



Introduction to the special issue: The field tradition in geomorphology

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ABSTRACT

In recognition of the critical role of field observations in the ongoing development of our discipline, the 43rd annual Binghamton Geomorphology Symposium (BGS) celebrated *The Field Tradition in Geomorphology*. By organizing a conference devoted to this theme, we sought to honor the contributions of pioneering, field-based geomorphologists and to encourage our community to contemplate how field work might continue to provide unique insight into a new, more technologically-driven era. For example, given recent advances in remote sensing methods such as LiDAR, what kind of added value can field work provide? Similarly, how can field-based studies contribute to societally relevant, large-scale questions related to climate change and sustainable management of the Earth system? Motivated by such questions, the 2012 BGS was convened in Jackson Hole, WY, a new, Western location that enabled participation by Rocky Mountain and west coast research groups underrepresented at previous Binghamton symposia. Also, in keeping with the field tradition theme, the 2012 BGS emphasized field trips, including a rafting excursion down the Snake River and an overview of the tectonic and glacial history of Jackson Hole. The on-site portion of the symposium consisted of invited oral and poster presentations and contributed posters, including many by graduate students. Topics ranged from an historical overview of the development of geomorphic thinking to long-term sediment tracer studies to a commentary on the synergy between LiDAR and field mapping. This special issue of *Geomorphology* consists of papers by invited authors from the 2012 BGS, and this overview provides some context for these contributions. Looking forward, we hope that the 43rd annual BGS will stimulate further discussion of the role of field work as the discipline of geomorphology continues to evolve, carrying on the field tradition into the future.

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1. Introduction

Geomorphology is fundamentally concerned with the surface of Earth, the physical processes that act upon the surface, and the manner in which these processes vary across space and over time to create distinctive landscapes. As a line of scientific inquiry, the origins of geomorphology date back to ancient Greece, and since that time basic field observations of land form and various agents of process have played a central role in developing first a conceptual and eventually a more quantitative understanding of the surficial environment. Because humans interact with, and influence, this environment on a daily basis, geomorphology is relevant to everyone, and anyone who has ever contemplated a hillslope or stream channel has dabbled in geomorphology. The field tradition in geomorphology is, thus, well-established — it is a tradition to which we have all, to some degree, contributed.

To honor and commemorate this tradition, the 43rd annual Binghamton Geomorphology Symposium (BGS) convened September 21–23, 2012, in Jackson Hole, WY. To recognize the significance of

field observations, field work, and field experience to the discipline, the theme of the meeting was *The Field Tradition in Geomorphology*; this special issue provides a compilation of papers presented, in oral and poster form, at the three-day symposium. Because the BGS is widely recognized as a leading international conference devoted specifically to geomorphology and has been held each year since 1970, “the Binghamton,” as the meeting is affectionately known, has itself become a cherished tradition within the geomorphic community. The 2012 BGS kept this tradition alive by honoring the field tradition that defines geomorphology. This theme provided an opportunity to reflect upon the history of the discipline, acknowledge key contributions made by a generation of pioneering geomorphologists dedicated to quantitative analysis of field data, and to consider the role of field-based inquiry as the geomorphic research community moves forward in a new, more technologically-driven era.

The theme of the 2012 BGS also was quite timely. A number of prominent geomorphologists — most notably Luna Leopold, M. Gordon “Reds” Wolman, Stan Schumm, Mel Marcus, Harold “Duke” Winters, Donald Johnson, and Jim Knox, to name but a few — have passed away recently, and devoting some time to reflect on their work, and the contributions of field-based researchers in general, seems an appropriate means of honoring the field tradition established by these pioneers. This is also an important time to look forward, however, as the

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discipline is currently experiencing a period of great change. In recent years, for example, geomorphology has gained prominence through its application to Mars and other planets (e.g., Lamb et al., 2008; NRC, 2010; Kleinhans, 2011). Similarly, geomorphologists increasingly are called upon to address questions of environmental change and sustainability, for which an understanding of surface processes is critical (NRC, 2010). Moreover, powerful new methods of data acquisition (e.g., LiDAR) and analysis (e.g., numerical modeling) are transforming geomorphology and already have enabled a number of important advances (Bishop et al., 2011). As additional tools are developed and applied, the role of field observations and field work must evolve as well, and the Binghamton Symposium provided a forum for discussing ways to maintain, nurture, and enhance the field tradition during a time of great change within the discipline.

To be more specific, the 2012 BGS provided an opportunity to begin considering a series of important questions on the past, present, and future of geomorphology. Among these are the following:

1. How can the discipline honor an empirical, ground-based past, embrace a theory-driven, computationally intensive future, and build upon a foundation of traditional field observation as a new era of research on Earth and planetary surface processes unfolds?
2. As this progression takes place, what is the added value of field work, given that more detailed, more reliable measurements of form and process can now be obtained efficiently, with minimal time in the field, or even remotely, without visiting a site at all?
3. Similarly, what can we gain via field observation that cannot be derived from computational models and numerical simulations that have come to provide increasingly realistic representations of landscapes and the manner in which they evolve over time?
4. To what extent can field-based inquiry contribute to societally relevant, large-scale questions related to climate change and sustainable management of the Earth system?

Part of our motivation for organizing this conference was to encourage our community to ponder these issues and engage in a dialog regarding the field tradition and the future. The 2012 BGS featured a lively exchange of memories, ideas, and unique perspectives and we hope that ongoing discussion of these topics will serve to further invigorate geomorphology. More specifically, we encourage researchers to identify productive synergies between traditional field observation and new measurement and modeling technologies, as articulated by Roering et al. (2013-in this issue) and Church (2013-in this issue). In this manner, the 2012 meeting continued the long tradition of BGS contributing to the growth and development of geomorphology.

Similarly, we expect that another important outcome of the 2012 BGS will be enhanced interaction between geomorphologists and workers in other areas of study. By reflecting upon the field tradition and the future of our own discipline, we hope to establish a shared vision and sense of identity that will allow geomorphologists to more effectively contribute to interdisciplinary studies and address larger-scale questions related to sustainable resource management. Thus, although the 2012 BGS primarily catered to the core geomorphic community, these proceedings will also inform ecologists, managers, and others who stand to gain from longstanding and more recently developed methods and insights from geomorphology.

As part of this general community-building effort, we actually broke with tradition by introducing a new geographic location — the 2012 BGS was held in Jackson Hole, WY. Previously, the BGS primarily had been an eastern phenomenon, and Wyoming is the farthest west the conference has ever been held. This new venue encouraged participation from research groups in the Rocky Mountains and on the West Coast that had been underrepresented at previous Binghamton symposia and, thus, fostered interactions among geomorphologists from across the country. International participants also were numerous, representing Canada, the United Kingdom, Australia, France, Switzerland, and Brazil. In addition, the spectacular landscape of Jackson Hole, together with the

theme of the meeting, provided ample rationale to make the symposium itself more field-oriented, featuring two full-day field trips described below.

These trips also helped to ensure that the field tradition would be passed on to the next generation of geomorphologists. The 2012 BGS involved established, senior personnel and also younger, up-and-coming researchers. Graduate students and early-career faculty were actively recruited to the symposium so that they might better appreciate the field tradition and be inspired to carry it forward through their own work. Although oral presentations and featured posters were by invitation, an open poster session gave students and faculty of varying rank an opportunity to showcase their work at a conference that was smaller, more focused, and more personal than the annual meetings of large professional organizations (e.g., the Association of American Geographers, or AAG, the Geological Society of America, or GSA, and the American Geophysical Union, or AGU). In total, 119 participants attended the conference, including 57 graduate students.

2. Rationale for the symposium

The key objectives of the 2012 BGS were to provide a venue to reflect upon the field tradition in geomorphology and to discuss the added value of field work when used in combination with more advanced methods of data collection and analysis. The conference served to foster an introspective evaluation of the historical development, current status, and future prospects of geomorphology. We believe that this assessment will help the geomorphic community to appreciate its scientific heritage and draw upon this proud tradition as researchers in the field pursue an ambitious agenda that is highly relevant to society (NRC, 2010). Similarly, we hope that the 2012 BGS will stimulate geomorphologists to strategize and identify ways in which traditional field observations might benefit from, and also enhance, more recently developed techniques, ultimately leading to novel insight on Earth surface processes.

Beginning with the first symposium, held in Binghamton in 1970, the BGS has served as a unique means for geomorphologists to gather and participate in focused discussions on a particular topic (Table 1). This series of meetings has played an important role in our community because geomorphologists tend to be housed in a range of different academic departments, including geography, geology, civil engineering, and, more recently, environmental science. Similarly, because geomorphologists generally attend conferences associated with their home departments (i.e., AAG for geography and GSA for geology), opportunities to meet and discuss geomorphology at conferences are limited. The purpose of the BGS series is to provide this type of opportunity and encourage the kind of intellectual exchange so critical to keeping a scientific discipline lively, energetic, and well-integrated. The 2012 symposium fulfilled this objective by bringing together senior researchers, early career scientists, and graduate students from across the country, including a much stronger contingent from western states, and around the world. The 27th Binghamton Symposium on *The Scientific Nature of Geomorphology* occurred a quarter century ago (Table 1) and the 2012 meeting allowed scholars representing various facets of the discipline, from mountain to coastal geomorphology, to revisit this theme by discussing the field tradition and the role of field work in future research. Because geomorphology is increasingly recognized as an important component of the Earth system central to biophysical interactions and various management issues, the proceedings of the symposium also will inform a broader community comprised of geographers and geologists as well as ecologists and resource managers.

To ensure that the overarching objectives of the symposium would be achieved, we pursued a pair of specific aims. The first goal of the 2012 BGS was to bring together the geomorphic research community to reflect upon the field tradition that has defined the discipline and to discuss the added value of field work as geomorphologists adopt more advanced, technologically and computationally-driven methods of data collection

Table 1

Binghamton Geomorphology Symposia (theme; organizer(s); location; year).

1. Environmental Geomorphology; D.R. Coates; Binghamton, NY; 1970
2. Quantitative Geomorphology; M. Morisawa; Binghamton, NY; 1971
3. Coastal Geomorphology; D.R. Coates; Binghamton, NY; 1972
4. Fluvial Geomorphology; M. Morisawa; Binghamton, NY; 1973
5. Glacial Geomorphology; D.R. Coates; Binghamton, NY; 1974
6. Theories of Landform Development; W.N. Melhorn & R.C. Flemal; Binghamton, NY; 1975
7. Geomorphology & Engineering; D.R. Coates; Binghamton, NY; 1976
8. Geomorphology in Arid Regions; D.O. Doehring; Binghamton, NY; 1977
9. Thresholds in Geomorphology; D.R. Coates & J.D. Vitek; Binghamton, NY; 1978
10. Adjustments of the Fluvial System; D.D. Rhodes & E.J. Williams; Binghamton, NY; 1979
11. Applied Geomorphology; R.G. Craig & J.L. Craft; Kent, OH; 1980
12. Space & Time in Geomorphology; C.E. Thorn; Urbana-Champaign, IL; 1981
13. Groundwater as a Geomorphic Agent; R.G. LaFleur; Troy, NY; 1982
14. Models in Geomorphology; M.J. Woldenberg; Buffalo, NY; 1983
15. Tectonic Geomorphology; M. Morisawa & J.T. Hack; Binghamton, NY; 1984
16. Hillslope Processes; A.D. Abrahams; Buffalo, NY; 1985
17. Aeolian Geomorphology; W.G. Nickling; Guelph, Ontario; 1986
18. Catastrophic Flooding; L. Mayer & D. Nash; Oxford, OH; 1987
19. History of Geomorphology; K.J. Tinkler; St. Catherine's, Ontario; 1988
20. Appalachian Geomorphology; T.W. Gardner & W.D. Sevon; Carlisle, PA; 1989
21. Soils & Landscape Evolution; P.L.K. Knuepfer & L.D. McFadden; Binghamton, NY; 1990
22. Periglacial Geomorphology; J.C. Dixon & A.D. Abrahams; Buffalo, NY; 1991
23. Geomorphic Systems; J.D. Phillips & W.H. Renwick; Oxford, OH; 1992
24. Geomorphology: The Research Frontier & Beyond; J.D. Vitek & J.R. Giardino; Hamilton, ON; 1993
25. Geomorphology & Natural Hazards; M. Morisawa; Binghamton, NY; 1994
26. Biogeomorphology; Terrestrial & Freshwater Systems; C.R. Hupp, W.R. Osterkamp, & A.D. Howard; Charlottesville, VA; 1995
27. The Scientific Nature of Geomorphology; B.L. Rhoads & C.E. Thorn; Urbana-Champaign, IL; 1996
28. Changing the Face of the Earth: Engineering Geomorphology; J.R. Giardino, R.A. Marston & M. Morisawa; Bologna, Italy ; 1997
29. Coastal Geomorphology; D.J. Sherman & P.A. Gares; Woods Hole, MA; 1998
30. Geomorphology in the Public Eye; P. Knuepfer & J.F. Petersen; Binghamton, NY; 1999
31. Modeling & Geomorphology; J.F. Shroder & M.P. Bishop; Binghamton, NY; 2000
32. Mountain Geomorphology - Integrating Earth Systems; D.R. Butler, S.J. Walsh, & G.P. Malanson; Chapel Hill, NC; 2001
33. Dams & Geomorphology; P.J. Beyer; Bloomsburg, PA; 2002
34. Ice Sheet Geomorphology; P.L.K. Knuepfer, J. Fleisher & D.R. Butler; Binghamton, NY; 2003
35. Weathering & Landscape Evolution; A.V. Turkington, J.D. Phillips, & S.W. Campbell; Lexington, KY; 2004
36. Geomorphology & Ecosystems; C.S. Renschler, M. Doyle, & M. Thoms; Buffalo, NY; 2005
37. The Human Role in Changing Fluvial Systems; W.A. Marcus & L.A. James; Columbia, SC; 2006
38. Complexity in Geomorphology; M.A. Fonstad & A.B. Murray; Durham, NC; 2007
39. Fluvial Deposits & Environmental History; P.F. Hudson, K.W. Butzer, & T.P. Beach; Austin, TX; 2008
40. Geomorphology & Vegetation: Interactions, Dependencies, & Feedback Loops; C. Hession, T.M. Wynn, J.C. Curran, & L.M. Resler; Blacksburg, VA; 2009
41. Geospatial Technologies & Geomorphological Mapping; L.A. James, M.P. Bishop, & S.J. Walsh; Columbia, SC; 2010
42. Zoogeomorphology & Ecosystem Engineering; D.R. Butler & C.F. Sawyer; Mobile, AL; 2011
43. The Field Tradition in Geomorphology; C.J. Legleiter & R.A. Marston; Jackson, WY; 2012
44. Coastal Geomorphology & Restoration; N. Jackson, K. Nordstrom, R. Feagin, & W. Smith; Newark, NJ; 2013
45. Planetary Geomorphology; D. Burr, A. Howard, & D. Jerolmack; Knoxville, TN; 2014
46. Laboratory Experiments in Geomorphology; S.J. Bennett, P. Ashmore, & C. McKenna Neuman; Buffalo, NY; 2015

and analysis. As several previous BGS have demonstrated, the meeting presents a unique opportunity for this type of state-of-the-science self-assessment (see, for example, the 12th, 19th, 24th, 27th, and 41st BGS). The 2012 symposium played a similar role by helping geomorphologists to develop a clear sense of where we have come from and where we, as a field-based field of study, are going. To stimulate and guide this kind of discussion, the second goal of the conference was to encourage those attending, as well as the broader geomorphic community, to carefully consider the questions posed above. We hope that the 2012 BGS leads to an ongoing exchange of ideas on the potential synergies between traditional field observations and more novel techniques as well as an effort to identify ways in which field-based geomorphologists can contribute to important, integrated studies in Earth system science. The 2012 BGS set in motion a process by which these ideas can be articulated, refined, and compiled to establish a research agenda that builds upon the field-based foundation of geomorphology and establishes a clear vision for the future of our discipline.

3. Overview of symposium and special issue

The BGS is a small annual conference that focuses on a different theme each year and typically consists of 15–20 invited papers, an open poster session, and often a field trip, spread over two and a half days. A list of symposia is provided in Table 1. To emphasize

the *Field Tradition in Geomorphology* theme, the 2012 symposium deviated from this structure and placed a greater emphasis on field trips. We anticipated that getting a group of geomorphologists out in the field together, observing and discussing the Earth surface, would provide a tremendously valuable, memorable experience; we were not disappointed. Indeed, among the highlights of the conference were two day-long field trips that provided opportunities to more directly experience and better understand this dramatic landscape.

The first excursion took 60 participants on a raft trip down the Snake River through Grand Teton National Park. In addition to conference organizers Marston and Legleiter, both of whom are involved in studies along the Snake, Jack Schmidt and Susannah Erwin helped to coordinate and lead the trip. The Snake River is a highly dynamic gravel-bed river that features a diverse range of channel morphologies, bears a strong tectonic imprint, and is subject to human impacts in the form of flow regulation (Nelson et al., 2013-in this issue). The trip began at Jackson Lake Dam with a discussion of water management issues and the implications for channel form and response. Representatives from the National Park Service also joined in this discussion because the Park Service is currently working to develop a revised management plan that reflects the recent designation of the Snake River as part of the National Wild and Scenic Rivers System (Fig. 1). Rafts put in at Pacific Creek, where Erwin



Fig. 1. The 2012 BGS featured a field trip along the Snake River in Grand Teton National Park that began with a discussion of river management issues of current concern to the National Park Service.

summarized the bedload transport measurements she has performed on this tributary, an important source of sediment for the Snake River below Jackson Lake. Once *en route* along the river, we made a series of stops at which Marston described the history of channel change along the Snake, Schmidt outlined the sediment budget of the river, and Legleiter discussed remote sensing methods for characterizing channel morphodynamics. The float concluded at Deadman's Bar, where a large cutbank comprised of fluvial gravel and glacial till provided a fitting segue to the second field trip.

The 2012 BGS continued on September 22, when 94 participants circumnavigated Jackson Hole to learn about the geomorphic history of this unique and beautiful valley. The trip was led by Dr. Ken Pierce, a distinguished scholar from the U.S. Geological Survey who has made significant contributions to our understanding of the tectonic framework of the American West, the volcanic activity associated with the Snake River Plain and Yellowstone caldera, and the history of Quaternary glaciation within the region. All of these topics featured prominently in the field trip as Dr. Pierce lead discussions of active normal faulting along the Teton Range front, moraines and terraces associated with various episodes of glacial advance and retreat, and numerous other landforms.

The on-site portion of the symposium consisted of a series of six invited oral presentations and a poster session. Invited presenters for the 2012 BGS were selected on the basis of their contributions to the geomorphic body of knowledge and their ability to comment insightfully on traditional field-based approaches as well as more recently developed methods. The opening keynote was delivered by Jack Vitek, who provided an entertaining and thought-provoking retrospective on the evolution of field work over the course of his career. Invited oral presentations were made by eminent geomorphologists Mike Church, Ellen Wohl, and Carol Harden as well as mid-career (Josh Roering) and early career (Kimberly Meitzen) faculty. Topics ranged from an anthology of lessons learned during decades of field studies conducted around the world (Harden, 2013-in this issue) to a commentary on the synergy between LiDAR-derived topographic information and traditional field mapping (Roering et al., 2013-in this issue). Complementing the oral presentations was a set of 11

invited posters, contributed by workers in a number of sub-disciplines of geomorphology, from fluvial and coastal to mountain and cold region geomorphology. The range of topics was considerable, spanning both field investigations, such as Haschenburger's study of the movement of tracer gravels along a Canadian river over a period of 20 years (this issue), and more historical or philosophical perspectives, such as Montgomery's "Faith in Floods: Field and Theory in Landscape Evolution before Geomorphology" (this issue). Finally, a total of 36 contributed posters, including 23 by graduate students, were presented at the symposium. A summary of the program, including lists of invited oral and poster presentations and contributed posters, is presented in Table 2. This special issue of *Geomorphology* compiles papers derived from the invited oral and poster presentations delivered during the 2012 BGS. Within the overall theme of *The Field Tradition in Geomorphology*, the articles that follow comprise three distinct categories, described in the following paragraphs.

The first set of papers provides historical and/or philosophical perspectives on the development of geomorphology (Montgomery, 2013-in this issue; Vitek, 2013-in this issue), the day-to-day practice of our discipline (Butler, 2013-in this issue; Harden, 2013-in this issue), and the complexity we confront in field settings (Wohl, 2013-in this issue). The first paper in this issue takes a longer-term, broader view of how people have conceptualized the origins of topography, which is the fundamental purview of geomorphology. Montgomery traces the evolution of thinking about the surface of Earth from the classical Greeks, through religious views focused on Noah's flood, to early geologists who learned to decipher Earth history from the rock record. Inspecting the development of our discipline revealed a theme that remains relevant to modern geomorphologists: faith in theories for landscape formation must not interfere with one's ability to assimilate field observations and allow the landscape to tell its own story. Vitek (2013-in this issue) also emphasizes the importance of observation, the common thread that links early scholars to current researchers through numerous intervening technological revolutions. The paper concludes with the important point that as human populations become ever more urban and technology-driven, geomorphologists serve a crucial role as the principal observers and reporters

Table 2

Contributions to the 2012 BGS (title, author(s), institution(s)).

Invited Oral Presentations:

- Geomorphology: Perspectives on Observation, History, and the Field Tradition, John D. Vitek, Department of Geology and Geophysics, Texas A&M University
- The Complexity of the Real in the Context of the Field Tradition in Geomorphology, Ellen Wohl, Department of Geosciences, Colorado State University
- Geomorphology in Context: Dispatches from the Field, Carol Harden, Department of Geography, University of Tennessee
- Geomorphology, Scale, and the Field Tradition: Applications for Environmental Flows, Kimberly M. Meitzen and Martin W. Doyle, Nicholas School of the Environment, Duke University
- Can Airborne Lidar Make Us Better Field Geomorphologists? Joshua J. Roering, Department of Geological Sciences, University of Oregon; Benjamin H. Mackey, Department of Geological Sciences, University of Canterbury, New Zealand; Kristin Sweeney and Natalia Deligne, Department of Geological Sciences, University of Oregon
- Shrinking the View: Knowing More and More about Less and Less, Michael Church, Department of Geography, University of British Columbia

Invited Poster Presentations:

- Experimental Sediment Introduction into the Rhine River Downstream from Kembs Dam: Feedbacks from Repeated Field Measures and High Resolution Imagery, Fanny Arnaud, David Beal, Hervé Piégay, Université de Lyon, France; Anne-Julia Rollet, Université de Caen, France; and Laurent Schmitt, Université de Strasbourg, France.
- Fieldwork – The Imperative Ingredient in Mountain Geomorphology, David R. Butler, Department of Geography, Texas State University-San Marcos
- Extending the Field Season: Employing Environmental Sensors to Capture Hillslope-channel Coupling in Arctic Alaska, Benjamin Crosby, Geosciences Department, Idaho State University; Joel Rowland, Los Alamos National Laboratory; Theo Barnhart and Pat Calhoun, Geosciences Department, Idaho State University; and David Finnegan, Cold Regions Research and Engineering Laboratory
- The Role of Fieldwork in Rock-Decay Research: Case Studies from the Fringe, Steve Gordon, Department of Economics and Geography, United States Air Force Academy; Ronald Dorn and Emma Harrison, School of Geographical Sciences and Urban Planning, Arizona State University; Case Allen, Department of Geography and Environmental Sciences, University of Colorado Denver; Niccole Cerveny, Cultural Sciences Department, Mesa Community College; John Dixon and Kaelin Groom, Department of Geosciences, University of Arkansas; Kevin Hall, Department of Geography, University of Northern British Columbia, Canada; Lisa Mol, School of Geography and the Environment, University of Oxford, United Kingdom; Paul Sumner, Department of Geography, Geoinformatics and Meteorology, University of Pretoria, South Africa; Alice Turkington, Department of Geography, University of Kentucky
- Tracing River Gravels: Insights from a Long-term field Experiment, Judith Haschenburger, Department of Geological Sciences, University of Texas at San Antonio
- Quantifying Hillslope Rates and Processes using an Interdisciplinary, Field-Based Approach, Arjun Heimsath, School of Earth and Space Exploration, Arizona State University
- Floods, Floodplains, and the Fluvial Signature of Extreme Events, Francis J. Magilligan, Department of Geography, Dartmouth College
- Interplay Between Field Observations and Numerical Modeling in Understanding Tree Root Throw Processes, Yvonne E. Martin, Department of Geography, University of Calgary, Canada; Edward A. Johnson, Department of Biological Sciences, University of Calgary, Canada; Olga Chaikina, Department of Geography, University of Calgary, Canada
- Faith in Floods: Field and Theory in Landscape Evolution before Geomorphology, David R. Montgomery, Department of Earth and Space Sciences, University of Washington
- Field Experiments in Unconstrained, Prototype Wind Tunnels, Douglas J. Sherman, Department of Geography, University of Alabama
- Mass Movements and Tree Rings: A Guide to Dendrogeomorphic Sampling and Interpretation, Markus Stoffel, Institute of Geological Sciences, Laboratory of Dendrogeomorphology, University of Berne, Switzerland, and Institute for Environmental Sciences, University of Geneva, Switzerland; David R. Butler, Department of Geography, Texas State University; and Christophe Corona, Institute of Geological Sciences, Laboratory of Dendrogeomorphology, University of Berne, Switzerland

Contributed Poster Presentations (* denotes student author):

- *Thirty Years of Fluvial Wood Dynamics in the Oregon Coast Range, Jane B. Atha, Department of Geography, University of Oregon
- *The Influence of Rock Properties on Bedrock and Sediment Erodibility in Laboratory Erosion Experiments and Natural Rivers, Jonathan D. Beyeler and Leonard S. Sklar, Department of Geosciences, San Francisco State University
- *Bedrock Strength Controls on the Erosion of the Colorado Plateau, Natalie Bursztyn and Joel Pederson, Department of Geology, Utah State University
- *Range of Variability in Geomorphic Changes in the Life Cycle of Beaver Ponds with Human Disturbances in Glacier National Park, Montana, Taylor A. Christian and David R. Butler, Department of Geography, Texas State University
- *The Role of Beaver in Shaping Steelhead Trout (*Oncorhynchus mykiss*) Thermal Refugia in a Central Oregon Stream, Florence N. Consolati and Joseph M. Wheaton, Department of Watershed Sciences, Utah State University; Bethany T. Neilson, Utah Water Research Laboratory, Utah State University; Nick Bouwes, Department of Watershed Sciences, Utah State University; and Michael M. Pollock, Northwest Fisheries Science Center, National Oceanic and Atmospheric Administration
- *Riparian Vegetation Change Jordan River, Utah, Brandon Davis, Jonathan Hilbert, and Suzanne Walther, Department of Earth Science, Utah Valley University
- *Three-Dimensional Field Mapping of the Granite Boulder Creek Restoration Project, Oregon, James Dietrich, Mark Fonstad, and W. Andrew Marcus, Department of Geography, University of Oregon
- *Hydraulic Modeling of Natural Step Crests in Step-pool Streams via Weir Flow Concepts, David Dust and Ellen Wohl, Department of Geosciences, Colorado State University
- Geomorphology, Photography, and 3D Mapping using Structure from Motion, Mark Fonstad and James Dietrich, Department of Geography, University of Oregon
- Field Work Drives Modeling to Predict Climate Change Effects on Streambed Scour and Consequences for Incubating Salmonids, Jaime R. Goode, University of Idaho, Center for Ecohydraulics Research; John M. Buffington, U.S. Forest Service, Rocky Mountain Research Station; Daniele Tonina, University of Idaho, Center for Ecohydraulics Research; Daniel J. Isaak and Russell F. Thurow, U.S. Forest Service, Rocky Mountain Research Station; Seth Wenger, Trout Unlimited; David Nagel and Charlie Luce, U.S. Forest Service, Rocky Mountain Research Station; Doerthe Tetzlaff and Chris Soulsby, Northern Rivers Institute, School of Geosciences, University of Aberdeen, Scotland
- Monitoring the Effectiveness of Large Wood at Maintaining Deep Pool Habitat through a 500-year Flood Event, Karen B. Gran (kgran@d.umn.edu), Department of Geological Sciences, University of Minnesota-Duluth
- *Drivers of Red Cedar Invasion Along the Missouri River, South Dakota, Samantha L. Greene and James C. Knox, Department of Geography, University of Wisconsin-Madison
- *Drainage and Landscape Evolution in the Bighorn Basin Accompanying Advection of the Yellowstone Hot Spot Swell Through North America, Eduardo Guerrero and Andrew Meigs, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University
- *Alpine Soil Temperatures: The Influence of Snow Depth and Duration, Jason R. Janke, Department of Earth and Atmospheric Sciences, Metropolitan State University of Denver
- *Field Evidence for the Timing of Formation, Deformation, and Incision of Colorado River Terraces near Moab, Utah, Andrew P. Jochems and Joel L. Pederson, Department of Geology, Utah State University
- *Flood Recession Rate Influence on Morphology of a Forced Bar in a Sand-bed Channel, Megan K. Kenworthy and Elowyn M. Yager, Center for Ecohydraulics Research, University of Idaho; Sarah M. Yarnell, Center for Watershed Sciences, University of California, Davis
- *Holocene and Modern Geomorphic Influences of Beaver in the Greater Yellowstone Ecosystem, Rebekah Levine, Grant A. Meyer, and Lyman P. Persico, Department of Earth and Planetary Sciences, University of New Mexico
- *A 50-year Natural Experiment: The Impact of Non-native Riparian Vegetation on an Unregulated Canyon-bound River, Rebecca B. Manners and John C. Schmidt, Department of Watershed Sciences, Utah State University
- *The Spatial Organisation of Large Wood in a Large Lowland River System: the Barwon-Darling River, Australia, Adrian R. Matheson and Martin C. Thoms, Riverine Landscapes Research Laboratory, University of New England, Australia
- Role of Erosion in Shaping Point Bars, John A. Moody and Robert H. Meade, U.S. Geological Survey
- *Periglacial Micromorphological Features in an Equatorial Páramo (Piedras Blancas), High Venezuelan Andes, Francisco L. Pérez, Department of Geography and the Environment, University of Texas at Austin

(continued on next page)

Table 2 (continued)

- *Effects of Riparian Vegetation on Topographic Change during a Large Flood Event, Rio Puerco, New Mexico, Mariela C. Perignon and Gregory E. Tucker, CIRES and Department of Geological Sciences, University of Colorado Boulder; Eleanor R. Griffin and Jonathan M. Friedman, U.S. Geological Survey
- *Integrating Field and Modeling Techniques for Studying the Geomorphic Response of River Systems to Climate Change, Sarah Praskievicz, Department of Geography, University of Oregon
- *Gully Headcut Erosion Mechanics and Morphological Consequences, Francis Rengers and Greg Tucker, Department of Geological Sciences, University of Colorado
- *3000-Year Record of Past Aridity in the Eastern Snake River Plain, Idaho: Evidence from the Idaho Falls Dune Field, Tammy Rittenour, Department of Geology, Utah State University
- *Spatial Distribution of Post-wildfire Hillslope Erosion caused by Convective Rainfall, Amanda R. Schmidt, State University of Santa Catarina, Brazil; and John A. Moody, U.S. Geological Survey
- *Measuring the Physical Complexity of Floodplains using LiDAR and Remotely Sensed Imagery, Murray Scown and Martin Thoms, Riverine Landscapes Research Laboratory, University of New England, Australia; and Nathan De Jager, Upper Midwest Environmental Sciences Center, U.S. Geological Survey
- *The Influence of Fire on Soil Erosion within the Alpine Treeline Ecotone, Divide Mountain, Montana, Melanie B. Stine and David R. Butler, Department of Geography, Texas State University
- *Determining the Degree of Glacial Modification in Mountainous Landscapes, Carl D. Swanson II and Audrey D. Huerta, Department of Geological Sciences, Central Washington University
- *Does Moss Grow on a Rolling Stone? Connections between Hydrologic Regime, Bed Disturbance and Periphyton Development, Christopher J. Tennant and Benjamin T. Crosby, Department of Geosciences, Idaho State University
- *Rock Mass Strength Controls on Erosion in the Teton Range, Wyoming, Lisa Tranel, Department of Geography-Geology, Illinois State University
- *The Geomorphological Signature of Mud-Nesting Swallows in Central Texas: Applying Ecosystem Engineering Concepts to Zoogeomorphology, Stephen G. Tsikalas, Department of Geography, Texas State University
- Modeling the Potential Effectiveness of Environmental Flows on the McKenzie River, Oregon, Suzanne Walther, Department of Earth Science, Utah Valley University
- *Cross-Valley Profiles in Deglaciated Canyons, Grand Teton National Park, Brandon J. Weihs, William D. Butler, and Richard A. Marston, Department of Geography, Kansas State University
- *Effects of Marmot-Induced Geomorphology on Conifer Germination: A Field and Lab-Based Approach, Clayton J. Whitesides, Department of Geography, Texas State University

of the Earth surface processes that affect us all. Building upon this conclusion, [Harden \(2013-in this issue\)](#) points out that field-based research enables a broader, more creative and open-minded perspective than office work and can lead to unexpected insights. In presenting examples of such ‘aha!’ moments, Harden illustrates the need to consider the spatial and temporal contexts of particular field sites and also our own preconceived mental contexts, echoing a theme from Montgomery. Spending time in the field can liberate us from these biases and allow the unexpected to lead to novel geomorphic insight. [Butler \(2013-in this issue\)](#) also argues that field work in mountain environments affords geomorphologists a unique opportunity to receive unanticipated, serendipitous “rewards” by which the landscape reveals formative processes. Moreover, the fine scales at which many of these processes operate favor field work over computational techniques and remote analysis. A prime example illustrating the value of field observations and conceptual synthesis thereof comes from Stan Schumm’s work on channel change, revisited by [Wohl \(2013-in this issue\)](#). Wohl describes how the ideas of complex response, river metamorphosis, and spatial zonation of drainage basins introduced by Schumm continue to guide thinking about alluvial systems in lowland environments. This paradigm is complemented by more recent research in resistant-boundary mountain channels, where field evidence points to non-linear response dominated by spatial and temporal thresholds. In both settings, Wohl argues, extensive field data are necessary to conceptualize and quantify these complexities and give rise to broadly applicable models of river process and form.

The next group of articles provides examples of current, field-oriented research spanning a range of sub-disciplines in geomorphology, from weathering ([Dorn et al., 2013-in this issue](#); [Heimsath and Burke, 2013-in this issue](#)) and hillslope processes ([Martin et al., 2013-in this issue](#); [Stoffel et al., 2013-in this issue](#)) to sediment transport ([Haschenburger, 2013-in this issue](#)) and channel change ([Nelson et al., 2013-in this issue](#)). Again, the unifying theme throughout this eclectic mix of topics is the critical role of field observations in forming our understanding of process. For example, [Dorn et al. \(2013-in this issue\)](#) describe a series of “case studies from the fringe” that illustrate the role of field work in rock decay research. Although laboratory and computational approaches recently have helped to advance our knowledge of rock weathering, this diverse collection of vignettes, drawn from environments ranging from the high arctic to a university campus, demonstrate that research on this topic remains “firmly footed in the field.” Similarly, [Heimsath and Burke \(2013-in this issue\)](#) review how

quantitative models of soil production and erosion have emerged from the marriage of field observations with more advanced analytical methods, such as cosmogenic radionuclide dating. By revisiting three key field sites that contributed to the development of these models and collecting higher spatial resolution data on chemical weathering rates and extents, [Heimsath and Burke \(2013-in this issue\)](#) highlighted the importance of quantifying local-scale variability in efforts to characterize soil production and erosion on hillslopes. Another process shaping forested hillslopes is tree root throw, which can lead to sediment transfer and soil formation. [Martin et al. \(2013-in this issue\)](#) use field data and numerical modeling to examine the role of tree topple in the development and temporal dynamics of pit-mound topography. For their primary field site in the Canadian Rockies, these dynamics are largely driven by wildfire disturbances, implying that the extent to which pit-mound topography is observed on the landscape is highly sensitive to when the observations are made, again attesting to the critical importance of site specific field data. Hillslopes also are affected by more episodic mass movements, and in this case, tree ring analysis can serve as a valuable dating tool. [Stoffel et al. \(2013-in this issue\)](#) describe dendrogeomorphic approaches to the study of landslides, avalanches, and debris flows and examine how issues related to sample distribution and sample size can influence reconstructions of these processes from tree ring records. This paper effectively argues for the need to set standards for data collection, analysis, and interpretation in field-based investigations.

Moving on to fluvial systems, the next paper originating from the 2012 BGS reports on a long-term tracer study of bed material transport. [Haschenburger \(2013-in this issue\)](#) monitored the dispersion of tagged gravels over a 17-year period and documented general trends and more complex patterns, such as channel locations where tracers become concentrated regardless of grain size. On the basis of these data, Haschenburger argues that field observations are critical to modeling sediment dispersion because they yield information on transport processes that must be provided as input to numerical models and cannot be obtained from laboratory flumes. Also taking a long-term perspective on channel change, and bringing the special issue closer to the site of the 2012 BGS, [Nelson et al. \(2013-in this issue\)](#) integrate previous field-based bedload transport measurements and sediment budgeting with an air photo analysis to examine the morphodynamics of the Snake River below Jackson Lake Dam from 1945 to 2002. This study indicated that changes tended to be concentrated in multithread reaches but did not detect systematic

narrowing or widening over time. Understanding the response of complex river systems, such as the Snake, will require a hybrid approach consisting of field observations and geospatial analysis.

The third set of papers casts an eye toward the future by describing how geomorphologists can contribute to interdisciplinary studies (Meitzen et al., 2013-in this issue), gain insight via the application of novel remote sensing methods (Notebaert and Piegay, 2013-in this issue; Roering et al., 2013-in this issue), and continue to honor the field-based heritage of our discipline in the context of ongoing technological developments (Church, 2013-in this issue). This last group of articles further illustrates how the field tradition in geomorphology provides researchers with a unique, intimate appreciation for the landscape that enables productive collaboration with workers from other disciplines and effective integration of emerging technologies. For example, Meitzen et al. (2013-in this issue) identify the specification of environmental flows as a research frontier for applied geomorphology. Environmental flows typically have been established based on ecological criteria, but Meitzen et al. point out that the interaction between flow, form, and substrate controls the distribution and suitability of habitat. Because geomorphology mediates the effects of flow regime on ecological processes, field-based investigations of channel and floodplain form and process can help to inform management decisions related to environmental flows. Another way in which geomorphology can evolve and continue to generate new knowledge is by adopting new methods of measuring and analyzing the landscape, as illustrated by the work of Notebaert and Piegay's (2013-in this issue) in the Rhone Basin of France. Digital terrain models and GIS tools were used to delineate floodplains and inform a hierarchical analysis that revealed significant local variability in floodplain width associated with lithological controls, base level changes and tectonics, and sediment supply. Though based on remotely sensed data, Notebaert and Piegay (2013-in this issue) emphasize that this type of geospatial analysis complements field-based investigation by enabling geomorphic processes, identified in the field, to be examined at larger spatial and temporal scales. Similarly, Roering et al. (2013-in this issue) refute the notion that remote sensing will replace field work, notwithstanding the remarkable insights generated in recent years as LiDAR has emerged as the preferred method of documenting the topographic signatures of active and ancient surface processes. In addition to providing useful base maps for field work, increasing sample size for testing models of landscape development, and allowing unanticipated landforms to be identified, Roering et al. (2013-in this issue) argue that LiDAR might enable geomorphologists to more effectively conceptualize landforms in the field by changing the way we perceive and think about the surface. Church builds upon this theme in the final paper of the special issue, a thoughtful commentary on the evolution and future prospects of geomorphology in light of technological advances and fundamental shifts in the way we conduct our science. Tracing the roots of geomorphology back to natural history, Church describes how the nature of field work shifted from long duration efforts to understand particular landscapes to relatively brief campaigns focused on collecting only those data required by model or theoretical criteria, reflecting a shift toward a more mechanistic approach that emphasizes generic formative processes. Such reductionism is inherently limited, however, and Church argues that geomorphology is a system science and that understanding larger-scale emergent phenomena will require direct observation – in other words, if we wish to comprehend the landscape, the field tradition must carry on.

4. Concluding remarks

The 43rd annual Binghamton Geomorphology Symposium, held in Jackson Hole, WY, focused on the theme of *The Field Tradition in Geomorphology* and this special issue presents a collection of papers presented at the conference and related to this general theme. In

addition to honoring the field-based heritage that defines our discipline, the meeting also provided an opportunity to contemplate the future of geomorphology and the role of field work as the study of the surface of Earth continues to evolve. The symposium provided a starting point for discussing this important topic, but we hope that the meeting, and the compilation of papers herein, stimulate further dialog regarding the added value of field observation as the discipline enters a new era shaped by emerging technologies, such as remote sensing, and the ways in which field-based geomorphologists can contribute to larger-scale understanding and management of the Earth system.

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