
Dr. Roberto Cayetano Lotero	Marcos Limberger	mlimberger@pop.com.br
Assistant Lecturer	Joao Paulo de Sousa	jps@fnn.net
lotero@unioeste.br	Vanessa Donatoni	ddonatoni@zipmail.com.cr
	Simone Sozzeki Lotero	simone.economia@ig.com.br
	Mauricio Mesurine	mesurini@yanoo.com.br
	Adilson T. Lima	enggump@ibest.com.br
	Rodrigo Stasiv	stasiv@hotmail.com
	Felipe Damarem	damarem@ibest.com.br
	Elison Cescon	ecescon@hotmail.com
	Carlos Eduardo	cemsilva@hotmail.com
	Andre Luiz Fiedler	maxxanto@hotmail.com
	Leandro Polisseni	Lpolisseni@hotmail.com
	Malcon Fernandez	malconxt@hotmail.com
	Everton Luiz Schaefer	everton_schaefer@yahoo.com.br

Contacts at Itaipu Binacional:

Carlos Augusto Braga Public Relations cbraga@itaipu.gov.br	Neli Rosa Rover Public Relations	Dr. Domingo Rodriguez Aquatic Ecosystems Division domingo@itaipu.gov.br

Contacts at Instituto Nacional del Agua:

Dr. Raul A. Lopardo Gerente rlopardo@ina.gov.ar	*Hydraulic and Mathematical modelling:* • Claudio Fattor (cfattor@ina.gov.ar) • Pablo Spalletti (pspallet@ina.gov.ar) • Patricia Jaime (pjaime@ina.gov.ar) • Angel Menendez (menendez@ina.gov.ar)	*Hydrological Warning System for the Plata River Basin* • Juan Borus (Models) • Marcelo Uriburu (Models) • Alvaro Soldano (Satellite images) • Gustavo Almeira (Meteorology) • Daniel Calvo (Systems