GEOMORPHORUM

Newsletter of the Geomorphology Specialty Group of the Association of American Geographers

Spring 2014, Issue No. 1 **Chris S. Renschler, Editor**

TABLE OF CONTENTS

http://www.aag-gsg.org/geomorphorum.shtml

OBITUARY

Maynard Malcolm Miller

By Dick Marston

Photograph of Dr. Miller by Ira Spring on a Juneau Icefield Expedition in November, 1953.

Maynard Malcolm Miller, explorer, committed educator and noted scientist whose glaciological research was among the first to identify hard evidence of global climate change as a result of human industrial activity, died on January 26 at his home in Moscow, Idaho. He was 93. Dr. Miller was Emeritus Professor at the University of Idaho where he previously served as Dean of the College of Mines and Earth Resources, and Director of the Glaciological and Arctic Sciences Institute.

In 1946 Bill Field and Maynard started talking about the work of various explorers during the 1930s on the Greenland Icecap and decided that a long term study was needed to determine what is transpiring in the upper (accumulation) zones of glaciers in Alaska. They chose the Juneau Icefield for ease of logistics, undertook reconnaissance work and lined up funding over the next couple of seasons. The project took off in 1949 with Bill as the Principal Investigator for AGS (handling the office work) and Maynard as the Field Party Leader. The early years of JIRP were sponsored by the American Geographical Society, discussed in a 1950 article in the Geographical Review (Vol. 40, no. 2, pp. 179-190) by W.O. Field and Maynard Miller. The AGS Juneau Icefield Research Project was also described by Jack Wright in his 1951 history of the AGS, Geography in the Making.

In 2007, just prior to his death, Cal Heusser published a monograph titled Juneau Icefield Research Project (1949-1958): A Retrospective in Elsevier's Developments in Quaternary Science. Heusser covered the origins of the project and the research activity, year by year, and making sure that credit was given where credit was due. Cal was the Principal Investigator for JIRP from 1951 to 1958.

The Juneau Icefield Research Project evolved into a teaching-research endeavor in the later 1950s at which time it was renamed the Juneau Icefield Research Program (still JIRP) and was developed in partnership with his late wife Joan Walsh Miller. More than 4000 students have participated, inspired through hands on involvement in scientific research in remote mountain environments in Alaska and around the world (www.juneauicefield.com). In recognition of this sustained impact in mountain science education, Maynard and Joan Miller were presented 1996 AAG Distinguished Teaching Honors.

As a scientist and climber on America's first Mt. Everest Expedition in 1963, Miller conducted research on atmospheric pollution and other contributors to climate change. On that historic expedition, as the West Ridge climbers returned from the summit, Miller sacrificed his precious scientific water samples, laboriously collected from the Khumbu Icefall, in order to rehydrate the exhausted climbers. Although a deeply spiritual person, Maynard Miller did not believe in any God of organized religion; instead, he found inspiration in the magnificence and wonder of nature. He also believed that through the challenge of rugged mountain expeditions, where teamwork is essential to achieve a common goal, the best in each individual may be revealed. His great joy was to share and provide these experiences for others.

A native of the Northwest, Miller graduated from Stadium High School in Tacoma, Washington. He studied geology and glaciology, receiving degrees from Harvard University and Columbia University, and his PhD in Geography from Cambridge University. During WWII Miller served on a Navy destroyer, seeing active duty in 11 major Pacific campaigns and sustaining injuries during an aircraft attack at sea. Late in life, Miller served three terms in the Idaho State House of Representatives where he advocated for expanding educational opportunities. He will be remembered for his enthusiasm, unrelenting optimism and phrases such as, "stress helps you grow" and his closing on mountain radio transmissions, "mighty fine, mighty fine".

Miller is survived by his sons and their spouses, Ross Miller (Denise), and Lance Miller (Jana). Miller also leaves behind his beloved grandchildren, Logan, Anna, Zachary and Eva, extended family in the Puget Sound area as well as scores of grateful students, scientific collaborators and co-adventurers. Celebrations of the life of Maynard Malcolm Miller will be announced at a future date.

See more at:
http://www.legacy.com/obituaries/juneauempire/obituary.aspx?n=maynard-malcolm-miller&pid=169627246#sthash.8dkvaCTJ.dpuf

PAST 2013 AAG

MINUTES OF THE 2012 GSG BUSINESS MEETING

Westin Hotel, Los Angeles, April 12, 2013, 7:30 pm
By the Editor

Robert Pavlowsky (Chair)
Mike Urban representing Melinda Daniels (Secretary-Treasurer)

I. Call to Order

Robert Pavlowsky called the meeting to order at 7:30 pm and welcomed everyone for the 32nd year of the GSG. The GSG is 277 members strong and includes 124 students.

II. General Announcements

A. Specialty Group Chairs Meeting

The 2013 AAG attendance is about 7400. (NYC=8500 & Seattle=7600). 5411 Abstracts of presentations in 1438 sessions take place this year. The GSG has 24 sponsored sessions. Interesting Note: AAG funding comes from staff grant writing and lobbying, not meetings… usually lose $ for meetings.

B. Taylor/Francis Routledge Distinguish Lecture

This year's speaker is Thomas Dunne, Bren School of Environmental Science & Management, University of California - Santa Barbara: "Risk to Floodplain Communities from River Channel and Floodplain Evolution". The chair and the audience thanked Tom for his presentation and the sponsor Taylor/Francis Routledge for their financial support.

C. GSG Involvement in Regional Meetings

The AAG would like to see more engagement of members and specialty groups at the regional meetings.

D. Progress in Physical Geography-Missing Links Session

The chair discussed a proposed "Tetrahedron of Physical Geography" including 1) Geomorphology 2) Hydrology 3) Climatology and 4) Biogeography.

The following questions were discussed with the members. Could paleo-environmental change – a central subfield? Is Human agency- pushing/pulling in and out of these areas? Is a computer modeling emphasis needed? If a human dimension needs to be emphasized, what should be the main theory or central paradigm for physical geography? Maybe climate change?
The three great theories of Evolution, Plate Tectonics, and … (for physical geographers) Climate/Environmental Change were discussed. The chair urged members and the leadership to continue the GSG's involvement in this discussion: "We can't miss our own boat…"

E. AAG Distinguished "Not a geographer" Scholars program

There is a new Distinguished Scholar Program at the AAG. The AAG will start a distinguished "but not a geographer" scholars program for the 2014 meeting in Tampa.- Five scholars per AAG conference will help the AAG to bridge to other disciplines.-Local scholar and SG(s) willingness to "host" with other activities. - Proposals will be judged for funding. GSG could work by itself or with other SGSs to sponsor a scholar to supplement present Distinguished Lecture Series or a more broader physical geography collaboration.

III. Specialty Group Reports

A. Approval of the Minutes

The 2012 GSG BUSINESS MEETING MINUTES New York, February 27, 2012 (as posted for review in the 2013 Spring Geomorphorum newsletter on the GSG website; submitted by Robert T. Pavlowsky were approved by the members in attendance.

B. Treasurer's Report

Mike Urban presented the report for Melinda Daniels, who could not attend this year's meeting. As of the meeting, the account activities for the financial year 2011/12 included $1,548 in dues collected.

Account Activity 2011/12 ($1,548 dues collected)

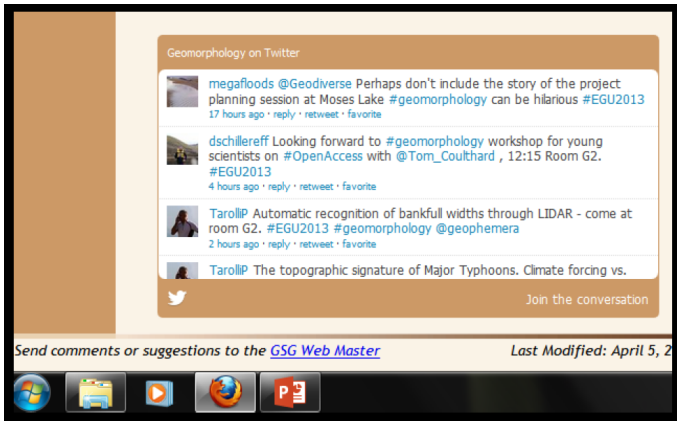
Date	Description	Receipts	Disbursements	Balance
8/31/11	Balance forward			$ 4,106.63
9/30/11	Dues collected for Sept. 2011	272.00		4,378.63
10/31/11	Dues collected for Oct. 2011	111.00		4,489.63
11/30/11	Dues collected for Nov. 2011	163.00		4,652.63
12/31/11	Dues collected for Dec. 2011	181.00		4,833.63
1/31/12	Dues collected for Jan 2012	146.00		4,979.63
2/8/12	IAG Dues 2011/2012		(786.39)	4,193.24
2/8/12	Wire fee for IAG Dues		(27.00)	4,166.24
2/29/12	Dues collected for Feb 2012	60.00		4,226.24
3/30/12	Arahams, Athol donation	123.00		4,349.24
3/31/12	Dues collected for Mar 2012	65.00		4,414.24
4/30/12	Dues collected for Apr 2012	125.00		4,539.24
5/24/12	Magilligan - reimburse for AM 2012		(225.00)	4,314.24
5/31/12	Dues collected for May 2012	102.00		4,416.24
6/19/12	Taylor&Francis ad payment	205.00		4,621.24
6/22/12	John Wiley&Sons ad payment	125.00		4,746.24
6/12/12	DeWitt - Geomorph. SG Award		(250.00)	4,496.24
6/13/12	Fyock - award		(400.00)	4,096.24
6/21/12	Manners - Award		(600.00)	3,496.24
6/30/12	Dues collected for June 2012	103.00		3,599.24
7/9/12	Gartner - award		(250.00)	3,349.24
7/31/12	Dues collected for July 2012	95.00		3,444.24
8/31/12	Transfer Marcus earnings to Geomorph SG per agreement	1,147.97		4,592.21
8/31/12	Dues collected for Aug 2012	125.00		4,717.21
8/31/12	Balance			4,717.21

Activity 2012/13 ($1,248 dues collected to 3/31)

Date	Description	Receipts	Disbursements	Balance
8/31/2012	Balance forward			$ 4,717.21
9/30/2012	Dues collected for Sept 2012	$ 111.00		$ 4,828.21
10/31/2012	Dues collected for Oct. 2012	$ 350.00		$ 5,178.21
11/30/2012	Dues collected for Nov. 2012	$ 194.00		$ 5,372.21
12/31/2012	Dues collected for Dec. 2012	$ 236.00		$ 5,608.21
1/31/2013	Dues collected for Jan 2013	$ 124.00		$ 5,732.21
2/28/2013	Dues collected for Feb 2013	$ 113.00		$ 5,845.21
3/31/2013	Dues collected for March 2013	$ 120.00		$ 5,965.21
3/31/2013	Balance			$ 5,965.21
	Invoiced Projected Receipts:			
	Elsevier	$ 125.00		
	Wiley	$ 125.00		
	Marcus Interest Transfer	$1,000.00		
	Estimated Remaining Disbursements:			
	Best student paper (MS)		$ 250.00	
	Best student paper (PhD)		$ 250.00	
	Wolman (MS)		$ 400.00	
	Wolman (PhD)		$ 600.00	
	IAG Dues		$ 751.00	
	Award Plaque Production		$ 80.00	
	Projected Balance			$ 4,884.21

C. Web Editor Report

Mike Urban continued to be leading the GSG Internet presence. The GSG webpage has now a twitter feed on the webpage (see below). No further report other than regular updates was presented.



IV. Old Business

A. Physical Geography Reception Update (DS program)

1) Reception in past format needed to be planned with AAG early on and have multiple sponsors
2) Past format: cost at 3K to 4K $
3) GSG chair asked other Physical Geography Chairs to discuss with membership, 3 return messages so far.
4) Good to socialize and collaborate among PGs. But old model needs a lot of T & E, lead person to push it.
5) Could cross-collaborate on sponsored sessions, distinguished scholars, field trips, or other social events? Ideas from the GSG membership?
6) GSG Chair will follow up on PG SGs after LA AAG to look for opportunities.

B. IAG Dues

IAG Dues are 1/3 USA, down from 1/2 contribution.

C. Student Awards

Open student award schedule this year, posters next.

V. New Business

A. Old "Gilbert Plaque

What to do with "old" Gilbert Plaques--Hang at AAG DC? Incoming treasurer will hold on to the old plaque and will discuss with the AAG leadership in the near future.

B. Other New Business

There was no other new business.

VI. Announcements

A. Journals

Dick Marston reported the latest news about the Journal Geomorphology. Mark Fonstadt reported on the review process and invited for submission to the Annals of the AAG.

B. Conferences

The upcoming Binghamton Geomorphology meetings were announced (see details in this newsletter).

C. Other

Note by the Editor: There were also others that invited for publication with other journals, but I did not take notes and/or do not remember all the details. Please come to our annual business meeting or read more about the journals and conferences in this and past issues of Geomorphorum that are posted on our webpage).

VII. Appointments

A. Awards Committee

Chris Renschler (outgoing Awards Committee Chair) nominated Peng Gao from Syracuse University. Peng Gao – this year not in attendance - indicated that he would attend the upcoming AAG meetings during his term and if he would be elected, he would be honored to accept the election. The members in attendance voted for Peng Gao joining the Awards committee.

B. Secretary-Treasurer

Robert Pavlowsky (outgoing chair) nominated Chris Renschler for the position of Secretary-Treasurer. The

members in attendance voted in favor and elected Chris Renschler as the new secretary-treasurer elect.

VII. Awards

Chris Renschler – the Chair of the Awards Committee – presented the 2013 GSG Awards.

The 2013 MASTERS GRADUATE STUDENT PAPER AWARD competition was still ongoing and will be announced in the fall 2013 Geomorphorum.

The 2013 PHD GRADUATE STUDENT PAPER AWARD was presented to **Christy Swann (Texas A&M)**: Wind-Blown Sand: Threshold of Motion.

The 2013 REDS WOLMAN MASTERS GRADUATE STUDENT RESEARCH AWARD was presented to **Helen W. Beeson (University of Oregon)**: The Influence of Deep-seated Landslides on Valley Width and In-channel Geomorphic Features in the Oregon Coast Range, USA.

The 2013 REDS WOLMAN PHD GRADUATE STUDENT RESEARCH AWARD to **Matthew Goslin (University of Oregon)**: Determining patterns of geomorphological change relative to spatial patterns of a river ecosystem engineer, Carex nudata

The 2013 GROVE KARL GILBERT AWARD was presented to **Jennifer L. Horwath Burnham (Augustana College) and Donald L. Johnson (University of Illinois – Urbana Champaign)**: Mima mounds: The case for polygenesis and bioturbation. Geol. Soc. Am. Spec. Paper 490. (Nomination and citation was provided by Randall (Randy) Schaetzl).

Jennifer Burnham was in attendance and thanked the audience (see the past Fall Geomorphorum for the citation and acceptance speech).

The 2013 MELVIN G. MARCUS DISTINGUISHED CAREER AWARD was presented to **Michael J. Woldenberg (University at Buffalo -SUNY).** Nomination and Citation was given by Frank Magilligan.

Mike Woldenberg was in attendance and thanked the audience (see the past Fall Geomorphorum for the citation and acceptance speech).

VII. Adjournment

The meeting was adjoined at 8:50 pm and everybody continued to Casey's Irish Pub on 613 S. Grand and 6th.

Important Note from the Editor: The minutes above were put together by the Editor and are mainly based on slides presented at the meeting by Robert Pavlowsky.

Follow Up Remarks by the 2013 Melvin G. Marcus Distinguished Career Award Recipient

By the Editor

The last Fall 2013 Geomorphorum included a response by the 2013 Melvin G Marcus Distinguished Career Award recipient **Michael (Mike) Woldenberg** (University at Buffalo / SUNY Buffalo). Since Mike was short on time before the last deadline for the newsletter, I invited him to add some more of his thoughts and share them with the wider Geomorphology community (see the last contribution in this issue).

I would like to take a moment to acknowledge the efforts of all those past Melvin G. Marcus Distinguished Career Award and G. K. Gilbert Award recipients (and the colleagues that shared their nomination letters and/or citation presented at the GSG Business meetings) that took the time to write up their speeches so that they can be shared with all our members.

I hope that this becomes again a good tradition and add to the already existing, inspiring on-line collection of contributions with thought provoking ideas and memorable stories. Thank you!

UPCOMING AAG IN TAMPA – April 8-12 2014

The GSG Business Meeting

THURSDAY, 4/10/2014,
7:30 PM - 8:30 PM
Room 19, TCC, First Floor

Please note that this event was initially scheduled on Friday but got moved in the final conference program to Thursday night:

The 2014 Distinguished Lecture in Geomorphology

Sponsored by Taylor-Francis/ Routledge

WEDNESDAY 4/9/2014
6:30 PM - 7:30 PM
Meeting Room 9, Marriott, Third Floor

Science, Policy, and Politics for Restoration of the Florida Everglades

William L. Graf
Department of Geography
University of South Carolina

Abstract

The Florida Everglades is a 6,000 sq km remnant of what was once a 12,000 sq km wetland in central and southern Florida, populated by a unique array of biota and defined by unusual hydrology and geomorphology. The purpose of this presentation is to explore how science, policy, and politics have interacted with each other to produce the present degraded ecosystem, and to provide a basis for the ongoing Comprehensive Everglades Restoration Plan (CERP). Historical analysis of the Everglades ecosystem and south Florida shows that there have been distinct periods of interactions among science, policy, and politics: the pre-development era before 1890 when natural hydrologic and ecosystem conditions prevailed, the development era of 1890-1980 that saw the installation of a vast water control infrastructure, and the restoration era after 1980 that has seen attempts to reverse ecosystem damages while preserving the water supply and flood control benefits of the system. Science has slowly developed explanations for Everglades forms and processes, but at each step science has served the needs of the prevailing policies for the region. Politics that grew out of a culture tuned to public investment in economic development strategies have guided decision making. Modern adaptive management and incremental adaptive restoration are also products of goals established under the influence of cultural forces. The history of science for the Everglades has been adaptive to changing demands by society, with a constant stream of new research questions driven not by research curiosity but by economic and environmental necessity.

The Progress in Physical Geography Lecture and Panel Session

FRIDAY, 4/11/2014
2:40 PM - 4:20 PM
Meeting Room 10, Marriott, Third Floor

Each year the international journal Progress in Physical Geography hosts a lecture and subsequent panel discussion at the annual AAG meeting. This year's session has been organized by David Butler, Section Editor of the "Classics Revisited" and "From the Archives" segments of the journal. Dave will speak on the importance of knowing the history of the discipline and how publishing in these sections of Progress in Physical Geography helps in understanding the past. Panel discussants include Session Moderator George P. Malanson (University of Iowa), Richard W. Dixon (Texas State University), Carol F. Sawyer (University of South Alabama), and the journal's Managing Editor, Nicholas Clifford (King's College, London).

All 25 GSG Sponsored Sessions

TUESDAY

River Observations, Monitoring, and Management
Tuesday, 4/8/2014, from 10:00 AM - 11:40 AM in Room 24, TCC, First Floor

Consecutive Session Series:

Advances and Challenges in Digital Elevation Models I (Overview)
Tuesday, 4/8/2014, from 8:00 AM - 9:40 AM in Room 30A, TCC, Fourth Floor
Advances and Challenges in Digital Elevation Models II (Coastal)
Tuesday, 4/8/2014, from 10:00 AM - 11:40 AM in Room 30A, TCC, Fourth Floor

Advances and Challenges in Digital Elevation Models III (Remote Sensing)
Tuesday, 4/8/2014, from 12:40 PM - 2:20 PM in Room 30A, TCC, Fourth Floor
Advances and Challenges in Digital Elevation Models IV (Geomorphology)
Tuesday, 4/8/2014, from 2:40 PM - 4:20 PM in Room 30A, TCC, Fourth Floor
Advances and Challenges in Digital Elevation Models V
Tuesday, 4/8/2014, from 4:40 PM - 6:20 PM in Room 24, TCC, First Floor

WEDNESDAY

Consecutive Session Series

Geoarchaeology and Stone Assessment
Wednesday, 4/9/2014, from 12:40 PM - 2:20 PM in Room 15, TCC, First Floor
Geoarchaeology of the Maya World
Wednesday, 4/9/2014, from 2:40 PM - 4:20 PM in Room 15, TCC, First Floor
Geoarchaeology: Novel Approaches to Analysis
Wednesday, 4/9/2014, from 4:40 PM - 6:20 PM in Room 15, TCC, First Floor

The Natural and Human Structuring of Rivers and other Geomorphic Systems I: A Special Session In Honor of Will Graf
Wednesday, 4/9/2014, from 8:00 AM - 9:40 AM in Meeting Room 9, Marriott, Third Floor
The Natural and Human Structuring of Rivers and other Geomorphic Systems II: A Special Session In Honor of Will Graf
Wednesday, 4/9/2014, from 10:00 AM - 11:40 AM in Meeting Room 9, Marriott, Third Floor
The Natural and Human Structuring of Rivers and other Geomorphic Systems III: A Special Session In Honor of Will Graf
Wednesday, 4/9/2014, from 12:40 PM - 2:20 PM in Meeting Room 9, Marriott, Third Floor
The Natural and Human Structuring of Rivers and other Geomorphic Systems IV: A Special Session In Honor of Will Graf
Wednesday, 4/9/2014, from 2:40 PM - 4:20 PM in Meeting Room 9, Marriott, Third Floor
The Natural and Human Structuring of Rivers and other Geomorphic Systems V: A Special Session in Honor of Will Graf
Wednesday, 4/9/2014, from 4:40 PM - 6:20 PM in Meeting Room 9, Marriott, Third Floor
Science, Policy, and Politics for Restoration of the Florida Everglades: The Taylor-Francis/Rutledge Distinguished Lecture in Geomorphology Presented by Professor William Graf
Wednesday, 4/9/2014, from 6:30 PM - 8:30 PM in Meeting Room 9, Marriott, Third Floor

THURSDAY

Geoarchaeology: Paleoenvironments in human contexts
Thursday, 4/10/2014, from 8:00 AM - 9:40 AM in Room 19, TCC, First Floor

Geomorphology, Hazards, and Vulnerability
Thursday, 4/10/2014, from 2:40 PM - 4:20 PM in West Hall, TCC, Third Floor

The North American Periglacial Realm - Papers in Honor of Professor Dieter H. Brunnschweiler
Thursday, 4/10/2014, from 2:40 PM - 4:20 PM in Florida Salon V, Marriott, Second Floor

Geomorphology Specialty Group Business Meeting
Thursday, 4/10/2014, from 7:30 PM - 8:30 PM in Room 19, TCC, First Floor

FRIDAY

Fluvial Forms and Processes
Friday, 4/11/2014, from 10:00 AM - 11:40 AM in Meeting Room 10, Marriott, Third Floor

The "Progress in Physical Geography" Panel - "Classics Revisited" and "From the Archives"
Friday, 4/11/2014, from 2:40 PM - 4:20 PM in Meeting Room 10, Marriott, Third Floor

Consecutive Session Series:

Human Impacts on Watershed Processes I
Friday, 4/11/2014, from 2:40 PM - 4:20 PM in Room 19, TCC, First Floor
Human Impacts on Watershed Processes II
Friday, 4/11/2014, from 4:40 PM - 6:20 PM in Room 19, TCC, First Floor

SATURDAY

When fluvial geomorphological science meets watershed policy and politics: Responding to extreme weather events
Saturday, 4/12/2014, from 8:00 AM - 9:40 AM in Meeting Room 9, Marriott, Third Floor

Coastal and aeolian processes and landforms IV: coastal geomorphology
Saturday, 4/12/2014, from 4:00 PM - 5:40 PM in Meeting Room 13, Marriott, Third Floor

OTHER UPCOMING MEETINGS

Binghamton Geomorphology Symposium

By the Editor

If you are interested in organizing a Binghamton Geomorphology Symposium, please contact the Chair of the Steering Committee, Jonathan Phillips (jdp@uky.edu).

45th Annual Binghamton Geomorphology Symposium (2014 BGS) on "Planetary Geomorphology."

September 12-14, 2014
Department of Earth & Planetary Sciences
University of Tennessee, Knoxville, TN

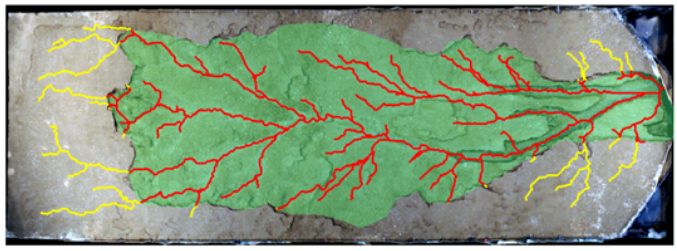
Organizers for the 2014 BGS are Devon Burr (dburr!@utk.edu) Alan Howard, and Doug Jerolmack.

During the past forty years of spacecraft exploration of the solar system, geomorphology has become an extraterrestrial science. Spacecraft missions to other planetary bodies continue to provide surface data at unprecedented resolutions, which in some cases are higher than the resolution of data for Earth. Several countries have recent, ongoing, or planned missions to investigate the surface of the moon. Cameras in orbit around Mars are providing images at a variety of wavelengths with coverage over significant proportions of the planet at resolutions down to meters per pixel. The MESSENGER mission in orbit at Mercury is returning data of novel tectonic and volcanic morphologies. And in the outer solar system, instruments on the Cassini spacecraft are showing that, despite their exotic materials, Titan and other Saturnian satellites have Earth-like surface morphologies. Myriad other missions to other terrestrial planetary bodies are also planned or ongoing.

By providing for substantial investigation of and trenchant comparison among the landforms of geologic bodies in our solar system, these data represent a new era in geomorphology.

The 2014 Binghamton Geomorphology Symposium (BGS) will support new scientific collaborations between and discoveries by the terrestrial and planetary geomorphology communities through presentation of planetary geomorphologic features and their terrestrial analogs. Investigations using spacecraft data, terrestrial field work, numerical modeling, and experimental results will be presented. The symposium will feature invited oral presentations highlighting comparisons between terrestrial and extraterrestrial processes and landscapes. Poster contributions are also welcome.

For more information about the 2014 BGS contact the organizers through Devan Burr (dburr1@utk.edu) or go to http://web.eps.utk.edu/symposium/index.php



46th Annual Binghamton Geomorphology Symposium (2015 BGS) on Laboratory Experiments in Geomorphology

September 18 to 20, 2015 (Friday through Sunday)
University at Buffalo - The State University of New York, Buffalo, NY

Conveners:
Sean J. Bennett, Department of Geography, University at Buffalo, Buffalo, NY 14261-0055, USA, seanb@buffalo.edu;
Peter Ashmore, Department of Geography, University of Western Ontario, London, Ontario, Canada, N6A 5C2, pashmore@uwo.ca; and
Cheryl McKenna Neuman, Department of Geography, Trent University, Peterborough, Ontario, Canada, K9J 7B8, cmckneuman@trentu.ca

This symposium seeks to bring together leading experts and emerging scientists actively engaged in laboratory-based, experimental research on geomorphic systems. Eight themes have been selected based on geomorphic phenomena, and eighteen speakers have been invited to make presentations. Contributors will be asked to highlight the unique capabilities of their facilities and

equipment, to discuss how their experimental research has or will transform knowledge of the geomorphic phenomena examined, and to critically assess broader issues concerning laboratory-based simulation of geomorphic systems.

For more information about the 2015 BGS contact the organizers through Sean Bennett (seanb@buffalo.edu) or go to https://www.ubevents.org/regengine/event_page.php

Tephra 2014 - Maximizing the potential of tephra for multidisciplinary science

By Marcus Bursik

August 3-7, 2014
Portland State University, Portland, Oregon, USA

Conveners:
Marcus Bursik, Stephen Kuehn, and Solene Pouget

This workshop will discuss major developments, best practices, and future directions/needs in tephra studies from both volcanological and tephrochronological perspectives. By bringing together a broad array of scientists who study tephra for different purposes, we intend to enhance interdisciplinary collaboration and data sharing. To provide training, the workshop will also incorporate hand-on sessions on optimal sample collection, dispersal modeling, age modeling, and database submission.

Applications and Abstract are due 15-April-2014. Letters of acceptance to the workshop will be sent on or before 1-May-2014. No payment is needed until acceptance letter has been received. Registration fees are due 15-May-2014.

The workshop is limited to 100 participants. 2- day or 4 - day participation is possible. The main discussions will be held on August 5th and 6th. All participants are urged to submit an abstract. A few of these will be chosen or solicited for oral presentation, others for poster presentation.

More information at
http://www.geohazards.buffalo.edu/documents/Tephra2014.shtml

8th International Conference on Aeolian Research (ICAR VIII)

By Ted Zobeck

The 8th International Conference on Aeolian Research (ICAR VIII) will be held in Lanzhou, China from Monday July 21 to Friday July 25, 2014. The conference will include technical sessions on the following themes:

1. Mechanics of aeolian processes
2. Aeolian geomorphology: desert, coastal and planetary
3. Aeolian deposits and loess
4. Paleo aeolian system: environment and its responses to global change
5. Aeolian dust and health
6. Desertification and its control: Anthropogenic interactions with aeolian systems
7. Modelling aeolian transport
8. Extraterrestrial aeolian research

The registration fee will include conference abstracts, a CD with full submitted texts, welcome and farewell banquets, a one-day, mid-conference field trip (including lunch) to the Badain Jaran Desert, home of the tallest megadunes on the Earth. We invite you to consider submitting a poster or oral paper for presentation at the meeting.

The conference web site is available at
www.2014icar8.com

This meeting is sponsored by the International Society for Aeolian Research (www.aeolianresearch.org).

Cuiling LAN
Secretary of the ICAR VIII
Email: cllan@cashq.ac.cn
Tel: +86-10-68597750, 13801206305

RESEARCH GROUP NEWS

University of Oregon's River Group

By Mark Fonstad

The University of Oregon's River Group has grown substantially and has been very active over the past year. The River Group is an informal research group that meets weekly to discuss river-related research and coordinate river-related classes and research projects. Most of the students in the group are graduate students in the Department of Geography, but the group also interacts with people in such other departments such Geological Sciences, Planning, Public Policy and Management, and Environmental Studies. The group hosted river-related seminars with scholars such as Gary Brierley, Frank Magilligan, and Joe Wheaton.

Pat McDowell led a large group of undergraduate and graduate students to the Middle Fork John Day River in northeastern Oregon for several weeks to conduct inventory and monitoring work in support of restoration activities by a multiagency group. Pat also published "Geomorphology in the Late Twentieth Century" in the Treatise on Geomorphology. She also presented a poster on the Middle Fork work at the IAG meeting in Paris in August.

Mark Fonstad had a busy year. Along with his regular editor duties at the Annals of the AAG, he also edited this year's published special issue on "Geographies of Water". This past summer, Mark and several graduate students conducted river process observations in the Cascades near McKenzie Bridge, Oregon. He gave several invited presentations including one at the AGU, the University of Illinois, and also to an international online audience as part of the Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI). He published a paper on cellular automata modeling in geomorphology in the new 14-volume Treatise on Geomorphology. Mark and Bruce Rhoads are organizing this year's special session in honor of Will Graf at the AAG meeting in Tampa: "The Natural and Human Structuring of Rivers and Other Geomorphic Systems".

Andrew Marcus has moved up the ranks from Associate Dean to Acting Dean to Interim Dean of the College of Arts and Sciences during the past year. As such, Andrew hasn't been able to participate fully in the UO River Group activities this year, though he is active on committees, and has managed to get to the Oregon Coast Range with Helen Beeson to look at stream habitats and has been active giving lectures on the production of the Atlas of Yellowstone.

Adriana (Didi) Martinez received her Ph.D. in the summer of 2013 and is now an assistant professor of Geography at Southern Illinois University Edwardsville. Her doctoral research centered on the mutual relationships between riparian vegetation and stream channel dynamics in the Sprague River, Oregon. Since starting her new position, Didi has been building up her research lab and field equipment as well as planning a project with Suzanne Walther (PhD., U. of Oregon 2011, now an assistant professor at Utah Valley University) on the effects of two impoundments along the Provo River, Utah.

Jane Atha finished her Ph.D. in the summer of 2013 and is now the Watershed/Lead Entity Coordinator of the Chehalis Basin in Washington. Her dissertation revisited Dick Marston's 1980 study of large wood and stream morphology dynamics in the Oregon Coast Range over a thirty-year period. In addition to her watershed coordinator duties, she has given lectures on her dissertation research to the Washington Department of Ecology as well as the USGS.

Sarah Praskievicz is finishing her dissertation on impacts of climate change on the hydrology and fluvial geomorphology of snowmelt-dominated rivers in the interior Pacific Northwest and will graduate with her Ph.D. in June. She has accepted a position as Assistant Professor in the Department of Geography at the University of Alabama.

James Dietrich is in the final leg of his doctoral research work centering on developing advanced topographic monitoring techniques for riverscape science. Last year, James was Outstanding Paper Award winner at the AGU for his work on mapping land and water surface topography with instantaneous structure from motion. Starting this fall, James will be a postdoctoral fellow at Dartmouth where he intends to work on river restoration and monitoring research in collaboration with other researchers including Frank Magilligan.

Polly Lind (Doctoral student) spent several weeks split into multiple trips conducting research on the Rio Pacuare, a high-energy tropical mountain watershed in Costa Rica. The research has been both exhilarating and logistically challenging; with the scale of fluvial forms considerably larger than what students focus on for fieldwork, and with the added complications of poisonous snakes and frogs hiding in the tall riparian vegetation. Polly's work centers on sediment transport of (very) large boulders to and from huge channel bars, and on how the river geomorphology may be affected by upstream land use changes. Her work has been helped by an NSF DDRI grant and a GSA Doctoral Student Research Award. Polly also presented her research results at the IAG meeting in Paris.

Matthew Goslin (Doctoral student) has become fascinated by a native riparian plant, the torrent sedge (Carex nudata), that has exploded in abundance throughout the Middle Fork John Day River, Oregon following the removal of cattle grazing and appears to be altering channel morphology, facilitating the complexity that is a goal of restoration work in this river. His work attempts to integrate fluvial geomorphology and ecology

toward understanding how river dynamics drive the sedge's distribution and how, in turn, the sedge may influence the evolution of the river. His proposed research garnered the AAG Reds Wolman Student Research Award (at the PhD level), and he also presented research findings to the Ecological Society of America meeting in Minneapolis. In addition to focused work in the Middle Fork John Day River – repeated topographic surveys, bank erosion monitoring – Matthew has explored rivers throughout Oregon sampling for the sedge, and he will expand his sampling into northern California this coming summer.

Doctoral student Swagata Goswami has been using Landsat imagery to understand the watershed scale morphometric controls on the lateral mobility of the Gangetic tributaries along North-Central Himalayas. A major part of her research focuses to track and comprehend the dynamics of the Kosi megafan between the Himalayan front and the Ganges. In addition to trips to India and teaching large online Natural Environment classes this past year, Swagata has also recently passed her comprehensive exam.

Helen Beeson (Masters student) spent a great amount of time in the field this past year, first with geomorphic change mapping in Oregon's Painted Hills, then doing her own field research in the Oregon Coast Range, and then doing high-resolution river habitat mapping in the Cascades. This past year, Helen won the AAG Reds Wolman Student Research Award (at the Masters level) as well as a GSA Research Grant for her proposed research: "The Influence of Deep-seated Landslides on Valley Width and In-channel Geomorphic Features in the Oregon Coast Range, USA".

Jenna Duffin, a first-year Masters student, helped Pat McDowell conduct stream surveys in the Middle Fork John Day basin in the summer of 2013. She plans on using change detection techniques and geomorphic theory to understand the efficacy of restoration activities in the John Day watershed.

Trevor Langston, also a first-year Masters student, spent the summer working with the USGS's hydroecology of flowing waters project. Trevor is in the research design phase of his planned research in the origins and dynamics of habitat and cold-water refugia in the Upper Willamette River, Oregon.

Sarah Proctor (Masters student) also helped Pat McDowell conduct stream surveys in the Middle Fork John Day basin in the summer of 2013 and is gearing up for her own summer field work using remote sensing to understand the mutual evolution of river channels and riparian vegetation communities in the South Fork Toutle River after the eruption of Mt. St. Helens in 1980.

Eli Tome (Masters student, Environmental Planning and Policy) has just started his work at the university of Oregon, and in his own words he wishes to "help rural communities blend policies that help develop their economy, while simultaneously working to preserve the natural environment. I'm particularly interested in developing policies that recognize the connection of terrestrial and aquatic environments within watersheds, and how people interact and rely upon these natural systems."

Andrew Dutterer (Concurrent Masters student, Environmental Studies and Community & Regional Planning) guided a group of 11 undergraduate students in the Environmental Leadership Program through field research on the McKenzie River, Oregon. Pollyanna Lind assisted in this research that was done in partnership with the McKenzie Watershed Council. Andrew's own research has focused on collaborative management processes directing a basin-wide salmon restoration monitoring project on the Middle Fork of the John Day River, where he assisted Professor Pat McDowell in field research in the summer of 2013.

BOOKS

Key Concepts in Geomorphology

By Paul Bierman and Dave Montgomery

Just a short note to let everyone know that **Key Concepts in Geomorphology**, the first new geomorphology textbook in many years, was published in December 2013 and is now available for classroom use. The development of the textbook and accompanying electronic media was supported in part by the US National Science Foundation.

This book differs from other textbooks in several ways. Most importantly, the content reflects extensive community input. Every chapter was reviewed by experts in the field and more than 40 reviewers have edited drafts of the book. It's full color, with hundreds of photographs and all new, pedagogically designed figures.

The book is already being used widely in the US and abroad and the reviews we've heard so far have all been positive. The book is suitable for use in geomorphology and physical geography courses and is being used in both.

You can learn more and order an examination copy from the WH Freeman web site:
http://www.whfreeman.com/catalog/Product/keyconceptsingeomorphology-bierman

If you have any questions, please get in touch with

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Progress in Physical Geography

By David Butler

Consider Suggesting a "Classics Revisited" or "From the Archives" Paper.

The international journal Progress in Physical Geography, published six times a year, is looking for authors who would be interested in submitting a paper to the journal's "Classics Revisited" section, which exams classic publications in any field of physical geography. How is a classic publication defined? That is often up to the author of the piece - it may be a publication that has significantly affected the field, it may be a paper that deserves a greater appreciation than it received when first published, or it may be a publication that was the first of its kind. "Classics Revisited" also publishes papers in "From the Archives", where a group of publications and the effects they have had on physical geography are examined. Contributions in either category can be focused on a specific portion of the discipline, e.g. geomorphology, or they can examine the broad field of physical geography. Interested? Potential authors should contact the Section Editor, David Butler at db25@txstate.edu , for more information or to pitch an idea for a contribution to the section. Please consult recent issues of the journal for published examples of "Classics Revisited" and "From the Archives" papers.

JOURNALS

Geomorphology

By Richard Marston

P2013 marked the 26th year that Elsevier has published the journal, Geomorphology. It is now published 24 times per year, with 4200 pages published in 2013. A Virtual Special Issue was published to celebrate the 25th anniversary of Geomorphology, available at http://www.journals.elsevier.com/geomorphology/virtual-special-issues/virtual-special-issue-for-geomorphologys-25th-anniversary/

This Virtual Special Issue consists of a collection of highly downloaded and top-cited papers published in the journal, and our selection was refined using a keyword search to include as many papers as we can that truly reflect the full spectrum of the discipline, from fundamental theory and science to applied research of relevance to sustainable management of the environment. Our selection also showcases a few more recent papers that reflect our current understanding of the field too.

The three co-editors-in-chief remain Richard Marston (since 1999, located at Kansas State University), Andy Plater (since 2005, located at the University of Liverpool), and Takashi Oguchi (since 2003, located at the University of Tokyo). The senior editor for special issues in the Americas is Jack Vitek and for the rest of the world is Adrian Harvey. The book review editor is Dave Butler. The Editorial Board is comprised of 65 members from around the world. Vic Baker and Nel Caine have served on the Editorial Board since the beginning in 1987! David Alexander, Ellen Wohl, and Oliver Korup have each reviewed over 100 manuscripts since 2005! Over 60,000 pages have been published since the first issue in July 1987. 114 special issues have been published, including the six below for 2013.

109. Studying Water-Erosion Processes with Geoinformatics (Guest Editors: Tal Svoray and Peter M. Atkinson)
110. Geomorphology in Spain: Special Issue in Honour of Prof. Mateo Gutierrez (Guest Editors: F. Gutiérrez, A.M. Harvey, A. Cendrero, J.M. García-Ruiz and P.G. Silva)
111. Coastal Geomorphology and Restoration--44th Binghamton Geomorphology Symposium (Guest Editors: Nancy L. Jackson, Karl F. Nordstrom, Rusty A. Feagin and William K. Smith)
112. The Field Tradition in Geomorphology: 43rd Binghamton Geomorphology Symposium (Guest Editors: Carl Legleiter and Richard Marston)
113. Process Geomorphology and Ecosystems: Disturbance Regimes and Interactions (Guest Editors: Markus Stoffel, Stephen Rice and Jens M. Torowski
114. Continental Shelf Drowned Landscapes (INQUA-CMP and IGCP-526) (Guest Editors: K.M. Cohen and F.J. Lobo)

The 2-year Impact Factor is 2.552, an all-time high for the journal, which places it very high among Geology journals. The 5-year Impact factor = 3.066. The number of manuscripts being submitted to the journal continues to grow at a high rate and will exceed 700 for 2013. Over 900,000 full-text articles were downloaded from the journal worldwide in 2013 via Elsevier's Science Direct website. The rejection rate for manuscripts is approximately 50%. It is now possible to publish Open Access articles in Geomorphology by selecting the sponsored article option after your acceptance. See http://www.journals.elsevier.com/geomorphology/how-to-publish-open-access/ .

"Article Usage Alerts" is a new free service offered by Geomorphology that enables authors to measure the impact of their article via its usage on ScienceDirect. At the journal website one can find a list of the "Most Downloaded Articles" and another list of the "Most Cited Articles." Members of the AAG Geomorphology Specialty Group occupy spots on both lists. The quality of reviews has never been better. In addition to regular articles, we are now encouraging submission of review articles, and some have already been published. Please contact one of the co-editors-in-chief if you are interested in submitting a review article on your favorite topic or if you are interested in organizing a special issue.

OTHER PUBLICATIONS

Edited Book

Butler, David R., and Cliff R. Hupp (Eds.), 2013. Treatise on Geomorphology, vol. 12, Ecogeomorphology. Academic Press, San Diego, CA, 1-321.

Chapters in Books

Butler, David R., 2013. Grazing influences on geomorphic systems. In: James, L.A., Harden, C.P., Clague, J.J. (Eds.), Treatise on Geomorphology. Academic Press, San Diego, CA, vol. 13, Geomorphology of Human Disturbances, Climate Change, and Natural Hazards, pp. 68–73.

Butler, David R., and Cliff R. Hupp, 2013. The role of biota in geomorphology: Ecogeomorphology. In: Butler, D.R., and Hupp, C.R. (Eds.), Treatise on Geomorphology. Academic Press, San Diego, CA, vol. 12, Ecogeomorphology, pp. 1–5.

Butler, David R., Clayton J. Whitesides, and Stephen G. Tsikalas, 2013. The faunal influence: geomorphic form and process. In: Butler, D.R., and Hupp, C.R. (Eds.), Treatise on Geomorphology. Academic Press, San Diego, CA, vol. 12, Ecogeomorphology, pp. 252–260.

Butler, D.R., Clayton J. Whitesides, John M. Wamsley, and Stephen G. Tsikalas, 2013. The geomorphic impacts of animal burrowing and denning. In: Butler, D.R., and Hupp, C.R. (Eds.), Treatise on Geomorphology. Academic Press, San Diego, CA, vol. 12, Ecogeomorphology, pp. 271–280.

Stoffel, Markus, Brian H. Luckman, David R. Butler, and Michelle Bollschweiler, 2013. Dendrogeomorphology: dating earth-surface processes with tree rings. In: Butler, D.R., and Hupp, C.R. (Eds.), Treatise on Geomorphology. Academic Press, San Diego, CA, vol. 12, Ecogeomorphology, pp. 125–144.

Westbrook, Cherie J., David J. Cooper, and David R. Butler, 2013. Beaver hydrology and geomorphology. In: Butler, D.R., and Hupp, C.R. (Eds.), Treatise on Geomorphology. Academic Press, San Diego, CA, vol. 12, Ecogeomorphology, pp. 293–306.

Journal Articles

Butler, David R., & Rachel M. Cavin, 2014. Biopedoturbation. Oxford Bibliographies Online: Geography. doi: 10.1093/obo/9780199874002-0077

Butler, David R., 2013. The field tradition in mountain geomorphology. Geomorphology 200, 42-49.

Butler, David R., 2013. Isaiah Bowman's Forest Physiography. Progress in Physical Geography 37(6), 855-858.

Butler, David R., 2013. Biogeomorphology and zoogeomorphology. Oxford Bibliographies Online: Geography. doi: 10.1093/obo/9780199874002-0061.

Butler, David R., and Markus Stoffel, 2013. John F. Shroder, Jr.'s 1978 and 1980 papers on dendrogeomorphology. Progress in Physical Geography 37(5), 701-705.

Stoffel, Markus, David R. Butler, and Christophe Corona, 2013. Mass movements and tree rings: a guide to dendrogeomorphic field sampling and dating. Geomorphology 200, 106-120.

GSG AWARD REMARKS - "Scientific Trespass"

This is a follow up on remarks made by 2013 Melvin G Marcus Distinguished Career Award recipient **Michael (Mike) Woldenberg** (University at Buffalo / SUNY Buffalo).

"Please note that the following response goes far beyond my comments at last year's awards presentation. Since then I have tried to summarize several ideas developed over a career and would like to share them in this response with the larger geomorphology community. As many of you know, I always enjoyed a great discussion about geomorphology and this is a way to say thank you for the award and leave you with some thoughts. If you have any comments and contributions in response, I would appreciate it if you would contact me via email (geomike@buffalo.edu) so that we can discuss these further and that I can include them with the appropriate acknowledgements in a peer-reviewed review paper sometime in the near future."

Mike Woldenberg

Scientific Trespass

(Expansion of remarks after receiving the Mel Marcus Award, April 12, 2013)

by Michael Woldenberg
Prof. Emeritus, Dept. of Geography,
University at Buffalo

My research has always exploited cross-disciplinary comparisons in searching for order and explanation of form. Most of the work has applied models that compare and explain forms and processes in geomorphology or economic geography to forms from biology and *vice versa*. This raises questions about disciplinary boundaries. Should disciplines be limited by the realm of the data (*e.g.* landforms or biological materials) or by a scale of investigation (*e.g.* between a minimum and maximum size) or enriched by a cross-disciplinary and comparative analysis of form using methods developed in one or more traditional disciplines? I have worked mainly with the second and third, a comparative analysis of form, using analogies, models and methods developed or applied by geographers, biologists, and other scientists *across traditional scales of investigation* (Woldenberg 1968a, 1985). Thus I am a practitioner of scientific trespass across these boundaries, in order to better understand the systematic aspects of the sciences. Fenneman (1919) was an early advocate of cross-disciplinary work in geography mainly to enhance the understanding of regions rather than the systematic sciences.

Of course I am not alone. There have been many of us. In fact, Mandelbrot (1967, 1977) created a new paradigm for scientific trespassers that has some roots in geography as well as mathematics. For some of the cross-disciplinary work by geomorphologists, see Williams (1997) who "tames" chaos theory for the uninitiated. See also Fonstad and Marcus (2005) on self-organized criticality, Fonstad and Murray (2007) on complexity, and Phillips on fractals (1993), chaos (1997, 2006) and emergence (2011).

G. K. Gilbert and Analogies

In a series of classic papers Gilbert (1886, 1896, 1909) discusses the use of analogy as a strategy for scientific explanation. Gilbert claimed that all scientific explanation begins with the use of analogy.

> The student's mind "...needs also to be stored with scientific knowledge, which shall serve as a foundation for analogies. If he would explain some feature of nature, he must depend on the explanations others have reached for other features; and he needs large resources of knowledge of the relations of phenomena." (Gilbert 1886, p. 288).
>
> "If my idea is correct--if it be true that tentative explanations are always founded on accepted explanations of similar phenomena---then fertility of invention implies a wide and varied knowledge of the causes of things, and the understanding of Nature in many of her varied aspects is an essential part of the intellectual equipment of the investigator... Knowledge of Nature is an account at the bank, where each dividend is added to the principal and the interest is ever compounded; and hence it is that human progress, founded on natural knowledge, advances with ever increasing speed." (Gilbert 1896, p. 12, 13).

To add to the investigator's store of knowledge that produces analogy, Gilbert (1909) advocated scientific trespass across disciplinary boundaries:

> "...to prevent misunderstanding, you are not to infer that an apology is made because I trespass on fields to which I have no title, for I am an advocate of the principle of scientific trespass. The specialist who forever stays at home and digs and delves within his private enclosure has all the advantage of intensive cultivation except one; and the thing he misses is cross-fertilization. Trespass is one of the ways of securing cross-fertilization to the paddock for his own crops, and of carrying cross-fertilization to the paddock he invades. Hypotheses, the trial theories which compete for development into final theories, spring by the principle of analogy from earlier and successful theories, and the broader the investigator's knowledge of explanatory science the greater his opportunity to discover hypotheses that may be applied to his own problems. Progress is ever through the interaction of the sciences one on another; and scientific trespass is one of the profitable modes of interaction. *The trespasser brings with him a mental attitude and a mental equipment which are new to the subject, and whether or no the idea he contributes eventually "makes good," its contribution creates a new category for observation and opens a new avenue of inquiry. And he carries back with him the pollen of new ideas..."* (my italics, Gilbert 1909, p. 122).

Hierarchies, Scaling (Horton's) Laws, Allometry and Isometry

A major aspect of my work reflects a 50-year interest in hierarchies, first involving central place systems and river networks and later tree-like networks in general. These hierarchies exhibit several geometric series relations with order. These were first described by Horton (1932, 1945) for streams and by Christaller for central place systems (1933, p.72, Baskin 1966, p. 67). Horton's method of ordering streams was slightly modified by Strahler (1952). See Strahler (1964) for a review of stream morphometry.

One can imagine a perfect geometric series where, for example, all areas are equal at a given order. Beckmann (1958) suggests a procedure for dealing with real hierarchical systems where there is always variability within an order. The range of the variability declines as size declines with the lower orders. Assuming little overlap between orders, one can rank from largest to smallest all the areas (or other variables as the case may be). If one plots the log of the size on the Y-axis against the log of the rank on the X-axis, the plot will be a straight line with a negative slope. (The graph may have a steeper decline at the smallest sizes). This is called a rank-size relationship. Beckman states that the rank-size relation (a power function) is an allometric relationship. Actually he should have said that two rank-size relations from a hierarchy could be

combined algebraically to form a power function. (I have not seen this derivation, but it can follow the method used in Woldenberg (1972) for geometric series). Power functions are often observed in natural and social systems. I will discuss their interpretation below.

At first I used Beckmann's idea that geometric series laws were rank-size, (Woldenberg 1966, Woldenberg and Berry 1967). But what causes the geometric series laws in the first place? The key may be the number law where the number of stream basins or market areas declines geometrically with order. This implies that the size of area increases with order.

Real systems exhibit an approximate geometric series showing a decrease of number with an increase of order for Strahler-ordered streams (this is equivalent to counting basin areas) and for central place market areas. The specific numbers at each order could be produced by mixing Christaller's hierarchies of hexagonal areas where space is successively divided by ratios of 3, 4 and 7 and taking a mean of two or three adjacent powers in the mixed series. For instance, 27 and 49 give an arithmetic mean of 38 and a geometric mean of 36.37. The two are combined to make the predicted value of approximately 37 (Woldenberg1968a, 1968b, 1969). I found that similar numbers per order occur for market areas of cities, basin areas of rivers, and branches of cow livers and trees. For instance, the following model agreed well for the number of market areas around Vaasa, Finland: 1, 3, 10, 37, 147, 518. Another model agrees with venous branching in cow livers (and the arterial branching of a human lung): 1, 3, 10, 37, 118, 421. A common river network resembles the following model: 1, 5, 21, 97, 421. In the past few years I have been working on an improved method for duplicating the observed series of number versus order for market or basin areas and for several biological branching networks (unpublished research).

Furthermore, since first order areas are approximately the same size, and since flows are proportional to size of area, and area forms a positive geometric series with order, then flows should increase geometrically with order. Other geometric variables such as basin length, stream width and depth or dynamic variables such as velocity, should also scale geometrically with order. In the case of central place systems, there should be geometric series laws for the number, size of market areas, distance traveled to market, the number of functions and the population (Christaller, 1933, p.72; Baskin1966, p. 67).

This leads to a general statement: two geometric series relating Y and X with order are related by a power function:

$$Y = aX^{b} \text{ and } b = \log R_Y / \log R_X. \qquad (1)$$

The ratios of change in each series are given by R_Y and R_X. (Leopold and Miller 1956, Woldenberg 1972). Such power functions reflect an allometric (or isometric) relation. If geometrical similarity is preserved as size changes, the relation is isometric. If shape (or function) changes with changes in size, the relation is allometric. Sometimes, increase in size requires a change in shape. (In the case of animals, "The organism changes geometrically to remain the same, physiologically." (Brody, 1945, p. 580). This is a good starting hypothesis for interpreting power functions in biological data and perhaps central place and river hierarchies. For an excellent review of allometry, see Gould (1966). Gould points out that function is maintained when certain key ratios of allometric relationships are preserved as size increases. He cites as an example that mammals of all sizes have four heartbeats per breath, even though large animals like elephants have few breaths and heart beats per minute, while mice have many breaths and heartbeats per minute.

In passing, I should mention that in economics a power function measures what is called elasticity. The exponent, equivalent to b in (1), is expressed as the percent change in Y divided by the percent change in X. In the study of fractals, the power function exponent b is known as the fractal dimension.

To summarize: the key to understanding power functions in hierarchical systems is to first understand how the geometric series of number with order is generated because number is inversely related to area. Given this number series, then area and flow, etc. also must scale geometrically with order. The precise geometric ratios and their related power functions preserve some function or principle

of optimality as size increases. For systems that are not characterized by geometric series laws, if two variables from the same system are rank size, then they are also related by a power function that may be optimal in some way.

Studying Biological Trees

At a dinner party in Boston, Martha Williamson mentioned that she had completed a Masters degree on cow livers at Cornell University (Williamson 1967). The thesis contained maps of the larger vessels of the hepatic vein, portal vein and the bile system for several cow livers. I assigned Strahler orders to the networks and was surprised to find the same mixed hexagonal hierarchies that could be found in central place and stream systems. I included these examples as well as data taken from botanical trees in my dissertation (Woldenberg 1968, 1969).

In the fall of 1968 Prof. Arthur Strahler told me about a morphometric study of the human airway in a past issue of *Science*. I contacted Prof. Averill Liebow at Yale and he put me in touch with Prof. Gordon Cumming's group of lung physiologists at the Queen Elizabeth Hospital in Birmingham, U.K. Cumming invited me to come to England to work on their lung data. Keith Horsfield had measured and indexed the connectivity of every link in a cast of the human airway (in the proximal zone above 8 mm. in diameter). Shiam Singhal had done the same for the human pulmonary artery. Each tree took one year to measure. This collaboration resulted in a pioneering study applying Strahler ordering to the human pulmonary artery and airway. In addition to the number law, we derived the length and diameter laws for the left and right lungs for the P.A. and the airways (Woldenberg et al. 1970; Cumming et al. 1970; Singhal et al. 1973). Branches from several of the broncho- pulmonary segments (a major region) of the left lung pulmonary artery were assigned orders and the numbers were very close to the central place hierarchy around Vaasa, Finland. The right lung pulmonary artery hierarchy segments often resembled the Munich system (Woldenberg et al. 1970). The airway exhibited a hierarchy with a low bifurcation ratio, $R_b = 2.8$, which I had never seen before.

Angles of branching and the least cost location of the junction

In a widely under-appreciated part of his argument showing that streams cut their own valleys, Playfair notes that even when a river network and its valleys develop in a hilly or mountainous region, "...Through them all, this law is in general observed, that where a higher valley joins one, of the two angles which it makes with the latter, that which is obtuse is always on the descending side...This alone is a proof that the valleys are the work of the streams;..." (Playfair 1802, p. 114, Chorley et al. 1964, p. 62).

Playfair is correct but not complete. Compare Playfair's statement to the observations of Roux (a collaborator of Pasteur) on arterial branching: "If an artery bifurcates into two equal branches, these branches come off at equal angles to the main stem. (2) If one of the two branches be smaller than the other, then the main branch, or continuation of the original artery, makes with the latter a smaller angle than does the smaller or 'lateral' branch. And (3) all branches which are so small that they scarcely seem to weaken or diminish the main stem come off from it at a large angle, from about 70 degrees to 90 degrees." (Thompson 1942, p. 952. Thompson's source and date of Roux's quote is ambiguous, but it must be before Murray's publications in 1926. The translation or summary is Thompson's).

Thus geomorphologists and biologists have long had an interest in branching angles between three streams or blood vessels meeting at a junction point. Observations led to empirical rules without an understanding of cause. If we see this problem as finding a junction of minimum cost, then simultaneously the angles between the branches are determined, and vice-versa. Thus one can use costs directly to produce a cost surface or to calculate angles between the branches.

An analogous problem is the location of a factory between two raw materials and a market. This was first modeled as a problem in statics, using weights to substitute for transportation costs/distance. This approach was used by the engineer Launhardt (1882) and by the economic geographer Weber (1907); see Georg Pick's mathematical appendix).

Pick also demonstrated the use of cost contours (isodapanes) to generate an aggregate cost surface. The lowest point on this surface located the factory. It simultaneously produces the optimal branching angles. (See Woldenberg and Horsfield (1983) for an historical summary of the problem).

Locating the junction away from the minimum cost point may cause a large departure from the optimal branching angles. Biologists have focused on angles, whereas economic geographers have focused on cost and ignored angles. Luna Leopold (1971) has also written on finding a minimum cost point for a junction of three branches using a cost surface.

Murray introduced the concept of optimality (cost minimization) to understanding what we would call the "hydraulic geometry" of arterial trees (Murray 1926a). Murray proposed that an artery minimizes the sum of pumping power (which favors larger diameters) and metabolic power cost (which favors smaller diameters). Using differential calculus, he derived that for *laminar* flow, power is minimized when

$$Q = C r^3 \qquad (2)$$

or, for students of the hydraulic geometry of rivers

$$r = a Q^{0.33} \text{ and } v = k Q^{0.33} \qquad (3)$$

where Q is flow, and r is radius, v is velocity and C, a and k are constants; $a^2k = 1$ and $(pi)\ r^2v = Q$. Murray (1926b) derived the angles of branching that would minimize power losses. These angles correspond to the general observations of Roux.

Uylings (1977) derived the flow - radius exponents and branching angles to minimize pumping and metabolic power losses for *turbulent* flow in arteries. Uylings found

$$Q = Cr^{7/3} \qquad (4)$$

In the format of hydraulic geometry,

$$r = aQ^{3/7} \text{ and } v = k Q^{1/7}. \qquad (5)$$

Compare these decimal exponents ($r = aQ^{0.43}$, Area $= a^2Q^{0.86}$ and $v = k Q^{0.14}$, to the average down stream relations for rivers where width x depth $= acQ^{0.9}$ and velocity $= k Q^{0.1}$. (Leopold and Maddock 1953). This comparison led me to attempt to connect the hydraulic geometry relations to minimizing power losses from fluid and sediment transport. (Yang et al., 1981).

Horton (1945) predicted the angle between a tributary and a main stream based on their slopes at the junction. Howard predicted river branching angles using the minimum power hypothesis (Howard 1971, 1991). With the correct angles, one can find the location of the junction at the lowest point on the cost surface.

Based on the work of Murray (1926a, 1926b and Howard (1971), Andre Roy (1982, 1985) developed least cost models for the branching angles of airways and rivers. The problem with angle models is that a substantial deviation from the ideal branching angles often does not correlate with the small increase in cost above the least cost position of the junction.

Evidently, costs, not angles, should be measured directly. Woldenberg and Horsfield (1983) measured the cost of 199 junctions from a cast of a human pulmonary artery. Each junction had three branches. The branch diameters at the junction and the positions of the free ends of each branch were recorded. The optimal junction location would depend on the "cost" used in the model. With this approach, the branch cost is given by the branch cost per unit length times the length and the sum of the costs for the three branches gives the cost of the junction.

Four minimum cost models were tried: surface area; volume; drag; and power. A dimensionless index (I) was assigned to each model for a given junction: I = actual cost/ minimum cost, where I is equal to or greater than one. The lowest value of I among the four principles was the "winner." Of the 199 junctions, the surface minimization principle won 126 times, volume won 48 times, drag won 9 times and power won 16 times. This result contradicts the expectation predicted by Murray (1926a, 1926b), that minimizing the sum of pumping power under conditions of laminar flow and the metabolic power cost of nourishing the volume of blood would be the relevant cost governing the location of junction points in arteries.

Three years later Woldenberg and Horsfield (1986) made a study of the angles for the same data set and devised a figure for predicting the best fitting of the four optimality principles. The observed angle between the two daughter branches was compared to the theoretical angles for each of the four cost principles at the observed exponent (x) for the radii at the junction. The value of x is given by

$$r_o^x = r_1^x + r_2^x \qquad (6)$$

where the parent branch radius is r_o and r_1 and r_2 are the radii of the two daughter branches. The junction with the best fitting angle also had the best (lowest) I index.

Grafting and reversal of flow in arteries

I found some examples of the reversal of tributary flow direction in the microcirculation of the spinotrapezius muscle of the rat. (Woldenberg 1986, p. 20). Apparently two arterioles grow towards each other with the acute angles between tributaries pointed in opposite directions. (Imagine two networks growing upslope on either side of a ridge). Tributaries from the two arterioles meet and join. I called this a G point to indicate grafting, a form of capture without the beheading seen with stream capture. It is easy for the geomorphologist to find these points of grafting. So far as I know, this grafting point that indicates the directions and development of network growth has not been recognized by anatomists.

Geomorphologists recognize that trellis drainage with tributaries entering a main streamat approximate right angles is caused by dipping or folded beds. A visually similar type of drainage pattern in the microcirculation is seen in striated muscles (muscles that have repeating patterns of thick and thin filaments). (Schmid-Schonbein et al. 1986, p. 44).

Network Size and Link Length in Rat Purkinje Cells of Various Ages

Prof. Roberta Pentney from the Medical School at the University of Buffalo asked me to collaborate on a study of the effects of aging on Purkinje cells in the cerebellums of rats. Purkinje cells form two-dimensional tree networks with several hundred first order branches and are amenable to the kind of analysis and measurement used on river networks. The number of terminal links was used to represent the size of the cell. We found that the number of terminal links increased from birth to 10 months (full maturity). At 18 months many cells began to deteriorate and lose branches and some died and disappeared. For very long-lived rats (28 months) a few Purkinje cells grew very big while the number of cells decreased.

We also observed that in mature healthy rats (10 months) the lengths of paired exterior (source) links were 13 and 8 microns. Unpaired exterior links (tributary source) links were 13 microns and interior links were 5 microns. Bifurcation ratios were often 3, but sometimes greater (and most did not fit my branching model). The link lengths suggested a Fibonacci growth model controlling link lengths. At 18 and 28 months, exterior links shorten and eventually disappear. When unpaired exterior links disappear, interior links join and increase in length (Woldenberg et al., 1993). Trawinski (1998) has done a preliminary search for Fibonacci ratios in stream link lengths.

Kinematic Waves of Red Cells in Capillaries

In my remarks to the Geomorphology Specialty Group on April 12, 2013, I said that it may be possible to interpret the movement of groups of red cells in capillaries as kinematic waves. The theory of kinematic waves was applied to groups of cars moving down highways by Lighthill and Witham (1955). Langbein and Leopold (1968) used the model to explain the movement of river channel bars and dunes. I had seen the movement of groups of red cells in a video presentation at a symposium on the microcirculation in 1985. At the time of my talk, I was not aware of further research on this topic. Later, I learned Lighthill (1968) found the model applicable to the movement of pellets in fluid filled elastic tubes. He also suggested that the model be applied to the movement of red cells in capillaries. Later, Fitz-Gerald (1969), Gaehtgens et al. (1980), Secomb and Gross (1984), Boryczko et al. (2003), and Giovanna et al. (2012), have described dynamical clustering of red cells in capillaries. Undoubtedly more references exist. I believe this area deserves further investigation,

using the graphical techniques of Langbein and Leopold (1968).

James Keill (1708) and Blood Vessel Morphometry

Now and then similar ideas develop in separate sciences and there is little impact across the disciplinary boundary. In the case of network morphometry in biology and fluvial geomorphology, the similar developments were separated by over 200 years! Robert Horton (1932, 1945) had a great impact on geomorphology by introducing network morphometry. He reversed the traditional (biological) method of *centrifugal* ordering from the main stream to the periphery. Thus, he introduced *centripetal* stream orders and derived geometric series scaling laws of number, length and basin area.

In an almost completely ignored paper, I describe the prescient work of James Keill (1708, 1738; Woldenberg 1997). Keill was interested in the circulation of the blood in order to explain how glandular secretions are created and distributed in humans. For simplicity he assumed that an artery bifurcates toward the periphery into two daughter branches. *Thus each branching began a new centrifugal order.* He measured the lengths and diameters of arteries at each order. He used the values at each order to create geometric-series scaling laws for the relation between order and number, mean length and mean diameter of arteries. Thus Keill anticipated Horton's laws. He also was able to estimate the number of orders in the network and used the sum of a geometric series to estimate the travel time for blood to traverse the network from the heart to the periphery.

The primary difference between Keill's and Horton's morphometry was the method of ordering. We now understand that centrifugal ordering, still used by many biologists, will not yield reliable scaling laws unless branching is perfectly symmetical. Horton's centripetal ordering as modified by Strahler (1952) handles asymmetrical branching and gives much more reliable scaling laws.

Conclusion

I believe, with Gilbert (1909) that scientific trespass enriches the supply of analogies that can be used to help explain form and process in geomorphology. We have much to learn from biology, especially physiology. *I also believe that we, as geomorphologists, can enrich the store of analogies and explanations in other disciplines even if we ordinarily operate at different scales.* I have seen my colleagues from biology and physiology eager to learn what we have to offer. It is clearly a two way street. D'Arcy Thompson (1942) believed that form results from some kind of optimality or goal seeking behavior. I believe that this system behavior is made possible by allometric power functions. These power functions can be constructed from the quotient of the logs of ratios in geometric series laws or their rank-size equivalents. The investigation of numbers of areas at each order reveals the same numbers at different kinds of hierarchies: market areas; basin areas; blood vessels and bile ducts. Paraphrasing Schaefer: Repeating… patterns are the expression of morphological laws (Schaefer 1953, Bunge 1962).

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