The Alumni Channel
A Newsletter for Alumni and Friends of St. Anthony Falls Laboratory
February 2004

Dam Removal and River Restoration

By Chris Bromley and Michael Kelberer

Chris Bromley, a Ph.D. student in the Geography Department of Nottingham University in the U.K., is currently visiting St. Anthony Falls Lab under the auspices of the NCED Visitor Program. His project is to build a scaled, physical model of Glines Canyon Dam and Lake Mills in Washington, and to collect data on the sediment management and channel evolution consequences of various dam removal strategies.

Dam removal, as a phenomenon, is largely confined to the United States. Officially, about 500 dams have been removed so far – the vast majority during the 1990s – out of a total of about 80,000 significant enough to be listed in the National Inventory of Dams (website: http://crunch.tec.army.mil/nid/webpages/nid.cfm).

Dams are removed for a variety of reasons, but most boil down to economic considerations. Dams have become unsafe (looming structural failures) or ineffective (loss of reservoir capacity through sediment buildup), or the original rationale for their existence has simply disappeared (irrigation for land no longer farmed), and in all these cases the owners have decided that the cost to repair/maintain the dam is no longer worthwhile.

By contrast, removal of the two dams on the Elwha River, which flows northward on the Olympic Peninsula in Washington into the Strait of Juan de Fuca, is possibly the first significant example of a dam removal project undertaken primarily for habitat restoration reasons. The Elwha Dam is located approximately five miles from the mouth of the Elwha River, and the Glines Canyon dam is located about eight miles further upstream. Both were built without fish passages, effectively eliminating what had been a significant habitat for spawning salmon. These salmon are at the cultural and economic heart of the life of the Lower Elwha Klallam Tribe, whose reservation abuts the river's mouth. After a long struggle (see the Tribe's history of the process at http://www.elwha.org/river.htm), the U.S. government allocated funds to purchase and remove the dams, with the express intent of restoring the salmon habitat.

Chris Bromley and his model: the upstream delta

As with most dam removal projects, the crucial problem to be solved is how to manage the sediment trapped behind the dams. Most dams' watersheds are highly developed, and the runoff of pollutants from mines, farms and industry has turned the trapped sediment loads behind the dams in to environmental time bombs. Dam removal can in these cases, ironically, convert a mainly inert (in anoxic conditions) and definitely confined pollution problem into a re-activated (through exposure to oxygen) and highly dispersed pollution problem.

The Elwha watershed, fortunately, is largely undeveloped – much of it, in fact, is essentially pristine wilderness. From an environmental point of view, this makes the restoration of the river system even more attractive. And it reduces the sediment problem to one of shear quantity. The lion's share of the river's impounded sediment, approximately 14 million cubic yards, is trapped behind the Glines Canyon Dam.

The USGS completed a preliminary study to characterize the stored sediment in 1994. They lowered the dam's reservoir level 20 feet over the course of a week, then let it stay at that level a further week, all the

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In this issue

Interview: Director John Gulliver
"The sunfish and the bass"

A little more than a year has passed since the National Center for Earth-surface Dynamics (NCED) was officially launched with the St. Anthony Falls Laboratory as its host. In a recent interview, new SAFL Director John Gulliver reflected on how NCED's arrival has affected the lab. Following is an edited excerpt from that interview. – Ed.

The National Center for Earth-surface Dynamics has had a major impact on the lab. In a way it's been like a sunfish swallowing a bass. We're the sunfish and we're very happy about this, but there have been some digestion problems as we've had to adapt and grow to encompass the NCED mission without losing our own.

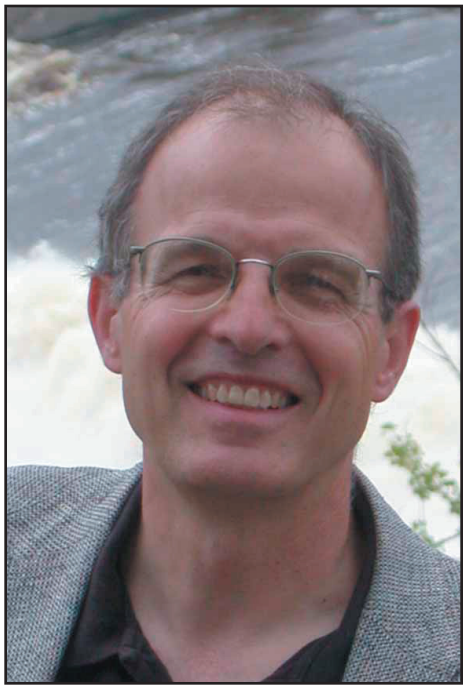
Gary Parker, Chris Paola and Efi Foufoula (together with other NCED PI's) wrote a terrific proposal which the NSF funded at $19.3 million over five years, with the possibility of renewing it for another five. NCED's arrival been a tremendous stimulus to interactions among the people here, and between us and the people continually coming in to give seminars and do research. It's a more exciting atmosphere – there are new students, new faculty, new post-docs, and the ongoing connections with faculty and students at the other NCED sites. Anytime you bring in this many talented people, the knowledge base expands dramatically. That is exciting to be a part of.

Outreach. We have some very interesting projects arising out of our NCED association that will be of great interest to the community at large, and I'm saying this also as a member of that public. The first involves the Science Museum of Minnesota (SMM), which is an NCED participant. NCED is assisting them in constructing an outdoor Science Park, and this is a major outreach activity. I'm enthusiastic about the quality of the SMM staff in terms of their dedication and knowledge. It's an ambitious project and we're a big part of it.

The second involves another NCED participant, the Fond du Lac Tribal and Community College. We are working with them to encourage more of their students to enter the science and engineering fields. The benefits of this will not be as visible immediately but in the long term they will be tremendous. Fond du Lac already has a well deserved reputation for graduating people who go on to prominent positions in the social services and liberal arts. Hopefully, with this association, we'll start to see that in the sciences as well.

Research. There's a lot of basic research going on, as you'd expect, but there's also a strong interest in applying it to problems that exist today in society. For example, dam removal issues, river restoration and Mississsippi River erosion and deposition are all earth-surface processes that are very real both to the civil engineering and geology professions.

Priceless. It would be difficult to overstate the value that NCED brings to the reputation of St. Anthony Falls Laboratory, to the two departments the lab is associated with, and to the University as a whole. The presence of NCED is raising our stature both nationally and internationally, and



with this increased prominence we'll start to see students applying who might not have considered it before. We will attract an even higher caliber of faculty to the Lab, and M.S. and Ph.D. graduates will have better job prospects because they are able to put St. Anthony Falls Laboratory and the National Center for Earth-surface Dynamics on their resumes.

Alumni cum laude . . .

I would like to say something about our great alumni. There aren't that many of them, when you compare the numbers to departments as a whole. Yet I believe we have as many alumni at our annual picnic as the departments do at their reunions. Seeing that kind of turnout is a rewarding experience.

The fact that so many alumni want to come back is a sign that we put the right kind of effort into educating quality graduate students and providing a great experience for them. It's a great compliment to our faculty.

With the tremendous growth we're seeing in research, visitors, and connections to the broader scientific community, that experience can only get better.

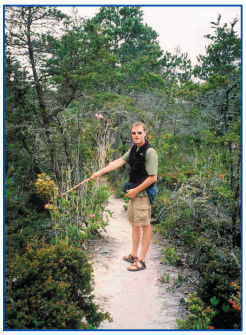
There's no people like lab people

Recent Lab Graduates

Erica Schierholz (M.S.) and John Gulliver
Brown Caldwell Engineers, St. Paul

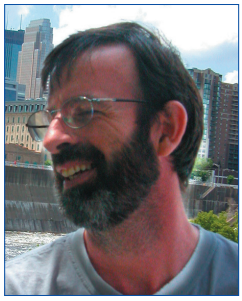
Violeta Lima (M. S.) and Vaughan Voller
INGEA, Barcelona, Spain

Les Hasbargen(Ph.D.) and Chris Paola
Indiana University



Scott Wright (Ph.D.)
Advisor: Gary Parker
USGS Flagstaff, AZ

Alicia Urban (Ph.D.)
Advisor: John Gulliver
Hydraulic Consultants, Inc., Sacramento



Horacio Toniolo (Ph.D.)
Advisors: Gary Parker and Vaughan Voller
University of Alaska, Fairbanks

Travis Bogan (M. S.) and Heinz Stefan
CDM Consulting Engineers, Denver, CO.

Efi Foufoula-Georgiou and Boyko Dodov (Ph.D.) St. Anthony Falls Lab

Not pictured:
Travis Schauer (M.S.)
Advisors: Roger Arndt and Ivan Marusik

Recent Awards

Anderson Award: The 2003 Alvin G. Anderson Award went to Miguel Wong, a PhD student with Professor Gary Parker.

Straub Award: The 2000 Lorenz G. Straub Award went to **Dr. Dragoslav Stefanovic**, for his thesis entitled, "Two Dimensional Modeling of Connective Exchange Processes in Stratified Lakes". Dr. Stefanovic did his PhD work under Professor Heinz Stefan at the University of Minnesota.

Efi Foufoula-Georgiou was elected to the executive committee of the Consortium of Univertisies for Advancement of Hydrological Sciences.

John S. Gulliver, PhD., P.E. Joseph T. and Rose S. Ling Professor and Head, Department of Civil Engineering, and Director, St. Anthony Falls Laboratory, has been awarded the 2003 Rickey Medal from the American Society of Civil Engineers in recognition of contributions to the field of hydroelectric engineering by educating new engineers and advancing the basic and applied knowledge to promote the viability and environmental compatibility of this resource.

Fernando Porté-Agel, PhD, Assistant Professor, SAFL Faculty, received a two-year appointment/research grant from the McKnight Land-Grant Professorship Program. Recipients are chosen based on the significance of their research; the degree to which past and present achievements demonstrate originality, imagination and innovation; the potential for significant contribution to the discipline; the quality of scholarly publication record ; and the potential for attracting outstanding students.

Heinz Stefan, PhD, Professor, SAFL Faculty**,** was the recipient of two awards in 2003: the Charles W. Britzius Distinguished Engineer of the Year Award from the Minnesota Federation of Engineering Societies, and the Dave Ford Water Resources Award for Outstanding Achievement in Water Resources in Minnesota. The latter was conferred at the 36th Annual Water Resources Conference in Brooklyn Center.

2003 Annual

Right to left: John and Barbara Killen, Warren Pahlin, Patricia Swanson, Douglas Barr, Joe Wetzel and Edward Silberman pose for a picture.

Director John Gulliver gives a lab update

Chris Thompson, Warren Dahlin and John Killen discuss current activities

Catherine Wetzel and Barbara Killen

Staffers Jon Reichs, Sara Johnson, Manuel Navarro, and Scott Dole

SAFL Picnic

Professor Roger Arndt and Joe Wetzel

John Killen and Ed Silberman

NCED Scientist Jeff Marr and Russ Berg

Right: PhD students Michal Tal and Wonsuck Kim prepare to serve

Doug Barr and Associate Director Omid Mohseni

NCED Interim Co-DirectorVaughan Voller gives an NCED update

Looking back: a letter from Efi

Dear friends,

I send you my greetings from Greece where I am on sabbatical at the National Technical University of Athens. (Don't think I spend all day at the beach – I do work too!) As most of you know, I stepped down as Director of the Laboratory on September 1, 2003 after four years of service. The directorship years have been a rewarding and cherished experience for me and I do hope that I honored your expectations. The dedication and hard work of all the staff and faculty has contributed to many accomplishments that we can all be proud of.

It is safe to say that in the last two years, the Lab has seen its way into the 20th century. We are now connected to the world via fiber optics, we have new power lines that allow us to have both the computers and the air conditions on simultaneously during the summer, we have one of the best on-campus videoconferencing screens in our conference room, and the graduate student and post-doctoral associate offices have been completely renovated (I wish I had such a desk space when I was a student).

None of the above would have been possible without the money, prestige and local/national attention that we gained by our success in attracting one of the six Science and Technology Centers funded by the National Science Foundation. The "National Center for Earth-surface Dynamics" (NCED) was established August of 2002 at the U of M with SAFL as its headquarters, and it is now in its second year of operation.

NCED has been the product of the hard and spirited work of several faculty and staff members. The competition for this center was fierce and we gave it our all to get it! We came to love the overnights at the Lab when the pressure was on and we even thought we could establish them as monthly events. The support and commitment of the Civil Engineering and Geology Departments, together with the excellent science team we put together and, of course, the unique experimental facility we all call "the Lab", made our proposal a success.

We have promised the nation that we will make breakthroughs in the new scientific discipline of "earth surface dynamics" which is at the cross-roads of engineering, hydrology, geology, ecology, biochemistry and environmental fluid dynamics. We can do this through cutting edge theoretical research, unique laboratory experiments, field work and innovative numerical modeling approaches. As you can tell, getting the center has increased rather than decreased our work load and commitment. The science is fun and the administration daunting. Gary Parker (1st year NCED director) and Chris Paola (new NCED director) deserve a special credit and thanks from everyone.

There are many people outside the Lab that I want to thank for their support and special mentorship during the past four years. At the expense of leaving many names out, I want to make special mention of John Gulliver as chair of Civil Engineering, Steve Crouch and Ted Davis as Deans of IT, Karen Wolterstorff at the Dean's office, and Anne Mockovak, now with the Chemistry Department. I also want to extend special thanks to John Thene and Chris Paola who served as Associate Directors (for Basic and Applied Research, respectively), and shared with me a common vision of where this place should be. Pat Swanson worked with me closely and provided a much needed corporate memory. She is missed now that she retired after 40 years of dedicated service. My post-doctoral associate Venugopal has been a resourceful source of continuous help and somehow always present in the most troublesome moments of SAFL and NCED. Finally, over the past four years we have had some special students that have invigorated our social life, have created an enviable volunteering system for lab functions, and have passed on good traditions to the next generation of students. (Alicia, are you reading this?)

On a personal note, I assumed the directorship when my daughter was a fourth grader and my son a kindergartener. I've felt the passage of time not from the endless hours at the office but from what I see in front of me now: a fine young lady and an independent 10 year old boy. I thank my husband for filling in for me when I was not at home and for supporting my endeavors. The message to all our young students, colleagues, and friends that start their careers is that all is possible if you enjoy what you are doing (and have an understanding spouse!)

The Lab is in great hands with its new director John Gulliver and its new Associate Directors Miki Hondzo (Basic Research) and Omid Mohseni (Applied Research and Operations). Please check our web site (www.safl.umn.edu) to learn more about our newest activities, social events (including an acclaimed soccer team), new people and our ever-evolving research activities and accomplishments.

As for me, I took a break from administration but I do look forward to resuming my position as NCED co-director after my sabbatical.

All the best to you and your families and warmest wishes for a happy and prosperous new year.

Yours, Efi

Dam Removal - continued

while taking data on sediment composition and transport, and stream incision and lateral adjustment. They found that about 60% of the sediment in the reservoir is stored in the upstream delta. Sands account for 30-40% of this total, and fines 40-50%, with the remainder gravel and coarser. The non-delta sediment is nearly all fines, and is smeared out in a thin layer across the basin floor.

As the dam is removed, the elevation difference between the reservoir water level and the entry point of the river will increase steadily, and this increase in slope will give the river the energy to entrain and transport that stored sediment through the reservoir and into the downstream river system, where it can create major environmental problems.

A significant increase in the river's suspended fines, for example, can severely impact downstream biota: killing fish through injuries to their gills and other sensitive organs, and killing populations of insects that the fish rely on for food. Fines can also fill in the interstices in gravel beds, making them unsuitable for spawning: fish eggs rely on water circulation through the gravel interstices to provide oxygen for metabolism and to carry away the waste products of that metabolism.

The impact of the coarse end of the fraction is even longer-lasting since it may take decades or centuries to get flushed down to the Juan de Fuca. This slow-moving sediment load can alter channel morphology and can, if it ends up being stored on the riffles (the high points of riverbed topography), raise the water surface elevation and cause flooding.

To study the sediment management problem, Chris Bromley has constructed a distorted Froude scale model of the Glines Canyon Dam on the model floor of the Lab. The basic plan for removing the dam involves an initial stage of lowering the reservoir level through the dam's sluice gates and penstocks. From there, it's a repeating notch-and-remove cycle: they'll cut a large notch at one side of the dam (see accompanying sketch), allow the level to drop to the bottom of the notch, remove the remaining dam structure above that elevation, then notch the other side and repeat. The two questions are how many vertical feet to remove in one cycle and how far apart to space the cycles to manage the sediment problem effectively.

The crucial element appears to be the length of each cycle, and in particular, the length of time the reservoir level is held constant. Longer times maximize the lateral deposition of sediment, thereby maximizing the amount of sediment retained in the basin. They also lengthen the time needed for the coarser fraction to move from the delta to the dam, allowing more drawdown before this fraction begins to affect the downstream system.

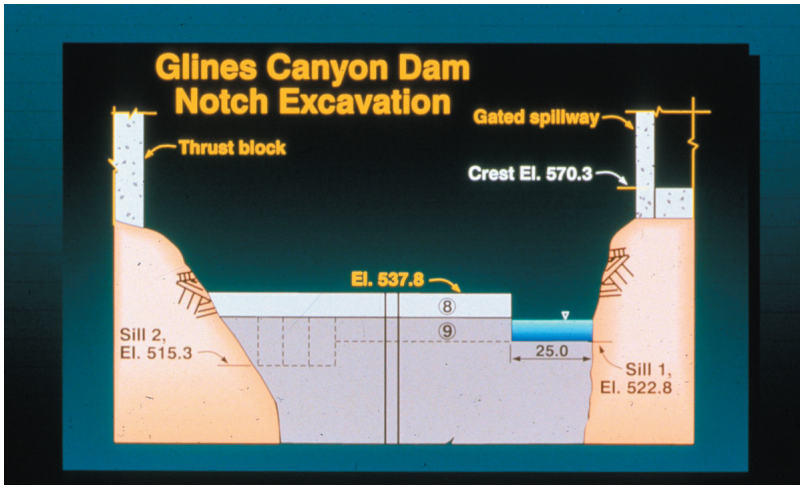
Glines Canyon before (upper) and after (simulated, below) dam removal.

Basically, the trade off is between slowing the process to minimize the sediment delivery downstream and completing it as fast as possible to reduce costs.

Bromley's experiment will measure the effects on sediment mobilization and re-distribution of different magnitudes and frequencies of the notch-and-remove cycle.

In addition, Bromley will examine the sediment management effects of various discharge regimes – in other words, how storm patterns will affect the process.

As of mid-December, Bromley had finished constructing the model, and had completed several preliminary runs aimed at testing the laser-based topography scanning system and high-temporal resolution photography system. He expects each experimental scenario to take about a week, and anticipates finishing the SAFL portion of his project by March, 2004.



Schematic of the Glines Canyon Dam removal strategy.

New Faces at the Lab

Since our last newsletter, several new people have joined the lab:

Sharon Bartlett	SAFL	Assistant to the Director
Karen Campbell	NCED	Knowledge Transfer Director
Diana Dalbotten	NCED	Education Director
Sarah Johnson	NCED	Junior Scientist Technician
Michael Kelberer	BOTH	Research Fellow
Bonnie Jean MacKay	SAFL	Administrative Specialist
Omid Mohseni	SAFL	Associate Director of Applied Research
Paul Morin	NCED	Computer Imaging Specialist
Charles Nguyen	BOTH	Information Technology Professional
Debra Pierzina	NCED	Administrative Specialist
Adam Recknor	SAFL	Principal Account Specialist
Diana Smith	SAFL/NCED	Junior Scientist Technician
Rochelle Storfer	NCED	Deputy Director Administration
Tuan Ta	NCED	Senior Accountant

Winter/Spring Seminars

January 21: Dr. Edward Cussler, Dept. of Chemical Engineering, University of Minnesota, Minneapolis
"Flake-filled barrier materials"
January 28: Dr. Mike Semmens, Dept. of Civil Engineering, University of Minnesota, Minneapolis
"TBA"
February 4: Dr. Jean-Francois Vinuesa, St. Anthony Falls Laboratory, University of Minnesota, Minneapolis
"Effect of turbulence on chemistry in the convective atmospheric boundary layer"
February 11: Dr. Sandra Yuter, Dept. of Atmospheric Sciences, University of Washington, Seattle, WA
"Physical characterization of tropical oceanic convection"
February 18: Dr. Ashley James, Dept. of Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis
"Surfactant Effects in Interfacial Fluid Dynamics"
February 25: Dr. Jon Pelletier, Department of Geosciences, University of Arizona, Tucson, AZ
"Arroyos and drumlins: Examples of pattern-forming instabilities in geomorphology"
March 3: TBA
March 10: Todd Dejournett, Graduate Student, Dept. of Civil Engineering, University of Minnesota, Minneapolis
"TBA"
March 17: No Seminar (Spring Break)
March 24: Scott Sobiech, Barr Engineering, Minneapolis, MN
"Continuous landlocked lake level simulation using XP-SWMM: Sunnybrook lake flood relief feasibility study"
March 31: Dr. Bruce Wilson, Biosystems and Agricultural Engineering Department, University of Minnesota, St. Paul
"Soil erosion from construction sites"
April 7: Suresh Hettiarachchi, HDR Inc., "Innovative Approach to Urban Flood Mitigation"
April 14: Dr. Robert Bernard, Waterways Experiment Station, Vicksburg, MS
"Gas-Transfer Simulations with the PAR3D Numerical Model"
April 21: Anderson Award: TBA
April 28: Andrew Erickson, Graduate Student, St. Anthony Falls Laboratory, Minneapolis
"Enhanced sand filtration for the removal of phosphorus from storm water runoff."
May 5: Maria Bergstedt, Graduate Student, St. Anthony Falls Laboratory, Minneapolis
"Influence of temperature stratification and

Pat Swanson Retires

Pat Swanson retired from SAFL early last year, and will be missed. Look for an interview with Pat in our next newsletter.

The Alumni Channel

The Alumni Channel is published by the St. Anthony Falls Laboratory, University of Minnesota, and is sent free of charge to laboratory personnel, students, alumni and friends. To receive a copy, please send your name, address and connection to the lab to the address below.

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Visitors Frequent the Lab

By Michael Kelberer

The past 12 months saw a significant influx of visiting researchers taking advantage of the lab's unique experimental facilities and superb support staff. Many, but not all, came under the auspices of NCED's International Cooperative Research/ apprenticeship Program (ICRP). Here is a partial list of the recent and soon-to-arrive academic visitors and their experimental research.

Robert Anderson (Earth Science, University of California Santa Cruz): Experimental Development of Slot Canyons. The Lab constructed a slot canyon model of wood and sculpted concrete on the model floor.

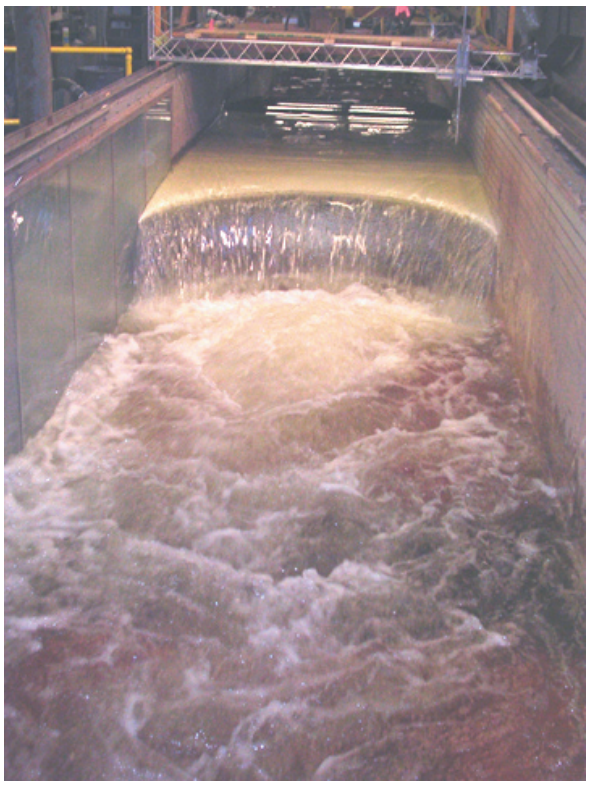
Chris Bromley (Geosciences, Oregon State University and Geography, University of Nottingam, UK): Controls on the rate and volume of sediment movement through and out of impoundments during dam removal. See story on page 1 for details.

John Buffington (Civil Engineering, Ecohydraulics Research Group, University of Idaho): Effects of channel morphology on intergravel flow within he shallow hyporheic zone of gravel-bed rivers: Implications for channel restoration and aquatic habitat. The experiments were conducted by Daneille Tonina in the tilting bed flume.

Tom Coulthard (Institute of Geography and Earth Sciences, University of Wales, UK): Experimental physical modeling of anabranching river evolution. Tom utilized the 2m by 16m open bed flume on the model floor to model anabranch formation and evolution in the face of various tree colonization patterns.

Morten Kjeldsen (Flow Design Bureau, Trondheim, Norway): Dr. Kjeldsen will be performing research in the newly revitalized SAFL High-Speed Water Tunnel.

Suzanne LeClair (Earth Sciences, University of Ottawa, Canada): Experimental investigation of turbidite-system sedimentation: the Origin of Waftites. Suzanne's experiments took place in the fish tank.



Greg Pasternak's Hydraulic Jump setup in the lab's Main Test Channel.

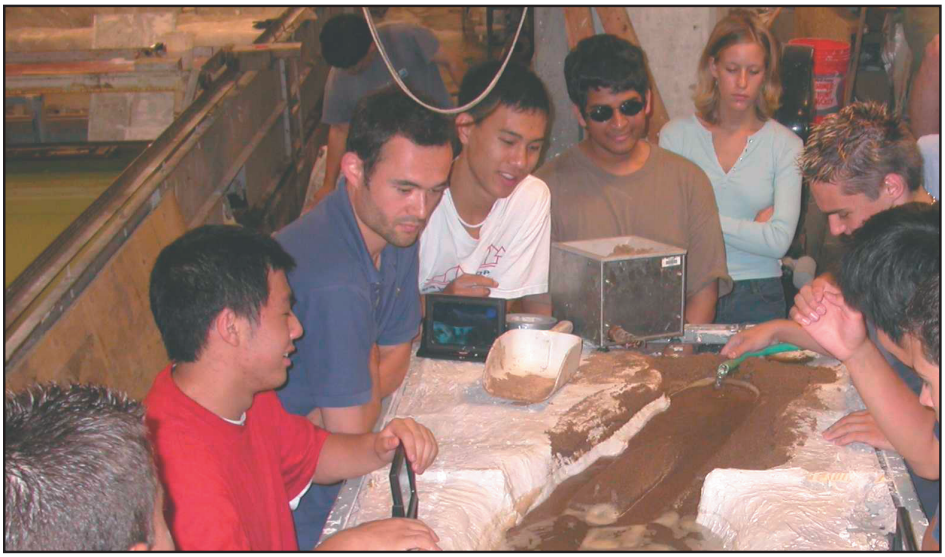
Makoto Higashino (Oita National Institute of Technology, Japan): Diffusive Boundary Layers in Lakes. Makoto, who was at the lab previously for a one-year sabbatical, returned twice to work with Heinz Stefan.

Greg Pasternak (Land, Air and Water Resources, University of California Davis): Hydraulic Jumps as Erosional Agents in Bedrock Channels.

Horacio Toniolo (Civil and Environmental Engineering, University of Alaska Fairbanks): Experiments in reservoir sedimentation. A 2003 Lab Graduate, Horatio returned to expand on his doctoral thesis work on continuous turbidity currents.

Peter Weiss (University of Valpariaso): Peter is a returning graduate ('96) working with John Gulliver on developing cost-effective methods for removing phosphorus from stormwater.

Peter Wilcock (Geography and Environmental Engineering, Johns Hopkins University): Sand routing over a course immobile streambed.



NCED Visitor Chris Bromley (blue shirt) took time out from his experimental schedule to create and teach a short course in Froude Scaling Algebra for high school students participating in NCED's Summer Math Camp. He had them develop four alternatives, then build a model (shown) to test them.

The Road Ahead:
Applied Research Projects at SAFL

By Omid Mohseni

The Applied Research group has a full slate of projects underway, with more in the pipeline:

ASHRAE.

The group is finishing up a project sponsored by ASHRAE to measure loss coefficients for various 6", 8" and 10" steel fittings.

NCED support.

The group has been, and will continue to be, very active in providing engineering support to NCED generally and to their visitors' program in particular.

Fish bypass system.

Just underway is a physical model study of a fish bypass louver system for the Shool St. Hydroelectric Power Plant in Cohoes, New York.

Diana Smith works on sealing the main channel of the fish bypass system model.

The system design calls for louvers to be placed in the diversion channel at a slight angle to the flow direction. Fish, sensing the surface waves, will move toward the channel wall where they will be directed toward the bypass channel.

The design needs to meet the Fish and Wildlife Services criteria for safeguarding the fish, while keeping the head loss created by the louver system to under one foot.

A 95-foot, 1:14 scale model (currently under construction – see photo) will be used to test flow through a system of 1900 vanes, each 0.2 inches wide and cut from stainless steel by water jets.

Bio-engineering.

An ongoing project sponsored by MNDOT involves scoping the research required to develop science-based strategies for applying bioengineering techniques to protect stream banks and slopes from erosion. Even after a decade and a half of using these techniques in the US (and longer in Europe), the field remains more of an art than a science. In addition to developing a research plan to give bioengineering techniques on a robust scientific basis, the Applied Research group will design an outdoor laboratory capable of performing that research. SAFL hopes to get that facility, but that's down the road.

Dick Christopher and Nate Flemming discuss construction of the fish bypass system model. They're standing just behind the gatehouses.

Shoreline erosion.

The Minnesota Pollution Control Agency has undertaken a large project to manage shoreline erosion on Lake of the Woods. The lab has begun the first two phases: field measurements and analyses of the historical data. The ultimate goal is to develop a model that will predict wave heights and the corresponding level of shoreline erosion, and a management plan (if there can be one) for lake water levels.

On the horizon.

One likely project in the near future involves a physical model study of dam removal (the Matilija Dam in Ventura County, California). In this case, sediment filling has reduced the dam's reservoir capacity to five percent of the original planned capacity. Our study would focus on the distribution of sediment remaining in the reservoir under several removal strategies. Another potential project involves testing a product that removes sediment from storm runoff as it enters the storm sewer system. A full-scale model of the system will be built on the turbine level of SAFL.

Engineering meets Ecology

"We found that we CAN work together"

St. Anthony Falls Laboratory Associate Director and NCED Principle Investigator Miki Hondzo has watched the Lab's mission evolve over the last several years. Like others who have contributed to this issue of the Alumni Channel, he cites the growing inclusion of non-engineering disciplines in the lab's approach to research and problem solving. For this article, he focused on the broadening of the lab's study of fluid mechanics and transport processes to include the living environment in which they occur.

A new Ecofluids Dynamics lab, funded jointly by SAFL and NCED, is nearly complete and will be used to study the interaction of small-scale fluid motion and micro-scale biological and chemical processes. Microbiology in this case refers to bacteria, phytoplankton and zooplankton. The chemical processes that will be studied are primarily those associated with nutrients – mainly nitrogen and phosphorus – and how they cycle through the environment. These biogeochemical cycles are at the heart of many environmental issues.

For example, one of Hondzo's students, Ben O'Connor, is developing a mechanistic understanding of nitrogen fluxes at the sediment-water interface, a process that is relevant to many environmental problems, such as the hypoxia (low oxygen concentrations in deep water) zone in the Gulf of Mexico that is caused by nitrogen-loading of the sediment in the Mississippi River (mainly in the Midwest). This example is one of a number of global environmental issues for which Hondzo expects SAFL will play a key role in finding multidisciplinary solutions.

The arrival of NCED has pushed the lab's multidisciplinary efforts to a new level, says Hondzo, by making this approach an integral part of all its funded research. A steady stream of visitors from all disciplines related to channels and channels networks has already contributed a lot to making the lab a more vibrant working environment. And collaborative research among PIs from different disciplines and different academic institutions is becoming the norm.

A multi-disciplinary research team roughs it at Angelo Reserve. From left, Miki Hondzo, Ben O'Connor, Mary Power, and Dina Dobraća

One such collaboration took place during a field trip to the Angelo Reserve in Northern California, the first official NCED field site. Participating were NCED PI Miki Hondzo and members of his Environmental and Biochemical Systems group (Tanya Warnaars, Ben O'Connor, and Dina Dobraća), NCED PI Mary Power, from UC Berkeley's Department of Integrative Biology and one of her students, and new NCED PI Jacques Finlay, from the Department of Ecology, Evolution and Behavior at the U of M. The Angelo reserve covers a nearly pristine portion of the Eel River watershed. Over the course of nearly two weeks, the site team took numerous measures of aquatic system productivity and respiration: temperature, oxygen levels, stream velocities, turbulence characteristics, nutrient concentrations. In addition, they characterized stream morphology and the nature and location of organisms from bacteria-scale to lizard-scale in both transverse and longitudinal directions. "One thing we definitely learned," says Hondzo, "is that we engineers and ecologists CAN work together."

Hondzo's group brought back large amounts of data (including four CD's worth of pictures), which they are sifting through and analyzing now. By March they will have a document ready that will show what they learned and what they still don't understand. This document will be their guide in planning future research activities for the Reserve.

"It's a great research environment there," says Hondzo, and he hopes more NCED researchers will make a point of going there. Especially, he adds, the more theoretically-oriented researchers. It's easy sometimes to spend all your time in front of a computer trying to push your models to the second decimal place, he says, when a trip to the field might make you realize we weren't that sure of the first.

The group plans to return next summer with more and better instruments. Ultimately, Hondzo says, to progress in environmental studies you have to do environmental measurements.

The effects of vegetation on river morphology being investigated by Michal Tal.

Graduate Student Fund

St. Anthony Falls Laboratory is a special place in many respects and holds a special place in the hearts of all of us. I take the opportunity to thank all alumni and friends that have generously contributed towards the graduate student fund over the past years. Your support has put to a good use and it never stops being needed. Someone recently asked me if now with the new center we still need their contributions. Yes we do! As you know, federal grants only pay for salary but not for much else that makes a big difference in graduate student life (library books, laptops for conference presentations, small travel grant supplements, renovation items, and some social activities support for graduate students). The Graduate Student Fund (GSF) is active and waits for your support!

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Best Wishes for a Happy New Year!