ABSTRACT PROCEEDINGS

(version October 5th 2005)

BGS '05

36th Binghamton Geomorphology Symposium

GEOMORPHOLOGY & ECOSYSTEMS

University at Buffalo - Buffalo, New York
October 7-9 2005

Abstracts by Titles

Abstracts by Author(s)

General Information

Organizing Committee:

- **Chris S. Renschler**, NCGIA/Dept. of Geography, University at Buffalo, Buffalo, NY
- **Martin W. Doyle**, Department of Geography, Univ. of North Carolina, Chapel Hill, NC
- **Martin C. Thoms**, CRC for Freshwater Ecology, University of Canberra, Australia

Sponsored by the

- **National Science Foundation** (Geography and Regional Science)
- **SUNY Conversations in the Disciplines** (State University of New York)
- **UB College of Arts and Sciences** (University at Buffalo)
- **UB Department of Geography** (University at Buffalo)

Supported by the

- **National Center for Geographic Information and Analysis** (University at Buffalo)
- **UB Blake Academic Success Center** (University at Buffalo)
- **UB Department of Geology** (University at Buffalo)

Contact Information

For more information or comments please contact the BGS 2005 organizers at:

- Telephone: +1 (716) 645-2722 ext. 23 / FAX: +1 (716) 645-2329
- Postal address: 105 Wilkeson Quad, Buffalo, New York 14261, U.S.A.
- Email: rensch@buffalo.edu
- BGS 2005 Webpage: http://www.geog.buffalo.edu/~rensch/binghamton/

Binghamton Geomorphology Symposium – A Brief History

In 1966 four geomorphologists and physical geographers at the State University of New York-Binghamton, all graduates of A.N. Strahler at Columbia University, began organizing weekly "brown-bag lunches" and discussing informally about their common interests: geomorphology and water. As the discussions became more focused over the next few years, and with the addition of Marie Morisawa to SUNY-Binghamton in 1970, the group put on the first Binghamton Geomorphology Symposium, focusing specifically on Environmental Geomorphology. These co-conspirators were dismayed at the increasing specialization and compartmentalization that had occurred in the sciences, and noted that many of the intriguing problems in science had become interdisciplinary. Because many problems in environmental science transcend traditional science and cut across scientific disciplines, they viewed the geomorphologist, as the surviving generalist in earth science, as being particularly capable of interacting in emerging environmental issues. Thus, they convened the first Binghamton Symposium, stating that "This Symposium is the first in what will be an annual symposia series in geomorphology." And so it was. The Binghamton Symposium has been held annually ever since for over three decades. Each year the Symposium covers a specific topic as it relates to geomorphology:

1. Environmental Geomorphology (1970)
2. Quantitative Geomorphology (1971)
3. Coastal Geomorphology (1972)
4. Fluvial Geomorphology (1973)
5. Glacial Geomorphology (1974)
6. Theories of Landform Development (1975)
7. Geomorphology and Engineering (1976)
8. Geomorphology in Arid Regions (1977)
9. Thresholds in Geomorphology (1978)
10. Adjustments of the Fluvial System (1979)
11. Applied Geomorphology (1980)
12. Space and Time in Geomorphology (1981)
13. Groundwater as a Geomorphic Agent (1982)
14. Models in Geomorphology (1983)
15. Tectonic Geomorphology (1984)
16. Hillslope Processes (1985)
17. Aeolian Geomorphology (1986)
18. Catastrophic Flooding (1987)
19. History of Geomorphology (1988)
20. Appalachian Geomorphology (1989)
21. Soils and Landscape Evolution (1990)
22. Periglacial Geomorphology (1991)
23. Geomorphic Systems (1992)
24. Geomorphology: The Research Frontier and Beyond (1993)
25. Geomorphology and Natural Hazards (1994)
26. Biogeomorphology (1995)
27. The Scientific Nature of Geomorphology (1996)
28. Engineering Geomorphology (1997)
29. Coastal Geomorphology (1998)
30. Geomorphology in the Public Eye (1999)
31. Modeling and Geomorphology (2000)
32. Mountain Geomorphology (2001)
33. Dams and Geomorphology (2002)
34. Ice Sheet Geomorphology (2003)
35. Weathering and Landscape Evolution (2004)
36. Geomorphology and Ecosystems (2005)
37. Human Impacts on Fluvial Systems (2006)
38. Complexity, Criticality, and Chaos in Geomorphology (2007)

Symposium Objectives

Of particular interest for the Binghamton Geomorphology Symposium (BGS) 2005 Geomorphology and Ecosystems" are empirical, theoretical, and modeling investigations of geomorphic and ecological links that occur at the whole ecosystem scale. Recent advances in ecological research have emphasized that material and energy flows and cycling across ecosystems are dominated largely at the biochemical and microbial levels, and further, that such processes are influenced heavily by either geomorphic setting or concurrent geomorphic processes. As such, we placed particular emphasis on soliciting papers focusing on links between geomorphology and biogeochemistry, nutrient cycling, and primary productivity within ecosystems (e.g. carbon fluxes within landscapes), both because of its relevance in terms of pure and applied research, and because this area has received relatively little attention within the geomorphic community.

We are glad to present papers that examine geomorphic and ecological links across a range of trophic levels within ecosystems, thus drawing attention to entire food-web dynamics that are influenced by geomorphic forms and processes. Finally, we drew upon more traditional geomorphic-ecological research by soliciting papers focusing on geomorphic influences on community ecology (e.g., habitats), and the influence of animals on landscapes. Several papers are targeted at more applied research within the realms of ecosystem restoration (e.g., river restoration, coastal restoration), and provide an appropriate balance between pure and applied science. We strongly believe that the BGS 2005 program provides a whole-system context for geomorphology and ecosystems, but also exposes some of the most critical and novel research currently underway. Further, we tried to create an atmosphere of truly interdisciplinary thinking and collaboration between geomorphologists and ecologists.

Our goal is a bit non-traditional from other BGS in that we explicitly target both geomorphologists and ecologists as speakers to present their expertise and cutting edge research in both fields. We seek to make each group more aware of the fundamental concepts, approaches, and current research within each discipline.

The goals of the proposed symposium are:

- current geomorphic research which is expressly focused on how geomorphic forms or processes affect whole ecosystems (at the watershed scale),
- current ecological research (at the ecosystem scale) which expressly considers geomorphology,
- conceptual issues within ecology and geomorphology which promote or restrict collaborative research (e.g., temporal and spatial scales, opposing methods of problem formulation),
- applications of geomorphology and ecology in environmental management or restoration, and
- increase exposure of research from young scientists, female scientists, students, and scientists from regions of the world not strongly represented in past Binghamton Symposia.

MANUSCRIPT ABSTRACTS

Paper 1: Remote sensing of floodplain geomorphology as a surrogate for biodiversity in a tropical river system (Madre de Dios, Peru)

Stephen K. Hamilton[1], Josef Kellndorfer[2], Bernhard Lehner[3], and Mathias Tobler[4]

[1] W.K. Kellogg Biological Station and Department of Zoology, Michigan State University, 3700 E. Gull Lake Drive, Hickory Corners, Michigan 49060, USA, [2]Radiation Laboratory, Electrical Engineering and Computer Sciences Dept., The University of Michigan, Ann Arbor, Michigan 48109, USA; [3] Conservation Science Program, World Wildlife Fund US, 1250 24th Street NW, Washington, DC 20037, USA; [4] Spatial Sciences Laboratory, Texas A&M University, 1500 Research Parkway, Suite B223, College Station, TX 77845, USA

The complex floodplains of large rivers offer a striking example of how geomorphology, by dictating patterns in the frequency and duration of soil saturation and surface flooding, influences ecosystem structure and function. This study draws on multiple sources of data from remote sensing, together with ground observations and water sampling, to distinguish floodplain ecosystems in the Madre de Dios River, a tributary of the Amazon River in Perú. This remote tropical river meanders across sub-Andean alluvial deposits in a tectonically active region and creates floodplain surfaces of varying ages, including terraces that are above the reach of present-day river floods. Data from Landsat ETM+ (optical multispectral), JERS-1 (L-band radar), and the Shuttle Radar Topography Mission (C-band interferometric Digital Elevation Models) were integrated in an object-oriented image analysis approach to distinguish five classes of floodplain vegetation. Vegetation classes generally correspond with successional age and reflect the activity of the riverine meander belt. Stage data for the river show erratic fluctuations and an annual range exceeding 8 m, but the maximum depth of floodplain inundation varied from >1 m close to the river to approximately 0.1 m on more elevated terraces. The major ion composition of standing waters on the floodplain during the dry season indicated the importance of emergence of local groundwater in maintaining saturated soils, particularly further from the river, where backswamp vegetation is distinct and includes palm swamps. Thus, a hydrological continuum exists from deep but sporadic river inundation near the river to constant soil saturation by groundwater emergence in distal backswamps, reflecting the geomorphological origin and age of the floodplain deposits. This hydrogeomorphic continuum results in fundamental ecological differences. The exceptionally rich biodiversity of the sub-Andean region may be ascribed in part to the enhanced biodiversity associated with fluvial geomorphological features, and, thus, conservation planning must account for the diverse landforms created by fluvial dynamics.

Paper 2: The role of aeolian dust in ecosystems

Grant McTainsh and Craig Strong

Centre for Riverine Landscapes, Faculty of Environmental Sciences, Griffith University, Brisbane, Queensland. 4111, Australia

The recent upsurge in research on aeolian dust has shown that dust transport systems operate on very large spatial and temporal scales, and involve much larger quantities of sediment than was previously realized. An inevitable consequence of this is that researchers from a range of neighbouring disciplines, including ecology, are beginning to realize that this new knowledge has important implications for their study areas. In the present paper, we examine the ecological implications (real and potential) of this expanding knowledge of dust transport systems, with a particular emphasis upon the Australian dust transport system. We track these ecological effects from source to sink. At source, wind erosion-soil-vegetation relationships are often dominated by temporal changes in rainfall. Nine years of measurements in the Channel Country of the Lake Eyre Basin, Australia show that vegetation and soils in dunefields can recover from drought, whereas on inter-fluve grasslands uni-directional and negative successional vegetation changes can result from wind erosion during drought. On floodplains, wind erosion and vegetation responses are complicated by flood frequency. Up to 1999, flooding of saline claypans did not increase vegetation but did increase wind erosion, through the supply of alluvial fines. After three floods within as many months, however, vegetation became established and rates of wind erosion r were dramatically reduced. Research on wind erosion is now gradually turning from the physical to the organic content of eroded dusts. In Australia organic matter content can reach 65% by mass, but this cannot be explained by removal of soil organic matter alone. Biological soil crusts stabilize soils against wind erosion and contribute to some of the organic dusts. The role of dust as a vector for pathogens is an area which deserves greater research attention in the future. Downwind from source, we show that dust contributions to soils are more widespread and more variable (in time and space) than earlier work on dust-derived loess soils has suggested. Recent studies also show positive dust impacts upon nutrient budgets within distant forest ecosystems, and significant contributions to river nutrient loads, especially in the arid sectors of internally-draining river basins. The number of studies of dust impacts upon marine ecosystems is increasing dramatically. Studies of dust within Antarctic ice cores combined with dust modelling provide compelling evidence that increased soluble iron-rich dust inputs to the Southern Ocean have stimulated phytoplankton populations. Modern process studies are, however, yet to clearly demonstrate these relationships. Finally, we examine the potential for major dust impacts upon global climates, using its positive and negative effects upon solar radiation and precipitation as examples of the complexity and importance of this new research area.

Paper 3: Influence of landslides on biophysical diversity – a perspective from British Columbia

Marten Geertsema[1] and James J. Pojar[2]

[1]Northern Interior Forest Region, British Columbia Ministry of Forests, Prince George BC, Canada V2L 3H9; [2]Canadian Parks and Wilderness Society –Yukon Chapter, Whitehorse, Yukon, Canada Y1A 5P7

Landslides have long been overlooked or underestimated as important natural disturbance agents. In particular the ecological role of landslides in maintaining biological diversity has been largely ignored. Here we provide a western Canadian (*British Columbian*) perspective on the influences of landslides on biophysical diversity, which is related in several ways to biological diversity. We recognize several types of biophysical/ecological diversity: site diversity, soil diversity, and the derivative habitat or ecosystem (including aquatic ecosystems) diversity. There are also a variety of landslide types, depending on materials and on the rate and style of movement. We discuss the roles of different landslide types on various aspects of terrestrial diversity. Landslides are simultaneously depositional and erosional processes that influence sites by redistributing materials and changing surface expression – usually creating a complex microtopography that can include very dry ridges and hummocks, and sometimes depressions with standing water. Landslide impacts to site also influence soil and soil development. Portions of landslides with exposed parent material are set back to the initial stages of soil development and ecological succession. Landslides can also change soil density, structure, porosity, surface texture, chemistry and microclimate. By changing site and soil, landslides also influence habitat. Landslides influence habitat diversity by engendering a mosaic of seral stages (often both primary and secondary), and in overwhelmingly forested landscapes often create nodes or hotspots of non-forested habitat and biota. In some areas, like the boreal forest, there is an important interplay between landslides and fire, while on the coast of British Columbia debris and snow avalanches can be the dominant disturbance agent. Low-gradient and deep-seated landslides are often opportunistically colonized by beaver and other water and shrub-loving fauna. Sag ponds and impounded streams provide aquatic habitat – often with standing dead trees. Landslide rubble and scarps provide denning/nesting habitat, escape terrain, and cliff habitat for vertebrates.

Paper 4: Precontact Vegetation and Soil Nutrient Status in the Shadow of Kohala Volcano, Hawaii

Oliver A. Chadwick[1], Eugene F. Kelly[2], Sara C. Hotchkiss[3], and Peter M. Vitousek[4]

[1]Department of Geography, University of California, Santa Barbara, CA 93106, [2]Eugene F. Kelly, Department of Crop and Soil Science, Colorado State University, Fort Collins, CO 80523, [3]Department of Botany, University of Wisconsin, Madison, WI 53706, [4]Department of Biological Sciences, Stanford University, Stanford, CA 94305

Humans colonized Hawai'i about 1200 years ago and have progressively modified vegetation, particularly in mesic to dry tropical forests. We use $\delta^{13}C$ to evaluate the contribution of C_3 and C_4 plants to deep soil organic matter, in order to reconstruct pre-human contact vegetation patterns along a wet to dry climate transect on Kohala Mountain, Hawai'i Island. Precontact vegetation assemblages fall into three distinct zones: a wet C_3 dominated closed canopy forest where annual rainfall is > 2000 mm, a dry C_4 dominated grassland with annual rainfall < 500 mm, and a broad transition zone between these communities characterized by either C_3 trees with higher water-use efficiency than the rainforest trees or C_3 trees with a small amount of C_4 grasses intermixed. The likelihood of C_4 grass understory decreases with increasing rainfall. We show that the total concentration of rock-derived nutrients in the <2-mm soil fraction differs in each of these vegetation zones. Nutrient losses are driven by leaching at high rainfall and by plant cycling and wind erosion at low rainfall. By contrast, nutrients are best preserved in surface soils of the intermediate rainfall zone, where rainfall supports abundant plant growth but does not contribute large amounts of water in excess of evapotranspiration. Polynesian farmers exploited these naturally enriched soils as they intensified their upland agricultural systems during the last three centuries before European contact.

Paper 5: Analogies between the dynamics of mineral sediments and vegetative particles in fluvial systems

Angela M. Gurnell

Department of Geography, King's College London, Strand, London WC2R 2LS

Riparian vegetation fragments and propagules form part of the organic sediment load of rivers. This review paper draws analogies between the transfer of these vegetative particles and that of mineral sediment within river systems. Whole plants, plant fragments and propagules are delivered to rivers by physical processes but the timing of seed release and the morphological characteristics of the plants moderate delivery. The transport and deposition of plant material is partly controlled by flow patterns but is also influenced by the buoyancy and morphology of the plant material. Once deposited, the vegetative fragments, propagules and the plants that develop from them can have significant local effects on flow hydraulics and sediment erodibility, producing complex assemblages of physical features. Aggregate vegetative particles are identified as being particularly important in accelerating vegetation colonisation of exposed river sediments, driving landform development and supporting the rapid development of a diverse cover of plants. The geomorphological significance of interactions between vegetative particles and fluvial processes is illustrated at different spatial scales. At the *catchment scale*, ribbons of mineral and vegetative particles are transfered downstream with inputs continuously supplied throughout the course of the river. Individual particles experience phases of mobilisation, transport and deposition. As a result, along larger rivers, down-river changes typically occur in the size and type of mineral sediment and vegetative particles, and also the species composition of the vegetative particles. Coupled with downstream changes in hydroclimatological conditions within the active zone of the river, marked downstream changes in interactions between fluvial processes, vegetation propagules and landforms can result. At the *patch scale* individual vegetative particles (particularly aggregate particles) deposited on exposed riverine sediments create local hydraulic complexity that induces the scour and deposition of sediment and further plant propagules, resulting in a suite of distinctive landforms which may support many plant species. Within *individual reaches*, patch-scale interactions between mineral sediment and vegetative particles are moderated or sieved by the form of the reach and its flow patterns, so that the integration of patch-scale effects can support the development of different landforms in different locations.

Paper 6: Stream channels in peatlands: the role of biological processes in controlling channel form

Jeffrey R. Watters and Emily H. Stanley

University of Wisconsin, Center for Limnology, 680 N. Park St., Madison, WI 53706, USA

While some aspects of peatlands are well studied, understanding of the hydrology and geomorphology of the associated surface drainage networks is quite limited. This paper attempts to describe some of the basic attributes of stream channels in peatlands, and asks whether the form and the mechanisms behind development represent a significant departure from self-forming alluvial streams. We use three approaches to better understand these poorly studied systems: an examination of the geomorphology of Allequash Creek, Wisconsin; a survey of aerial photographs of similar peatland-stream complexes in northern Wisconsin; and a review of the existing literature on peat-influenced and wetland channels. Distinct features of Allequash Creek and other Wisconsin streams in peatlands include absence of mineral substrates, low width/depth ratio, presence of lateral pool-like structures along the channel margin, long straight reaches, and acute-angle bends. Further, the lateral location of the thalweg was apparently independent of planform or cross-sectional form, and no-flow zones often occurred along both edges of channel cross-sections. Collectively, these features represent a distinct departure from characteristic forms of alluvial channels. Deep peat samples from Allequash Creek and aerial photographs from other sites indicate that these streams represent remnant lake systems whose basins filled with peat. Thus, we suggest that the processes responsible for channel form in these low energy peatland systems are largely governed by groundwater hydrology and the biology of peat accumulation and decomposition. In this manner, biological forces – not just physical drivers such as channel discharge and sediment supply – are central to the understanding of stream geomorphology in peatlands.

Paper 7: The problem of boundaries in defining ecosystems: a potential landmine for uniting geomorphology and ecology.

David M. Post[1], Martin W. Doyle[2], John L. Sabo[3], and Jacques C. Finlay[4]

[1]Department of Ecology and Evolutionary Biology, Yale University, New Haven, CT, 06520- 8106; [2]Department of Geography, University of North Carolina, Chapel Hill, NC 27599-3220; [3]Department of Biology, Arizona State University, Tempe, AZ 85287; [4]Department of Ecology, Evolution, and Behavior, University of Minnesota, St. Paul, MN 55108

Forging stronger linkages between geomorphology and ecosystem ecology depends, in part, upon developing common conceptualizations of an ecosystem. Because most ecosystem processes are scale dependent, the choice of boundaries is of profound importance to the conceptualization of an ecosystem and to the scope and validity of questions being asked within that ecosystem. Indeed, any conceptualization of an ecosystem requires constraining the spatial and temporal scales of analysis. Thus, it is of particular importance to match the ecosystem boundaries to the question being asked or to the processes being studied and, to facilitate better communication among disciplines, to be explicit in the definitions adopted for an ecosystem. Defining an ecosystem can be problematic when the processes of interest operate at potentially different scales, and little research exists comparing scales of geomorphic processes with those of ecological processes. Here we will discuss the importance of scale in geomorphic and ecological research, and compare and contrast disciplinary biases and inclinations. To highlight the problem of conflicting spatial scales, we will draw on recent attempts to link the structure of food webs to measures of ecosystem size. In particular, problems arise where little or no strong association exists among community membership, resource supply, and physical boundaries. Similar problems arise when trying to link geomorphologic and ecological processes that can operate at different, but variable, temporal scales.

Paper 8: Hierarchical patterns of physical-biological associations in river ecosystems

Melissa Parsons[1] and Martin C. Thoms[2]

[a]Centre for Water in the Environment, University of the Witwatersrand, Private Bag 3, WITS 2050, Johannesburg, South Africa; [b]*Water Research Centre, Cooperative Research Centre for Freshwater Ecology, University of Canberra, ACT 2601, Australia*

The interplay of biological and physical patterns and processes within river ecosystems generates a complex matrix of interactions. A challenge in interdisciplinary river science is to dissect patterns and processes in multi-causal river ecosystems into hierarchical levels of organization. Hierarchy theory, and the associated concept of scale, provides a sound framework for achieving this. We present two interdisciplinary case studies that demonstrate how a multiscale approach can dissect hierarchies of organization in river ecosystems. The first case study examined patterns of large wood character and distribution at three scales of a hierarchy of morphological river system organization in the large, lowland River Murray. The character and distribution of large wood was uniform at the largest reach scale (95 km length of river) because stream energy conditions are relatively uniform within a reach. However, there was an association between lower-level functional sets (straight or bend sections of river) and functional units (12 quadrats within each functional set) and the character and distribution of large wood, because stream energy differs between straight and bend morphologies, and the inner and outer-channel functional units. Thus, functional-sets and functional-units are important levels of organization for large wood in the River Murray. The second case study examined the associations between macroinvertebrate assemblage distribution and environmental influences across a hierarchy of river system organization in the upland Murrumbidgee River catchment. We previously demonstrated that macroinvertebrate assemblages were arranged hierarchically at the region, cluster within region, reach within cluster and riffle within reach scales, with region and reach being the strongest signatures. In this study we related different scaled environmental factors, collected across a hierarchy of catchment, zone (valley confinement), reach (similar stream orders) and riffle scales to the region and cluster levels of macroinvertebrate distribution. The hierarchical pattern of large, region-level and local, reach-level macroinvertebrate distribution was matched by a large catchment-scale and local reach-scale of environmental influence. Intermediate zone-scale environmental factors and smaller riffle-scale factors were not important influences. Thus, large regions and catchments and local reaches are important levels of organization for macroinvertebrate-environment associations in rivers of the upper Murrumbidgee catchment. Both case studies support the applicability of hierarchy theory to describe the organization of physical-biological associations in river ecosystems. The multi-scaled approach allowed the detection of levels of hierarchical organization, and showed other hierarchical characteristics such as emergent properties and top-down constraint/bottom-up influence. Hierarchical understanding of river ecosystem organization will enhance river conservation and management because it facilitates a holistic, ecosystem perspective rather than a partial, single-scale, single-component or single-discipline perspective.

Paper 9: A framework for interdisciplinary understanding of rivers as ecosystems

E.S.J. Dollar[1], C.S. James[1], Kevin H. Rogers[1], and Martin C. Thoms[2]

[1]Centre for Water in the Environment, University of the Witwatersrand, Johannesburg, South Africa; [2]Water Research Centre and the CRC for Freshwater Ecology, University of Canberra, ACT 2601, Australia.

Conceptual frameworks are useful tools to order phenomena and material, thereby revealing patterns and processes. In interdisciplinary research, two or more areas of understanding can be joined into a single conceptual-empirical structure. A framework for the interdisciplinary study of river ecosystems is presented in this paper. The framework recognises parallel hierarchies in the geomorphology, hydrology and ecology of a river with different organisational elements and levels or organisation for each discipline. It assigns spatial and temporal scales for each level of organization for the different discipline hierarchies whereby different parts can be distinguished by different frequencies of occurrence and/or rates of change. Integration of the different disciplines, within the context of a particular study, is represented by flow-chain model that describes process interactions that can change an ecosystem from one state (a template) of biophysical heterogeneity to another (a product). The framework concept is applied by first describing in detail the relevant organizational levels that characterise the different subsystems of the river ecosystem in the context of the problem being addressed. This is followed by the identification of appropriate scales and variables within the different organizational levels. Then the interactions with the products of template/agent of change/controller interactions that may account for any feedback influences are described. A series of examples are provided to illustrate the use of the framework in various interdisciplinary settings.

Paper 10: Functional Ecomorphology: Feedbacks between Form and Function in Fluvial Landscape Ecosystems

Stuart G. Fisher[1], James B. Heffernan[1], Ryan A. Sponseller[1], and Jill R. Welter[1]

[1]School of Life Science, Arizona State University, Tempe, Arizona, 85287 USA

The relationship between form and function has been a central organizing principle in biology throughout its history as a formal science. This concept has been relevant from molecules to organisms but loses meaning at population and community levels where study targets are abstract collectives and assemblages. Ecosystems include organisms and abiotic factors but ecosystem ecology too has developed until recently without a strong spatially explicit reference. Landscape ecology provides an opportunity to once again anneal form and function and to consider reciprocal causation between them. This ecomorphologic view can be applied at a variety of ecologically relevant scales and consists of an investigation of how geomorphology provides a structural template that shapes, and *is shaped by* ecological processes. Running water ecosystems illustrate several principles governing the interaction of landscape form and ecological function subsumed by the concept of "Functional Ecomorphology". Particularly lucrative are ecosystem-level interactions between geologic form and biogeochemical processes integrated by hydrologic flowpaths. While the utility of a flowpath-based approach is most apparent in streams, spatially explicit biogeochemical processing pervades all landscapes and may be of general ecological application.

Paper 11: Dynamics of soils and the land surface since the rise of agriculture

Hans-Rudolf Bork[1], Christine Dahlke[1], Stefan Dreibrodt[1], Karl Geldmacher[2], Yong Li[3], Andreas Mieth[1], Bernd Tschochner[2], and Tom Vanwalleghem[4]

[1]Kiel, Germany, [2]Potsdam, Germany, [3]Beijing, China, [4]Leuven, Belgium

The key elements of ecosystems, soils, and the land surface are intensively affected by land use and by the spatial structure of landscapes since the onset of cultivation. The long term quantitative consequences of human activities on the development and the destruction of soils are widely unknown. The complex long term land surface – soil formation – soil erosion – climate - land use – landscape structure - interactions were investigated and quantified in China, on Easter Island, in the Pacific Northwest of the USA, in South Africa, Belgium, and Germany. Only the destruction of the vegetation which occurred in very different periods and cultures caused soil erosion. Extreme precipitation events cut deep gully systems into the slopes and valley bottoms that were used agriculturally. About a third of the total soil erosion during the last 1,500 years in Germany was caused by two rare precipitation events during the first half of the 14th century. Intensive gullying resulted in the abandonment of individual fields. To be able to continue with agriculture, humans filled small gullies at least 4,750 years ago in northern China and since several centuries in Central Europe. Excluding the tremendous effects of rare and extreme events, soil erosion rates increased dramatically in all of the investigation areas that were used agriculturally. During the 20th century, as a result of several factors such as the reallocation of land (increase of field sizes), introduction of new crops and new crop sequences (resulting in longer periods with no protection of the soil by vegetation), new equipments (machines which compact soils and enable the use of steep slopes) and political decisions ("The Native Title Act" of 1923 in RSA, the "Great Leap Forward" in 1959 in China) significantly increased soil erosion.

Paper 12: Redistribution of soil and soil organic carbon in agricultural ecosystems

Jerry C. Ritchie[1], Gregory W. McCarty[2], Erik R. Venteris[3], and T.C. Kaspar[4]

[1]USDA-ARS Hydrology and Remote Sensing Laboratory, Beltsville, MD 20705 USA; [2]USDA-ARS Environmental Quality Laboratory, Beltsville, MD 20705 USA; [3]Ohio Division of Geological Survey, Columbus, Ohio 43224, USA; [4]USDA-ARS National Soil Tilth Laboratory, Ames, IA 50011 USA.

Patterns of soil organic carbon (SOC) vary widely across the landscape and lead to large uncertainties in the SOC budget, especially for agricultural ecosystems where water, tillage, and wind erosion redistributes soil and SOC. It is often assumed that soil erosion results in a loss of SOC from the agricultural ecosystem but recent studies indicate that soil erosion and its subsequent redistribution within fields can stimulate SOC sequestration in agricultural ecosystems. This study investigates the relationship between SOC and patterns of soil redistribution in three tilled agricultural fields using the fallout ^{137}Cesium technique to measure soil redistribution. ^{137}Cesium and SOC concentrations in agricultural soils are significantly correlated in our study areas. Hillslope areas (eroding) have significantly less SOC than soils in toe slope areas (deposition). SOC decreased as gradient slope increases and soils on concave slopes had higher SOC than soils on convex slopes. These data suggest that patterns of soil redistribution and topographic patterns may be used to help understand SOC dynamics on the agricultural landscape. Different productivity and oxidation rates of SOC of eroded versus deposited soils also contribute to the spatial patterns of SOC. The strong significant relationships between the patterns of soil redistribution and SOC concentrations in agricultural soils, however, suggest that they are moving along similar physical pathways in these systems. Our study also indicates that geomorphic position is important for understanding soil and SOC movement and redistribution patterns within a field or watershed. Such information can help develop and implement management systems to increase SOC in agricultural ecosystems.

Paper 13: Evaluation of a small sediment nourishment on an estuarine beach to enhance habitat suitability for horseshoe crabs

Nancy L Jackson[1], David R Smith[2], Ronnachai Tiyarattanachai[3], and Karl F Nordstrom[4]

[1]Department of Chemistry and Environmental Science, New Jersey Institute of Technology, Newark, New Jersey 07102, USA; [2]United States Geological Survey, Leetown Science Center, Kearneysville, West Virginia 25430, USA; [3]Department of Chemistry and Environmental Science, New Jersey Institute of Technology, Newark, New Jersey 07102, USA; [4]Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, New Jersey 08904, USA

This field study evaluates the effect of nourishing an estuarine beach with gravel to enhance spawning rates by horseshoe crabs. A total of 564 m^3 of coarse sand and gravel were emplaced in two 90 m-long treatment segments at Bowers Beach, Delaware, USA from 9 to 11 April 2002. Field data were gathered between 6 April and 24 May 2002 to characterize the two fill segments and the un-nourished segments between them as well as two control segments at the adjacent Ted Harvey Beach. Sediment samples were taken from the foreshore surface and at depth before and after the nourishment. Bay water levels, wave heights, and beach ground water characteristics were monitored over a 12-hour tidal cycle at one of the nourished (15 May 2002) and the unnourished segment (16 May 2002) at Bowers Beach and at one of the control segments at Ted Harvey Beach (21 May 2002) using piezometers and pressure transducers inserted in wells. The beaches were cored to estimate the density of horseshoe crab eggs deposited during the spawning season. Horseshoe crab eggs were buried in pouches at 0.15 to 0.20 m depth for 30 to 40 days to evaluate survival in developing into embryo or larval stage. Bulk sediment samples were taken to evaluate moisture characteristics near to locations where egg pouches were buried. Density of spawning females at Bowers Beach was 1.04 m^{-2} in 2001 and 1.20 m^{-2} in 2002. These rates are lower than at Ted Harvey Beach but reveal an increase in spawning while Ted Harvey Beach underwent a considerable decrease (2.63 m^{-2} to 1.35 m^{-2}). Sediments low on the foreshore remained nearly saturated throughout the tidal cycle at both beaches. The average hydraulic conductivity on the upper foreshore at the non-treatment section at Bowers Beach (0.19 cm s^{-1}) was less than at Ted Harvey Beach (0.27 cm s^{-1}), and the finer, better sorted sediments at depth at Bowers Beach resulted in a higher porosity, creating greater moisture retention potential. Egg development was greatest at mid foreshore at all sites. Eggs at the lower foreshore elevation remained viable, but did not develop to the embryo stage. Between-beach differences were limited to high elevations where higher mortality occurred at Ted Harvey Beach due to desiccation. Adding small amounts of gravel to a sand beach may change the appearance of the surface but may not appreciably increase mean grain size and sorting at depth or the hydraulic conductivity over the spawning season. The pebble fraction may be important for site selection, but finer sizes may be more important for egg survival because of moisture retention.

Paper 14: Reactivation of a cryptobiotic stream ecosystem in the McMurdo Dry Valleys, Antarctica: a long-term geomorphological experiment

Diane M. McKnight[1], C. M. Tate[2], E.D. Andrews[3], D. K. Niyogi[3], K. Cozzetto[1], K. Welch[4], W. B. Lyons[4], and D. G. Capone[5]

[1]Institute of Arctic and Alpine Research, University of Colorado, Boulder, CO, USA, 80309; [2]Water Resources Division, U.S. Geological Survey, Denver, CO, USA 80303; [3]Biological Sciences, University of Missouri-Rolla, Rolla, MO 65409; [4]Byrd Polar Research Center, Ohio State University, Columbus, OH; [5]Wrigley Institute for Environmental Studies, University of Southern California, Los Angeles, CA 90089

The McMurdo Dry Valleys of Antarctica contain many glacial meltwater streams that flow for 6 to 12 weeks during the austral summer and link the glaciers to the lakes on the valley floors. Dry valley streams gain solutes longitudinally through weathering reactions and microbial processes occurring in the hyporheic zone. Some streams have thriving cyanobacterial mats. In streams with regular summer flow, the mats are freeze-dried through the winter and begin photosynthesizing with the onset of flow. To evaluate the longer term persistence of cyanobacterial mats, we diverted flow to an abandoned channel, which had not received substantial flow for approximately two decades. Monitoring of specific conductance showed that for the first three years after the diversion, the solute concentrations were greater in the reactivated channel than in most other dry valley streams. We observed that cyanobacterial mats became abundant in the reactivated channel within a week, indicating that the mats had been preserved in a cryptobiotic state in the channel. Over the next several years, these mats had high rates of productivity and nitrogen fixation compared to mats from other streams. Experiments in which mats from the reactivated channel and another stream were incubated in water from both of the streams indicated that the greater solute concentrations in the reactivated channel stimulated net primary productivity of mats from both streams. These stream-scale experimental results indicate that the cryptobiotic preservation of cyanobacterial mats in abandoned channels in the dry valleys allows for rapid response of these stream ecosystems to climatic and geomorphological change, similar to other arid zone stream ecosystems.

Paper 15: The geomorphic and ecological effectiveness of habitat rehabilitation works: continuous measurement of scour and fill around large logs in sand-bed streams

Dan Borg, Ian Rutherfurd, and Mike Stewardson

Cooperative Research Centre for Catchment Hydrology, School of Anthropology, Geography and Environmental Studies, The University of Melbourne, Australia, 3010

Geomorphologists, ecologists and engineers have all contributed to stream rehabilitation projects by predicting the physical effect of habitat restoration structures. In this study we report the results of a stream rehabilitation project on the Snowy River, SE Australia; that aims to improve fish habitat and migration associated with scour holes around large wood in the streambed. Whilst engineering models allow us to predict maximum scour, the key management issue was not the maximum scour depth but whether the holes remained stable at a range of flows, and if they were present when fish actually required them. This led to the development of a new method to continuously monitor scour in a sand bed, using a buried pressure transducer. In this study we monitored fluctuations in the bed level below three large logs (1m diameter) on the Snowy River. Each log had a different scour mechanism: a plunge pool, a horse-shoe vortex (analogous to a bridge pier), and a submerged jet beneath the log. The continuous monitoring demonstrated a complex relationship between discharge and pool scour. The horseshoe-vortex pool maintained a constant level, whilst, contrary to expectations, both the plunge-pool and the submerged-jet pool gradually filled over the 12 months. Filling was associated with the average rise in flows in winter, and occurred despite several freshes and discharge spikes. The plunge-pool showed the most variation, with bed levels fluctuating by over one metre. A key factor in pool scour here may not be the local water depth at the log, but the position of the log in relation to larger scale movements of sand waves in the stream. These results question assumptions on the relative importance of small floods or channel-maintenance flows that lead to beneficial scour around large wood in sand-bed streams. Further, the continuous measurement of scour and fill around the logs suggested the presence of pool scour holes would have met critical requirements for Australian bass (*Macquaria novemaculeata*) during the migration period, whereas normal methods of field monitoring would have suggested the contrary. The results of this study have demonstrated that geomorphic effectiveness is not always synonymous with biological effectiveness. Whilst physical models emphasise extreme changes, such as maximum scour, the key biological issue is whether scour occurs at the critical time of the life cycle. Continuous measurement of sand levels is an example of a geomorphic technique that will help to develop models that predict biologically meaningful processes, not just extremes.

Paper 16: Nonlinear biofluvial responses to vegetation change in a semiarid environment

Mel Neave[1] and Scott Rayburg[2]

[1]Division of Geography, School of Geosciences, Madsen Building (F09), University of Sydney NSW, 2006 Australia; [2]Cooperative Research Centre for Freshwater Ecology, University of Canberra ACT, 2601 Australia

The desertification of grassland communities in the Jornada del Muerto Basin, southern New Mexico, USA, has occurred in association with a series of geomorphic responses that have influenced the system of vegetation change. Rainfall simulation experiments indicate that the volume of runoff generated from basin surfaces and its ability to erode are greatly affected by the distribution of vegetation, which ultimately controls processes such as rainsplash erosion, soil infiltrability and crust development. Animal activities also influence rates of sediment movement from unvegetated surfaces by disrupting soil crusts and making loose sediment available for transportation by overland flow. Shrublands in the Jornada Basin have a patchier vegetation cover than grasslands, with vegetated areas (shrubs) being separated by unvegetated (intershrub) zones. The exposed intershrub surfaces are more vulnerable to erosion than the grass and shrub surfaces. Thus, yields of water and sediments, calculated using rainfall simulation experiments, were higher for vegetated (shrub and grass) plots than they were for unvegetated (intershrub) plots. The runoff and erosion model, KINEROS2, predicts that at the base of a 100 m slope, shrubland surfaces shed seven times more runoff and 25 times more sediment than grassland surfaces. Evidence to support the prediction of higher rates of erosion in the shrubland can be found in the form of the extensive rill networks that are common in this community. The contraction of grasslands has been associated with elevated rates of erosion that have altered the morphology of the surface, lowering slopes between shrubs, and increasing the amplitude of the microtopography. Overall, the viability of the exposed soils for recolonization by grasses has been reduced, reinforcing the system of shrubland invasion and lending support to the use of state-and-transition models to describe ecologic responses to change within this environment. Combined, these results indicate that biophysical interactions in semiarid environments, such as the Jornada del Muerto Basin, are extremely complex and highlight the need for integrative investigations in these regions.

STUDENT POSTER PRESENTATIONS

Paper 17: Modeling semi-arid vegetation change and erosion

Daniel B.G. Collins

Rafael L. Bras; Department of Civil and Environmental Engineering; MIT; Daniel_@mit.edu

In portions of the Pajarito Plateau, northern New Meixco, a history of grazing and fire suppression, superimposed by sporadic droughts, has led to a change in community structure, and in turn also of erosion rates. The extent of ponderosa pine forest with a blue gramma subcanopy has diminished, moving successively higher in altitude, and replaced by pinyon-juniper woodland. The concomitant loss of ground cover is cited as the cause of increased erosion rates, which poses challenges for forest management, archaeological preservation, and public health protection from soil contaminated by weapons testing at a DOE facility. Presented is a physically based model that integrates the hydrological, ecological and geomorphological processes that operate across the plateau. A stochastic climate is linked to soil moisture, which drives vegetation dynamics. The hydrological regime, modulated by vegetation, drives the topographic change of the plateau's mesas. Numerical experiments are conducted with a view to assess the potential implications of landuse change on the soil resource and feedbacks on vegetation structure in this and other water-limited environments.

Paper 18: Self-Organized Criticality, Fluvial Wood, and Riverbank Instability

Jane Heath and Mindy Conyers

Department of Geography, Texas State University–San Marcos, San Marcos, TX 78666 USA; Jane.heath@gmail.com

The interactions between in-channel and near-channel wood with mountain fluvial geomorphic processes are extremely important in monitoring and managing aquatic ecohydrologic systems. Recently, the intrinsic spatial variability of riverbank instability has been theorized to obey a power law describing the magnitude and frequency distribution of failure. We postulate that this power law relationship can be extended to smaller order mountain streams, and that the slope of the power law can be correlated with effective wood in and around the fluvial system. The pattern has been interpreted as the signal of a self-organized critical (SOC) system. While fluvial instability is the result of many factors such as gross channel morphology, stream power, riverbank material, and grain-level processes, fluvial wood can control some amount of bank instability and sediment supply to rivers. The study area for this research is the Upper Animas watershed within the San Juan Mountains of southwest Colorado. The geologic substrate of the Animas watershed is comprised of both extrusive and intrusive igneous rocks that have lead to a history of precious metal mining in the region. We surveyed 25 km of Mineral and Cement Creeks, two upper tributaries of the Animas River. We measured riverbank instability using two different field methods. First, we visually estimated unstable riverbank areas as a percent of successive 100 meter reaches along the stream. Also, we tested a photogrammetric method for measuring bank areas using ground-based photography. The areas of high and low fluvial wood were estimated through ground and aerial photo interpretation. The variability in the instability can be measured by comparing the slopes of the SOC power laws in areas of high wood versus those areas with low fluvial wood abundance. The overall slope of the riverbank power laws within the two tributaries is 2.09, making these streams susceptible to small frequent sediment pulses. Division of this power law into rich and poor fluvial wood segments allows for interpretation of the direct interactions between organic and geomorphic processes. This power law slope is greater than those recently measured in Yellowstone Park demonstrating that the streams of the San Juan Mountains are not as readily disturbed by major geomorphic shifts. The interaction between geomorphic and ecological systems often results in non-equilibrium forms and processes. If it is true that SOC dominates ecohydrologic instability, it allows us to make both spatial and temporal predictions of likely changes resulting from various stream management policies.

Paper 19: The tidal creek geomorphology and vegetation patterns of a restored salt marsh at Freiston Shore, UK

Eliza B Ghitis[1], Heather A Viles[1], and Larissa A Naylor[1,2]

[1]Centre for the Environment, University of Oxford, Dyson Perrins Building, South Parks Road, Oxford, OX1 3QY. E-mail: eghitis@ouce.ox.ac.uk.; [2]Ecology and Soils Group, Environment Agency, Block 1 Government Buildings, Burghill Road, Westbury on Trym, Bristol. BS10 6EZ.

Tidal creek networks in salt marshes play an integral role in sediment dynamics, ecological function, and water quality. Simultaneously, salt marsh vegetation influences a number of physical features by altering sedimentation, wave strength, and tidal energy. This study investigates the links between vegetation patterns and tidal channel morphology in natural and restored salt marshes at the Freiston Shore Managed Realignment site in the Wash estuary, Lincolnshire, UK. In the UK, government agencies have pursued a policy of Managed Realignment (MR) since the late 1990's in order to cope with the present and future failure of existing sea defense structures. These schemes create new intertidal habitat inland of the old defenses, sometimes breaching them for this purpose. The natural creek development in MR sites is gradual and the persistence of artificial drainage can retard establishment of a biological community dependent on specific hydraulic and sediment regimes. As part of the Wash Banks flood defense, MR at Freiston Shore created 66 hectares of intertidal zone with a number of excavated channels beside an established, mature salt marsh. Empirical observation of vegetation species abundance was conducted on a series of transects along the length of both natural and engineered tidal creeks. Each transect, perpendicular across the channel, consisted of sites directly adjacent to and away from the creek margins. This data was analyzed with respect to the morphology and dimensions of the specific creeks. The geomorphological data was established through aerial photogrammetry and a LiDAR digital elevation model combined into a geographic information system created for this purpose. These linked parameters offer a potential tool for assessment of the condition of a rehabilitated salt marsh after MR. A deeper understanding of the interrelated processes of geomorphology, ecology, and hydrology would allow the creation of more viable, self-sustaining systems in the future.

Paper 20: Comparison of Transient Storage Characteristics in Restored and Unrestored Reaches of the Provo River, Heber Valley, Utah

Randy R.Goetz[1], Michael N. Gooseff[2], and John C. Schmidt[1]

1 Department of Aquatic, Watershed, and Earth Resources, Utah State University, Logan, Utah, USA; rgoetz@cc.usu.edu ; 2 Department of Geology and Geologic Engineering, Colorado School of Mines, Golden, Colorado, USA

We performed Rhodamine-WT (RWT) stream tracer tests in order to compare transient storage characteristics between restored and unrestored reaches of the Provo River, Heber Valley, Utah. The 13-mile long section of the Provo River located in the Heber Valley (Middle Provo) has undergone extensive geomorphic and hydrologic alteration during the 20th century due to federal reclamation projects. The Provo River Restoration Project (PRRP) is intended to mitigate the negative environmental impacts of reclamation activities by completely renaturalizing the channel and floodplain. Restored reaches are designed with alternating pool-riffle sequences, mid-channel gravel bars, point bars, secondary channels, and relatively high sinuosities. Unrestored reaches are constrained by dikes, making them relatively straight, topographically homogenous, and providing a narrow distribution of water velocities within the channel. Test reaches in our study were chosen in order to provide a statistically sound basis for determining the general effects of the PRRP in terms of transient storage. In each 500 to 800 meter long reach, a single pulse of RWT was injected at a discharge close to base flow (125 cfs). Breakthrough curves were developed using RWT concentrations automatically logged in the field at 5-second intervals. We simulated field data using STAMMT-L software, which solves a one-dimensional, dual-porosity, advective-dispersive transport equation. Model parameters yielded estimates of the average cross-sectional area of transient storage, and average transient storage residence time in each reach. Results suggest that restoration efforts have produced a relative increase in these aspects of transient storage. We hypothesize that greater geomorphic complexity introduced by channel restoration will increase hyporheic exchange as well.

Paper 21: Changes in Physical Aquatic Habitat Revealed by Sediment Coring

Ryan Murphy and Enrique Gomezdelcampo

Bowling Green State University; Department of Geology; 190 Overman Hall; Bowling Green OH 43403-0218; pmurph@bgnet.bgsu.edu

The Sandusky River watershed located in northwest Ohio has been influenced by agriculture since the late 1800's. The Ohio Environmental Protection Agency (OEPA) recently completed a study entitled Biological and Water Quality Study of the Sandusky River and Selected Tributaries 2001, which identified various tributaries and reaches within the Sandusky River watershed that failed to meet biological water quality standards due to modified streamflow and degraded habitat. Results from the OEPA study have compelled local, county, and state agencies to address restoration strategies on degraded tributaries in the Sandusky River watershed. However, prior to implementation of restoration strategies it is important to consider the natural state of a stream preceding anthropogenic impacts. Sediment coring coupled with seismic refraction from channel cut-offs presents a unique opportunity to analyze substrates that existed prior to human settlement in the area and estimate the extent of degradation in an existing channel. Comparison of pre-settlement substrates from channel cut-offs with current substrates from the existing channel can reveal the amount of change in substrate size and be used to infer the velocities of the waters. Substrate and streamflow are vital parameters for aquatic habitat. High velocity water creates coarse grain substrates due to the transport of fine grain sediment through these zones, while lower velocity waters allow fine grain sediment to settle out and be deposited. This can be confirmed in riffle zones which mostly consist of coarse grain sands, gravels, and cobbles while pools typically consist of fine grain sands, silts and muds. Preliminary work in the vicinity of Bucyrus, Ohio has identified the depth to bedrock and verified the types of deposits present within a selected channel cut-off. Sediment cores are being collected using modified vibratory methods such as Vibracore to gain a detailed record of the change of substrates through time in the channel cut-off. Analysis of the pre-settlement substrates in the sediment cores will be used to infer the velocities of the pre-settlement waters. The results from this study will help determine the extent of human alteration in the Sandusky River watershed by identifying the type of aquatic habitat that existed prior to anthropogenic impacts.

Paper 22: Integrating Spatial Ecosystem Information to Calibration of Watershed Models

Taehee Hwang, Lawrence E. Band, and Daehyok Shin

Department of Geography, University of North Carolina at Chapel Hill, North Carolina**H7666@email.unc.edu**

Spatial patterns of forest canopy co-evolve and adjust to a combined effect of terrain, microclimate and soil moisture. Regeneration of forest canopy following disturbance interacts with soil moisture in the rooting zone, which can limit photosynthetic capacity and growth patterns. In turn, the forest canopy influences soil water contents, runoff production and recharge by controlling interception and evapotranspiration. We make use of a GIS-based eco-hydrological model (RHESSys; Band et al. 1993) which is capable of estimating both the microclimate, soil moisture gradients, and canopy water and carbon cycling to estimate the spatial pattern of vegetation. In order to consider feedback of dynamic spatial vegetation patterns on canopy interception, throughfall and soil moisture patterns, RHESSys parameterizations are first conditioned on streamflow data varying m (the decay rate of hydraulic conductivity with depth), Ksat0 (saturated hydraulic conductivity at surface) and SDepth (an effective soil depth) for a water cycle. The behavioral parameter sets are then further conditioned on spatial estimates of maximum LAI from satellite information (Landsat ETM+) with additional two parameters: SLA (specific leaf area) and SLAratio (the ratio of shaded to sunlit LAI), which have a strong sensitivity to a spatial pattern of LAI. Finally, it is shown that despite the uncertainty in the prediction of spatial LAI this calibration strategy can efficiently narrow down behavioral parameter sets for both water and carbon cycles, which are strongly interlinked together.

Paper 23: Hydraulically determined functions of woody debris pieces within a large woody debris jam

Rebecca B. Manners, Melanie J. Small, and Martin W. Doyle

Department of Geography, University of North Carolina, Chapel Hill, NC 27599; manners@email.unc.edu

Numerous studies exist on the hydraulics of large woody debris (LWD) jams and the mechanisms behind their geomorphic influence. Most of these studies treat LWD jams as single, solid objects, adjusting for factors such as length, diameter, and angle of the largest key member and are conducted in flumes allowing for the manipulation of flow conditions. Yet LWD jams are clearly not single cylindrical logs, but rather an accumulation of woody pieces ranging in size from leaves and twigs to entire trunks. In this paper we treat large woody debris jams as complex and porous accumulations of heterogeneous material to understand the relative importance of the different size fractions comprising a jam. To investigate the hydraulic function of the various size classes of material, we systematically removed three LWD jams on the Indian River. Located in the Adirondacks Natural Preserve, this river experiences recreational releases in the summer from Abanakee dam, just upstream of the study sites. Using these releases, we measured the flow fields around the jam at each stage of removal at high and low flow. We relate the hydraulic significance of these pieces by comparing the flow fields, drag on the jam and the local bed shear stress distribution around the jam at different stages of removal. Accumulated woody material comprised 34-54% of the total volume but 75-95% of the total surface area in the jams. These pieces created a porous framework that when blocked by a nonporous material greatly increased the near-bed shear stress in the flow-convergence zone (~200%). Our results suggest that current models for LWD jams oversimplify their hydraulics. These findings have implications for predicting local morphological changes and the hydraulic habitat associated with both natural and engineered LWD jams.

Paper 24: Simulation and Validation of Short- and Long-term Soil Redistribution and Carbon Sequestration Pattern in Landscapes

Martin Minkowski[1], Chris S. Renschler[1*], Jerry C. Ritchie[2], and Mary H. Nichols[3]

[1]National Center for Geographic Information and Analysis, Dept. of Geography, University at Buffalo, Buffalo, NY 14261, [2]USDA ARS Hydrology and Remote Sensing Lab., BARC-West, Beltsville, MD 20705, [3]USDA-ARS Southwest Watershed Research Center, Tucson, AZ 85719; *Corresponding author: rensch@buffalo.edu

Understanding erosion processes and carbon sequestration patterns are keys to developing methods to determine sediment and carbon budgets at the landscape scale. Methods to simulate and assess the dynamics of erosion and carbon sequestration processes with spatially-distributed erosion models will also allow developing appropriate land use management and policy recommendation. A newly developed spatially distributed approach used by the Geospatial Interface for the Water Erosion Prediction Project (GeoWEPP) enables it to take advantage of detailed topographic pattern to derive soil redistribution patterns at various scales. This new approach simulates the sediment budget along representative hillslopes of contributing areas to a single channel pixel rather than that traditionally used for larger contributing areas to a channel segment. Comparisons of the new method to prior methods with less detailed representation of hillslope processes demonstrated that the processes on hillslopes, the hillslope-channel interface, and the channels could be represented more appropriately. In the case of the nested Lucky Hills watersheds – a rangeland ecosystem study site near Tombstone, Arizona – detailed climate, runoff and sediment time series were used to parameterize and validate the performance of a spatially distributed soil erosion model. The distributed ^{137}Cesium samples were used to validate the long-term spatially redistribution of sediments. Overtime, fluvial processes remove ^{137}Cs-bounded soil particles from the upper hillslopes to lower hillslope parts within a watershed. By measuring the amount of ^{137}Cs-bounded material at a site, the amount of erosion and deposit over time can be calculated. These measurements were then used to validate the erosion model simulation results on long-term soil redistribution pattern within the watershed as well as the event-based runoff and sediment yield measurements at the outlets of the nested watershed.

Paper 25: Restoration manipulations as experiments linking geomorphology and nutrient retention in streams.

Cailin Huyck Orr[1], Emily H. Stanley[2], and Kristy L. Rogers[2],

[1]UNC-Chapel Hill Carolina Environmental Program [2]UW-Madison Center for Limnology; csorr@wisc.edu

Channel geometry and benthic sediment control in-channel nutrient retention by influencing both biotic and abiotic mechanisms. Substrate size and type determine physical properties of adsorption and desorption from particle surfaces. Substrate type can also influence the degree of hyporheic flow and amount of transient storage in a system which, in turn leads to changes in availability of nutrients to biotic uptake. The stability of benthic sediments can determine benthic community and colonization, parameters associated with biotic uptake and primary productivity. Stream restoration projects often involve large manipulations of channel geometry, dominant benthic substrate type, or both. These manipulations are excellent opportunities to study the impact of changing channel parameters on nutrient retention and processing. They are also an opportunity to test directly some of the controls geomorphic parameters have on biotic or ecological processes in streams. To study the impact dam removal has on nutrient uptake rates we used experimental nutrient and conservative tracer additions to examine reach-scale phosphorus retention in a forested, second-order stream. The removal of two small dams on 9-July-03 allowed us to determine how nutrient dynamics were influenced by changes in channel geometry and benthic sediment type. We calculated nutrient spiraling metrics from a series of short-term injections, measured cross sectional profiles, and determined benthic sediment size at weekly intervals for two months before and after the removals. We then compared the uptake length change to changes in benthic sediment type, channel geometry and hydrology that occurred as a result of the dam removals. Our findings are consistent with results of previous studies which indicate that benthic sediments may play an important role in controlling the SRP concentrations in Boulder Creek, and that variation in sediment composition may create spatial heterogeneity in phosphorus concentrations in streams.

Paper 26: Controlling Factors of Plant Diversity Across Multiple Spatial Scales in Fens of New York State

Stephen H. Reynolds*, Matthew T. Distler, Jennifer J. Gillrich, Kay L. Hajek, and Donald J. Leopold

SUNY-CESF, Syracuse, NY 13210, **Sharrisonreynolds@hotmail.com** *State University of New York, College of Environmental Science and Forestry, 512 Illick Hall, 1 Forestry Drive, Syracuse, NY 13210; sharrisonreynolds@hotmail.com.

Fens, minerotrophic peatlands with circumneutral to alkaline pH and dominated by calciphilic plant species, support diverse plant communities including a disproportionate number of protected species. Therefore, they are a high priority for conservation. The high plant species richness is a function of numerous abiotic and biotic factors, however, the effect of these factors on diversity has received little attention at multiple spatial scales. Here, a hierarchical approach is used to examine vascular and nonvascular plant diversity patterns among fens of three different ecoregions of New York State: the Great Lakes Coastal Plain, the Northern Appalachian Boreal Forest, and the Lower New England Northern Piedmont. These patterns were explored across regional, landscape, and within-site scales. At the regional scale, species richness is expected to be highly influenced by geomorphic history and superficial and bedrock geology, resulting in a gradient of highly calcareous, or "rich", to acidic, or "poor", sites. Determinants of peat accumulation, including hydrology and geochemistry, are expected to be strongly correlated with diversity patterns at the landscape scale while, at the within-site scale, biotic influences including available species pool, peat deposition, and canopy cover are expected to show strong influence. Also at this small scale, pronounced microtopography resulting from the differentiation of peat accumulation, windthrow of trees, or presence of certain hummock-forming species (e.g. Carex stricta, Osmunda cinnamomea, Sphagnum) enhances richness levels by partitioning niches along a gradient from ombrotrophic hummocks to highly minerotrophic hollows within a small (1m2) area. We investigate the interactive effects of the examined factors and suggest that diversity will be highest in, and conservation efforts should be directed toward, fens exhibiting the greatest variation at multiple spatial scales.

Paper 27: The transition of meandering to anabranching patterns in the middle Amazon River: response to Holocene climatic change?

José Max G. Rozo and Afonso César R. Nogueira

Departamento de Geociências, Universidade Federal do Amazonas; Campus Universitário, Manaus, Amazonas, Brazil.; contact: jmaxgr@ufam.edu.br

The Amazon River is the main component of a complex ecosystem characterized by high biodiversity in the Amazon rainforest. The investigation of the middle Amazon River's alluvial plain represents a good opportunity to elucidate the depositional episodes developed in the Holocene in northern Brazil. The use of remote sensing tools and sedimentological analysis of riverbanks between Careiro Island and the mouth of the Madeira River, allowed the identification of three morphological units that overlie Upper Cretaceous and Neogene units of the Amazon basin: 1) scrolled floodplain deposits, comprising fine-grained grey siltic sands intercalated with grey and brown bioturbated muds and composing couplets in heterolithic inclined stratification; 2) organic-rich overbank deposits, represented by brown to black sandy mud and peat, laminated and bioturbated muds of oxbow lake and floodplain deposits, and fine- to medium-grained argillaceous sands organized in coarsening upward cycles of crevasse spay deposits; and 3) sand channel bars, comprising moderate to very well sorted fine-grained sands with dune morphology. A meandering configuration for the middle Amazon River channel is evidenced by the presence of inclined heterolithic stratification of point bars. Subsequently, this pattern was modified to an anastomosed style classified as a type 1 anabranching river. We propose that climate change leading to increased humidity as recorded between 6000 and 4000 yr BP, correlated with a relative base-level (sea-level) rise, influenced the dynamics of the Amazon River.

Paper 28: Mechanisms of organic matter storage and remobilization on a regulated river

Melanie J. Small, Rebecca B. Manners, and Martin W. Doyle

Department of Geography; University of North Carolina; Chapel Hill, NC 27599; mjsmall@email.unc.edu

Significant amounts of past research have focused on the creation of organic matter (OM) budgets in streams and on the importance of roughness elements such as woody debris and bank vegetation for OM retention. Very little emphasis has been placed on the mechanics of OM movement through stream systems, particularly in regard to regulated rivers with frequent flood pulses. In a combination of field and flume simulations, this study examines the hydraulic mechanisms behind coarse particulate organic matter (CPOM) movement and retention, and the possible effects of flow regulation on CPOM transport through a system. The Indian River and sections of the Hudson River, located in the Adirondacks National Preserve, experience recreational releases four times weekly from April to October. These releases increase the discharge of the river by approximately 1 order of magnitude (100 to 1300 cfs). In a side channel of the river, paper "leaves" were released, and after each successive "flood" the longitudinal location and retentive structure on which each leaf was caught was recorded. In regulated and unregulated reaches of the river, the presence and absence of OM in the upstream, downstream, and sides of all protruding boulders was recorded. In a flume, scaled leaves were placed around boulders and the discharge increased until all leaves were hydraulically removed. Velocity and turbulence around the leaf packs were measured in the flume using a 3D acoustic Doppler velocimeter. Preliminary results from the side channel indicate that leaf litter finds temporary storage around boulders, large woody debris and on the channel bed. These leaves are then transported downstream and either retained again or flushed from the system during subsequent floods. Once retained, leaves caught on small woody debris (D<10 cm) were more stable (90% of those originally retained) than those retained on boulders, large wood, vegetation, and the bed. However, in total, 60-70% of total leaves released were transported out of the system. Observations from the flume studies suggest that OM deposited on the upstream and downstream sections of boulders are stable at steady discharges. OM deposited upstream of boulders was relatively immobile as discharge increased, but deposits in the lee eddies of boulders were quickly re-organized or remobilized as turbulence increased with increasing discharge. This susceptibility of lee deposits to a rapid rise or fall in the hydrograph was further substantiated by a significant increase in the total frequency of OM found around boulders, and particularly in the lee deposits (61% to 14% and 23%) in unregulated reaches of the Hudson compared with regulated reaches of the Indian. These results question our current understanding of the stability of organic matter and the ability of other trophic levels to function in streams with frequent and rapid flood pulses.

Paper 29: Nutrient dynamics of inset floodplain sediments and the influence of inundation.

Mark R. Southwell, Martin C. Thoms, and M. Reid

Water Research Centre; University of Canberra; ACT 2601; Australia;
Martin.Thoms@canberra.edu.au

Floodplains are both sources and sinks for sediment and nutrients in river floodplain ecosystems. While large quantities of nutrients are liberated from floodplain sediments upon inundation the subsequent deposition of fine sediment as floodwaters recede provides a potential source of nutrients for floodplain surfaces. The exchange of nutrients between floodplains and river channels is important for the overall productivity of these ecosystems. This study examines the carbon (C), nitrogen (N), and phosphorus (P) content of surface sediments on various floodplain surfaces along two reaches of the Barwon-Darling River in south-eastern Australia. The nutrient content of floodplain surface sediment was examined before and after two inundation events, as was the nutrient status of sediment deposited during these events. The majority of floodplain surfaces investigated were a sink for sediment-associated nutrients after the first event with notable increases in C, N and P content, although some acted as sources of C, N and P with decreases in nutrient content post inundation. During the first inundation event increases in C, N and P appear to have been due to the enriched nutrient content of the deposited sediment thus providing a nutrient subsidy to these floodplain surfaces. The second flow event inundated floodplain surfaces in one reach only and was higher in magnitude but shorter in duration than the first event. Although similar trends were seen for C and P; the response of N was decidedly more variable, with six out of nine floodplains having a reduction in sediment nutrients following inundation; a nutrient stress. We conclude that the overall pattern of nutrient subsidies and stresses relates to variations in sediment supply, the duration and magnitude of flow events and in situ microbial activity thus creating a mosaic of floodplain surface productivity in this system.

Paper 30: Upstream to Downstream Trends of Geomorphic Variables in Three Eastern Oklahoma Ecoregions

Dale K. Splinter[1], Daniel C. Dauwalter[2] Richard A. Marston[3], and William C. Fisher[2]

[1]Calvin College, [2]Oklahoma State University; [3]Kansas State University; daleks@okstate.edu

Few geomorphic studies have investigated to what extent the characteristics of stream channels vary by ecoregion. We surveyed 149 reaches over three-years in eastern Oklahoma to better understand patterns between the characteristics of stream channels at different spatial scales. Ecoregions were used to separate geographic locations in eastern Oklahoma. Stream surveys were conducted in the Ozark Highlands (34 reaches), Boston Mountains (35 reaches), and the Ouachita Mountains (80 reaches). These three regions were selected because streams flowing through these regions have direct economic importance to stream fisheries management. Reaches were selected in a stratified random manner. Streams were stratified by stream order (1-4) so that both upstream and downstream channels were surveyed. Sample size of reaches selected per ecoregion was based upon an area weighted average of all three ecoregions. Geomorphic variables used to test for significant differences between ecoregions were particle-size, large woody debris, bankfull width, width-depth ratio, and reach sinuosity. A co-variance test was performed that evaluated whether the downstream trends in geomorphic variables were significantly different ($p<0.05$) between ecoregions. All three ecoregions are significantly different in particle-size. The Boston Mountains are significantly different from the Ozark Highlands in large woody debris. Bankfull width and width-depth ratios are significantly different between the Ouachita Mountains and both the Ozark Highlands and Boston Mountains. No significant differences exist between ecoregions with respect to downstream trends in sinuosity. Smallmouth bass (*Micropterus dolomieu*) densities were evaluated by ecoregion and stream order. Reaches were snorkeled and smallmouth bass were counted following a common methodology. One-way ANOVA procedures show that there is an interaction between ecoregion and stream order. This suggests that the differences between ecoregions change among stream orders. The density of smallmouth bass in the Ozark Highlands and the Boston Mountains differ significantly ($p<0.01$) from the Ouachita Mountains in third and fourth order streams, but not in first or second order streams. Linear trends in smallmouth bass densities exist with stream order in the Ozark Highlands and the Boston Mountains, but not in the Ouachita Mountains. This study shows that ecoregion and stream order play a role in the characteristics of stream channels and smallmouth bass densities in eastern Oklahoma streams. The Oklahoma Department of Wildlife Conservation will use the data from this study to get a better understanding of the stream classification structure in the eastern portion of the state, which will help implementing stream restoration designs in eastern Oklahoma streams.

Paper 31: Forest age, woody debris, and nutrient dynamics in headwater streams of the White Mountains, NH

Dana R. Warren[1], Emily S. Bernhardt[2], Robert O. Hall, Jr.[3,4], and Gene E. Likens[4]

1Department of Natural Resources, Cornell University, Ithaca, NY 14853; 2 Department of Biology, Duke University, Durham, NC 27708; 3 Current Address: Department of Zoology and Physiology, University of Wyoming, Laramie. WY 82071; 4 Institute of Ecosystem Studies, Box AB, Millbrook, NY 12545; Contact: drw23@cornell.edu

Instream processing can substantially alter nutrient export from forested watersheds and there is increasing interest in factors that can influence or predict nutrient dynamics in streams. In this study we evaluate the relationship between instream nutrient uptake and two related factors: forest age and woody debris volume. Using nutrient releases, we measured the uptake velocities of phosphate, nitrate, and ammonium for five streams within the Hubbard Brook Experimental Forest (HBEF), NH. The 1998 annual nutrient flux was also calculated for each watershed. We surveyed woody debris and debris dams in all five streams to quantify their volume and abundance in each stream. Relationships between nutrient uptake velocity and nutrient flux from each watershed were assessed relative to forest age and woody debris characteristics using linear regression. Contrary to expectations, nutrient fluxes were not related to forest age. Instream woody debris volume was greater in watersheds with older forests (r^2=0.97). Phosphate uptake velocity was strongly positively correlated with both forest age and woody debris volume (r^2=0.99; $p<0.001$ in both cases); however, nitrate and ammonium were not related to either factor. We attribute the positive relationship between phosphate uptake velocity and forest age/large woody debris volume to increased abiotic adsorption of phosphate by the inorganic sediments retained by woody debris. Nitrogen uptake in these streams is primarily biological and is not predictably related to structural channel features. We expect woody debris abundance to increase in HBEF streams as the forest matures, with a subsequent increase in phosphate uptake in the drainage streams.

Paper 32: Assessing the Effects of Streamflow High on the New Zealand Mud Snail, Boulder Creek, Colorado

Kristina Klos Wynne and John Pitlick

Department of Geography, University of Colorado, Boulder, CO 80309, USA; Kristina.wynne@colorado.edu

The effects of hydrologic and geomorphic perturbations on aquatic ecosystems are of great concern as questions pertaining to ecosystem health and invasive species remain unanswered. Of particular interest in the American West is the introduction and spread of the New Zealand Mudsnail, an invasive organism that was confirmed in Colorado in November of 2004. Previous studies of the New Zealand Mudsnail, in streams in the northern Rocky Mountains have provided some insight into their distribution and habitat preferences, yet the link to geomorphology has remained largely unstudied. This study combines the fields of fluvial geomorphology and aquatic biology to investigate the relationship between high streamflows and the density of the New Zealand Mudsnail in Boulder Creek, CO. Five study sites representing areas both with and without snails were selected in an approximately 10 kilometer reach of Boulder Creek. Field measurements were conducted in the summer of 2005 to gain information pertaining to sediment size, channel geometry and discharge and are used to assess spatial differences in flow. Flow modeling will also be conducted to obtain a high resolution view of bed topography, boundary shear stress and sediment transport. The modeled flow velocities will be used to determine whether New Zealand Mudsnail population densities are significantly affected by variations in sediment transport, intensity and substrate disturbance. Additionally, snail collections were done prior to, during and following peak flow in order to assess longitudinal changes in population densities as well as habitat preferences within study reaches. Preliminary results indicate that the New Zealand Mudsnail population in the selected study reach of Boulder Creek display habitat preferences, both for the size of sediment to which they attach and for the location of that sediment within the channel. These habitat preferences are hypothesized to be correlated with lateral shear stress variations in the channel. Before peak flows, the snails were found throughout the width of the channel. Following extended near-bankful flows which moved the majority of the sediment on the bed, snails displayed preference for more stable habitat, particularly that sediment located on the sides of the channel. The preliminary examination of the data suggests that the channel forming flows did not, however, contribute significantly to the downstream movement of the snails in the study reach.

Paper 33: Use of Benthic Macroinvertebrates to Assess Water Quality in a Great Lakes Watershed

Christopher Riley and Shreeram Inamdar

Buffalo State College Great Lakes Center; Buffalo, NY; cjriley@lycos.com

Benthic macroinvertebrate surveys have proven effective in assessing water quality across a range of geographic regions and land use settings. Benthic macroinvertebrate communities were surveyed at four sites within the Cazenovia Creek watershed in western New York, a 135mi2 subwatershed of the Buffalo River. The sites differed in terms of land use, stream order, and sediment yield. Benthics were sampled monthly from July 2003 to June 2004 and temperature, pH, DO, specific conductance, and turbidity were continuously monitored using YSI data sondes. In addition, each site was assigned a habitat assessment score based on the USEPA Rapid Bioassessment Protocol for Use in Streams and Rivers, and monthly grab samples were lab analyzed for major nutrients, cations, and anions. Using the benthic macroinvertebrate data, seven community metrics including: Family richness, Percent EPT, Family-level Biotic Index, Percent Model Affinity, Percent Dominant Family, Percent Chironomid, and Shannon Diversity Index were compiled to assess macroinvertebrate assemblage health, and develop correlations to physiochemical stream conditions. Correlations between benthic community indices and water quality parameters were assessed across the four sites. Frequency analysis was performed to determine if "threshold" values of stressors corresponding to "impaired" and "desirable" benthic habitat can be identified. Investigations were made to determine if robust regression relationships between benthic macroinvertebrate indices and water quality stressors exist and if they can be quantified. Such relationships would provide an important tool for resource agencies to manage and mitigate impaired streams.

POSTER PRESENTATIONS

Paper 34: Interaction of Ecological and Fluvial Processes in the Supply of Large Woody Debris to Stream Channels

Jacob Bendix[1] and C. Mark Cowell[2]

1Department of Geography, Syracuse University, 144, Eggers Hall, Syracuse, NY 13244-1020, jbendix@syr.edu; 2Department of Geography, University of Missouri, 8 Stewart Hall, Columbia, MO 65211-6170, mcowell@missouri.edu

A growing body of literature emphasizes the effects of large woody debris (LWD) on fluvial processes. Temporal variation in the supply of wood to the channel is generally related to hydrological events and fluvial processes: large floods are disturbance agents that kill trees and simultaneously drop them into the channel. In this paper, we consider the role of another disturbance agent, fire. Wildfires can kill large numbers of trees in a single event, potentially causing a large pulse of wood input either at once if the trees are felled by the fire or during subsequent floods when snags are knocked over. In 2003, we inventoried the supply of snags at 11 transects across the valleys of two southern California streams burned by the 2002 Wolf Fire, Potrero John and Piedra Blanca Creeks. We returned in 2005 and repeated the inventory to learn how many had fallen – thus measuring the proportion of the burned trees that contributed in the short-term to LWD supply. We also used flood debris to reconstruct flood stages from significant floods that occurred in January 2005, to asses the impact of flooding on the rate of "snag-fall." Although tree mortality due to the fire in 2002 was extensive at all of the sites (we measured 340 snags in 2003), our results show considerable spatial variability in the conversion of those snags to LWD, reflecting the role of hydrogeomorphic processes. In spite of the subsequent floods, the majority of snags (83%) were still standing in the summer of 2005. The rate of snag-fall was apparently related to flood stage, as snags that did fall were mostly at cross-sections which experienced high flood stages, frequently in the portions of those cross-sections where flow was deepest. These results suggest that although the widespread mortality associated with wildfire inevitably supplies dead wood which will become LWD, that supply can be delivered over a substantial period of time, rather than in an abrupt pulse. Further, the timing of that input varies spatially, reflecting the distribution of subsequent flood impacts.

Paper 35: Integration of Fluvial Geomorphology into the Practice of Streambank Protection Design in the Buffalo District of the US Army Corps of Engineers

Paul Bijhouwer

US Army Corps of Engineers, Buffalo District, Buffalo, NY,
Paul.bijhouwer@usace.army.mil

Under Section 14 of the 1946 Flood Control Act, the US Army Corps of Engineers (USACE) is authorized to develop and construct streambank and shoreline stabilization projects to protect public infrastructure facilities. Past streambank stabilization projects constructed under this authority have often consisted of conservatively designed riprap revetments covering the entire streambank in an area of active erosion. In response to changing stakeholder expectations and as part of our commitment to integrating the USACE Environmental Operating Principles into the way we do business, the Buffalo District is incorporating techniques of fluvial geomorphology into the design of Section 14 projects. This is illustrated by a recent project: Canadaway Creek at Village of Fredonia Sewer Line. This project will protect the main trunk sewer that conveys wastewater to the treatment plant. Canadaway Creek is a high energy gravel and bedrock stream, and the project reach is highly active. It is also a Class B(T) stream, with a healthy trout population. The project was initiated following an episode of erosion which created a channel loop reducing the distance between streambank and sewer line from 150 ft to 100 ft. An initial design alternative consisted of 1000 linear ft of riprap revetment, bank and channel reshaping, and filling placement. Subsequent field monitoring of the erosion revealed that the eroded channel loop has become blocked by large woody debris at the upstream end, is dry during normal flow conditions, and generally appears to be stabilizing. Historic mapping and aerial photography reveal that the meander of Canadaway Creek in the project area is migrating progressively to the northwest. This trend is influenced by the upstream reach, which has been straightened and armored downstream of a railroad crossing. Given the severe environmental consequences of failure of the trunk sewer and evidence of stream instability, the project was deemed justified. Even though recent erosion appears to be less of a threat to the sewer than was initially believed, if the recent meander migration continues it will eventually fail the sewer. In light of uncertainty as to the eventuality and timing of future erosion, a trench-fill revetment design alternative was developed. A trench-fill revetment is a stone-armor revetment with a massive stone toe constructed in an excavated trench behind the river bank. The stream is expected to complete the work by eroding to the revetment, causing the stone toe to launch down and armor the subaqueous bank slope. A trench-fill revetment allows stabilization along a predetermined alignment and is simpler to design and construct than a revetment placed on an active stream. Since it is built in the dry, construction impacts to the stream are eliminated. It also provides the required protection while allowing the stream to continue to meander and maintain its natural character within prescribed limits. The protection is only activated if the stream continues to erode its banks to the point where the trench-fill is exposed.

Paper 36: Calcium and Thorns: A Hypothesis

Mark A. Blumler

Dept. of Geography, P.O. Box 6000, SUNY-Binghamton, Binghamton, NY 13902-6000; mablum@binghamton.edu

The distribution of thorny or spiny species is correlated with geology. In Latin America, thorn scrub/thorn woodland occurs on limestone and basalt. In Africa, thorny Acacia savanna occurs on fertile soils, while non-thorny miombo woodland is found where soils are poor. The Mediterranean and adjacent Near East, with abundant calcareous rock, is a center of diversity for thorny plants (cf. the many references in the Bible). Ecologists believe that thorns serve primarily as a mechanical defense against herbivory, and that such defenses are relatively cheap where soil is fertile and so growth is rapid. In contrast, chemical defenses are more likely where soil is infertile. While this is undoubtedly correct, observations in the Mediterranean region show that thorny plants can be abundant on infertile but often calcareous substrates such as on rendzinas. A particularly interesting case is that of the "tragacanths" - spiny cushion plants - which are abundant and remarkably diverse in Near Eastern mountains, in contrast to alpine regions of all other mountain ranges of the globe, which have cushion plants that are mostly non-spiny. Since the tragacanths diversified long before the advent of pastoralism, their presence cannot be ascribed to grazing by domestic animals. Soils are often shallow, and in that sense infertile, at high altitudes, where the bulk of these slow-growing species grow. I hypothesis a role for soil calcium in thorn formation. Calcium typically dominates the exchange complex in semi-arid and many arid region soils, especially of course where the bedrock is calcareous. Calcareous dust tends to be ubiquitous in arid regions and their borders, so calcium status may be good even on some soils formed over non-calcareous bedrock. Where calcium dominates the exchange complex, it typically is taken up passively in the transpiration stream, in quantities far in excess of what the plant needs. The excess is preferentially deposited in cell walls, and hardens them. Thus, especially where transpiration rates are high, calcium may facilitate thorn formation.

Paper 37: Multi-scale Geomorphic Impacts and Controls on Alpine Treeline

David R. Butler[1], George P. Malanson[2], Stephen J. Walsh[3], Lynn M. Resler[4], Daniel B. Fagre[5], and Carol F. Sawyer[1]

[1]Department of Geography, Texas State University-San Marcos, San Marcos, TX 78666-4616 db25@txstate.edu, sawyer@txstate.edu; [2]Department of Geography, University of Iowa, Iowa City, IA 52242 george-malanson@uiowa.edu; [3]Department of Geography, University of North Carolina, Chapel Hill, NC 27599-3220; swalsh@email.unc.edu; [4]Department of Geography, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061; resler@vt.edu; [5]Glacier Field Station, U.S. Geological Survey, Glacier National Park, West Glacier, MT 59936; dan_fagre@usgs.gov

Alpine treeline is an ecotone separating subalpine forest from alpine tundra. Traditional explanations suggest that the general elevation and shape of alpine treeline are primarily functions of temperature (e.g., the 10ºC isotherm for the warmest month) and net carbon balance of plants. Whereas these factors clearly influence the location of the ecotone, ongoing and recent geomorphic processes and landforms also influence, and in some instances control, the elevation, pattern, and, especially, dynamics of alpine treeline. Geomorphic processes and landforms influence alpine treeline at coarse, medium, and fine spatial scales. At coarse scales (e.g. across valleys), snow avalanches, debris flows, and rockfall/talus deposits distinctly depress treeline below the regional, climatically influenced, treeline elevation. At a medium, landform-specific, scale, some surfaces are inhospitable to seedling establishment and survival. Examples include boulder deposits such as talus deposits, avalanche boulder tongues, and solifluction treads. Fine-scale processes such as frost heaving and churning are inimical to seedling survival, whereas other processes such as turf exfoliation (rasenabschälung) may facilitate seedling establishment by creating microsites that are less compacted, more penetrable by seeds, and sources of moisture retention. Placement of individual boulders across the local surface is also important, as boulders offer leeward shelter for seedling establishment in sites where the microclimate might otherwise be too harsh for their survival. Temporal shifts in the nature and severity of geomorphic processes also influence the elevation and pattern of alpine treeline. Many local treelines were elevationally depressed by the harsher climate and geomorphic processes of the Little Ice Age. Glacial and rock glacier advances during the Little Ice Age created harsh, often barren surfaces that could support trees under modern climatic conditions. Such sites, still being revealed as glaciers have receded in the post-Little Ice Age period (since ca. 1850 in the American West), are only slowly undergoing treeline expansion due to limited soil resources.

Paper 38: A Micro-scale Qualitative Assessment of Landscape Stability in the Semi-Arid Environment of Northeastern Brazil

Antonio Carlos de Barros Corrêa

Departamento de Ciências Geográficas – Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil; Dbiase2001@aol.com

This study was developed in the semi-arid backlands of Northeastern Brazil, in the State of Pernambuco. The study-area is located along a fluvial environment, where native dry forest and thorn-scrub are interspersed by an arboreal vegetation dominated by the exotic "Algaroba"(Prosopis julifora) and buffel grass (Cenchrus ciliaris l.). Evidences of desertification, such as overgrazing, rill erosion and topsoil salinization are pervasive in the area, however the assessment of landscape responses to human induced impacts are rather difficult to establish, primarily due to the lack of remote sensing imagery at adequate scale, and the absence of an in depth understanding of the behavior of local surface systems. In order to overcome such hindrances and expedite the acquisition of in situ spatial information for planning purposes, a data-gathering methodology was proposed aimed at the qualitative analysis of the natural components of small areas allegedly affected by desertification processes. The field research was carried out at one hectare (10.000 m2) plots. The plots were divided into a hundred cells of 10m X 10m, according to a grid model. Following that a qualitative and semi-quantitative analysis was carried out, based on the in loco determination of the morphodynamic parameters, as put forward by Tricart (1977), for each 100m2 cell, applied to four categorical levels. A detailed geomorphological map, with indication of processes and surface materials, was also produced in the field. The final aim of the work was to apprehend and depict the main geomorphological features and land-surface processes within a micro-scale spatial framework under the constraints of the semi-arid conditions of Northeastern Brazil.

Paper 39: Effects of variable discharge regimes on river ecosystems: Impact of frequent water releases from Abanakee Dam on the Indian and Upper Hudson Rivers.

Randy Fuller[1], Sarina Doyle[1], Lisanne Levy[1], James Owens[1], Erin Shope[1], Lilien Vo[1], Beth Wolyniak[1] , and Martin W. Doyle[2]

[1]Biology Department, Colgate University, Hamilton, NY 13346; [2]Geography Department, University of North Carolina, Chapel Hill, NC; Contact: R. Fuller: rfuller@mail.colgate.edu

To assess the effects of variation in discharge on river ecosystems, we measured organic matter transport, periphyton abundance, and macroinvertebrate density in the Indian, Upper Hudson, Cedar, and Boreas Rivers. The Abanakee Dam has regulated releases (4 days/week during the summer) into the Indian River to support a white-water rafting enterprise and therefore the greatest impact was expected in this river, with lesser impacts on the Upper Hudson below its confluence with the Indian River. The Boreas and Cedar Rivers were used as control sites for comparison with the rivers influenced by the water releases. Transport of organic matter in the rivers decreased seasonally from May to July. However, organic matter transport increased by more than two orders of magnitude in the Indian and Hudson Rivers for all sampling periods during the regulated releases from the Abanakee Dam. Along with changes in the amount of organic matter transport, there was a change in the composition of organic matter from mostly terrestrial sources (leaves and twigs) in May and June, to autochthonous sources of organic matter such as filamentous algae in July and August in the Indian, Cedar, and Upper Hudson Rivers. However, the Boreas River continued to transport terrestrial material throughout the summer but at a lower concentration. The abundance of periphyton increased from May through July in the Indian, Cedar, and Upper Hudson Rivers while remaining at somewhat lower levels in the Boreas River. Regions of the Indian River that were heavily scoured due to the water releases experienced low chlorophyll a levels; however, ash free dry mass values in the heavily scoured regions were not dramatically different from values in the Boreas River. In comparison with the other rivers, the Indian and Cedar Rivers had higher densities of both net-spinning caddisflies and grazing mayflies. Net-spinners were likely using the plankton from the reservoirs and sloughed periphyton from the river whereas the grazing mayflies were probably supported by the abundance of periphyton in these rivers. The Boreas River with its lower periphyton abundance had higher densities of gathering mayflies which may rely less on periphyton as an energy source. Also, the heavily scoured regions of the Indian River had similar macroinvertebrate densities to refuge areas behind an island, but the species composition in these areas is different. Based on preliminary results, the water releases from the Abanakee Dam significantly reduced periphyton abundance in some areas of the Indian River channel and there was increased organic matter transport, however these impacts did not seem to have negatively affected macroinvertebrate abundance.

Paper 40: Response of Stream Morphology to Floods and its Influence on the Habitat of Trout in Paradise Creek, PA

Shixiong Hu and Jeffrey Hardy

Department of Geography, East Stroudsburg University of PA, East Stroudsburg, PA 18301; **shu@po-box.esu.edu**

The Paradise Creek Watershed is a sub-watershed with an area of 44.5 square miles in the Delaware River Basin. Famous for rich, old-growth forests and beautiful scenery, the high-gradient headwaters of the Paradise Creek cascades down hundreds of feet off the Pocono Plateau in short distances, plunging through deep ravines and creating the typical stream landforms of step-pool and riffle-pool in the Paradise Valley. The high quality water, mountainous forests and low temperatures in the pools provide ideal habitats for wild trout in this small watershed. Unfortunately, the watershed experienced two 100 years floods within a seven month period during 2004 and 2005. The huge flood events brought great changes in the river morphology and significantly influenced the trout habitat. This study is divided into two parts. In part one, the GIS software TauDEM and LandSerf are utilized to analyze the surface features of the river network and landforms from DEM data. The slopes, contribution area, wetness index and other factors obtained from DEM and land use data are used to identify the river channel reaches that are susceptible to large changes during flooding events. In part two, the potential problem areas identified by TauDEM and LandSerf are investigated in the field. Our data measurements combined with the Delaware River Basin Commission fluvial measurements are used to examine the river bank stability in the upper reaches, and the response of stream morphology downstream due to the large amount sediment movement. Preliminary results indicate that 1) the huge floods caused dramatic changes of the river morphology in the flood plain, which are represented by river shifting in the glacier till valley, destruction of step-pool system and serious sedimentation in the pools; 2) these flood events damaged greatly the habitat of wild trout, as indicated by increasing temperature in the destroyed or shallow pools, depleted oxygen by the sediment deposits and the removal of bank cover; and 3) TauDEM and LandSerf are excellent GIS tools for the analysis of surface landforms and the river network in the watershed.

Paper 41: Hydrogeomorphic controls on storm-event water and solute exports across catchment scales

Shreeram Inamdar[1] and Myron Mitchell[2]

[1]Geography and Great Lakes Center, 1300 Elmwood Avenue, Buffalo State College, Buffalo, NY 14222, inamdasp@buffalostate.edu; [2]Environment and Forest Biology, 1 Forestry Drive, SUNY-ESF, Syracuse, NY 13210. mitchell@syr.edu

We studied the storm-event exports of water and solutes across four partly nested forested catchments located in Western New York, USA. The catchments have been monitored over the last two years for streamflow discharge, all cations and anions, DOC and DON. The watersheds included - S1 a 696 ha watershed; S2 a 3.4 ha watershed nested within S1; S3 a 1.6 ha hollow catchment nested within S2; and S5 a 1.9 ha first-order catchment outside S1. The watersheds have varying proportions of riparian and hillslope saturated areas. The areal extent of saturated areas was mapped using field surveys and topographic indices. A modified topographic index (based on the downslope index) was generated using a 2m DEM for all catchments. The mean topographic index values for S1, S2, S3, and S5 were 5.76, 5.83, 5.72, and 6.06, respectively. The percent catchment saturated areas in the same order were 2.1, 0.9, 0.7, and 4.3%. Event runoff ratios decreased with increasing catchment size for the nested catchments (S1, S2, and S3). Event new water amounts increased with increasing catchment size across the nested catchments. Event flow-weighted DOC concentrations increased with increasing catchment size from S3 to S1, whereas nitrate concentrations followed an exactly opposite trend. S5, which had the maximum saturated area %, produced the highest DOC concentrations. The pattern in DON export is being evaluated. Water and solute fluxes for individual storm events (with varying antecedent moisture conditions) are also being studied. We hypothesize that the patterns in water and solute responses observed across the four catchments are influenced by the varying extent of riparian and hillslope landscape units and their hydrologic connectedness with the drainage network. Results from this study will further our understanding of hydrologic and topographic controls on solute export patterns from watersheds.

Paper 42: Geomorphic Effects of Forest Vegetation Change in the Ouachita Mountains

Jonathan D. Phillips[1], and Daniel A. Marion[2]

[1]Tobacco Road Research Team, Department of Geography, University of Kentucky, Lexington, KY, 40506-0027, jdp@uky.edu; [2]Southern Research Station, USDA Forest Service, P.O. Box 1270, Hot Springs, AR 71902, dmarion@fs.us.gov

Interrelationships between trees and topography, regolith thickness, soil morphology, weathering, and regolith mixing and redistribution in 16 plots in the Ouachita Mountains, Arkansas reveal systematic differences in the geomorphic effects of pines (mainly Pinus echinata) and hardwoods (chiefly Quercus spp.). This study assesses the potential geomorphic impacts of vegetation change. The major geomorphic effects of trees in the study area are attributable to tree throw, mass displacement by root growth, infilling of stump hole depressions, and facilitation of rock weathering. Pines and hardwoods may differ significantly in the rate, style, and relative importance of these processes. Ice storms are the major tree-throw mechanism in the Ouachitas.. Thus pines, with greater winter surface area, comprise about 75 percent of uprootings. Though 93 percent of trees are likely to experience "standing death," the total surface area influenced by tree throw is greater than that of stump holes due to the displacement of large root wads. Pines and oaks both displace soil by root growth proportionally to their sizes, which are comparable at maturity. However, the rates differ, as pines grow faster and are more short-lived, while the hardwoods often grow slowly and may be quite long-lived. Styles also differ—hardwoods generally have little basal mounding, so displacement around the trunk is primarily lateral. Pines have basal mounds, with a vertical as well as horizontal component to the displacement. Stump holes may infill with transported material from upslope, organic debris, and local slumping of the pit walls. Because of the displacement styles, rock fragments and other materials displaced by trunk growth are more likely to fall into the stump holes of hardwoods. Trees promote bedrock weathering by exploiting fractures, joints, and bedding planes, facilitating moisture flux and biological activity. However, as shade-intolerant, early-successional species which are typically the first woody colonizers of rock outcrops, pines are much more likely to play a role in the early, incipient development of soil and regolith. Both pines and hardwoods in the study area have taproot growth forms and are associated with local regolith thickening. The entire forest surface area can be affected by displacement, tree throw, and stump holes within the Quaternary, and in some scenarios within the Holocene. Regolith turnover is a function of the relative frequency of uprooting vs. standing death, basal area, and average lifespan. Thus variations in stem density, basal area, and the relative proportion of pines and hardwoods can significantly influence the magnitude and relative importance of these processes.

Paper 43: The Use of Hydrogeochemical and Geomorphic Data for Elucidating Nutrient Dynamics in a Forested Ecosystem: Brubaker Run Watershed, Lancaster County, Pennsylvania

Jason R. Price[1], Leah Jackson[2], Thomas Greco[2], and Jeremiah Mbindyo[2]

[1]Department of Earth Sciences, Millersville University, P.O. Box 1002, Millersville, PA 17551-0302; Jason.Price@millersville.edu; [2]Department of Chemistry, Millersville University, P.O. Box 1002, Millersville, PA 17551-0302

An ecological system has a detailed budget of inputs and outputs of nutrients which are continuously transported by meteorologic, geologic/hydrogolic, and biologic vectors. These vectors have been quantified for the Brubaker Run watershed located in Lancaster County, Pennsylvania. The flux of the base cations (Na+, K+, Mg2+, Ca2+) lost from the weathering profile of the Brubaker Run watershed have been calculated using two independent methods: (1) Combining precipitation elemental fluxes, stream discharge, and elemental concentration data for Brubaker Run, yielding a short-term (six month), present-day, average flux; and (2) Combining total denudation rates derived from cosmogenic 10Be in fluvial sediments with bedrock and soil bulk chemistry, providing a long-term (multi-millenial) average flux. Short-term stream flux values (minus precipitation inputs) will be influenced by the biomass. However, in the case of the long-term flux calculations, the biomass of a forest can be considered to be in steady state, and will not affect the calculated flux values. The short-term base cation flux values are systematically higher than the long-term flux values, with the exception of K, which is substantially lower. Because Na is not a significant plant nutrient, the systemic elevations in Na, Mg, and Ca may reflect a relatively wetter, and concomitantly warmer, climate of the watershed during the six month period of sampling. The aberrant behavior of K, however, may potentially reflect reduced present-day muscovite weathering rates, or more likely, that the current watershed biomass is an anomalously large K sink. Measured deciduous forest net primary production stoichiometries reported in the literature nearly always show that Ca is preferentially consumed relative to K, consistent with the approximate stoichiometry of photosynthesis. On average, the Ca stoichiometry of a deciduous forest should be approximately twice that of K. The Brubaker Run forest is characterized by extensive invasive plant species such as Ailanthus altissima, Rosa multiflora, Lonicera japonica, Ampelopsis brevipedunculata, and Celastrus orbiculata resulting from previous agricultural land-use. These invasive plant species may, at least in part, be influencing the K biogeochemical dynamics of the ecosystem.

Paper 44: Channel Network Change in a Complex Distributary System: the Narran Lakes

Scott Rayburg and Martin Thoms

CRC for Freshwater Ecology, University of Canberra, Belconnen, ACT, Australia; scott.rayburg@canberra.edu.au

Extensive channel networks are a feature of wetland systems in the dryland regions of Australia. At the wetland landscape scale these channel networks are important physical habitats that support diverse flora and fauna communities. The Narran Lakes Ecosystem, situated in northern NSW, is a terminal wetland for the Narran River and is a significant site for migratory water birds. Consequently, it is listed on the Ramsar List of Internationally Important wetlands. The Narran Lakes Ecosystem is composed of several lakes, intervening floodplains and wetlands, and an extensive distributary channel network. The channel network is dynamic and highly unstable and is the primary avenue by which water is delivered to, and distributed throughout, the system. The purpose of this study is to assess changes in the channel network within the Narran Lakes between 1969 and 2003. Channel network patterns were digitized for a series of aerial photographs (1969, 1992, and 2003) in order to determine the rate and manner of change in the channel network. Specifically, changes in channel network area, the length, width and sinuosity of channel links, and the composition of link types are addressed. For most channel network characteristics, there was little or no change between 1969 and 1992. However, substantial alterations in channel network characteristics were observed between 1992 and 2003. These changes included a reduction in channel network area, an elongation of link length and a decrease in link sinuosity. The net result of these changes is a smaller, less diverse channel network in 2003 than was present in 1992 or 1969.

Paper 45: Soil and Soil Organic Carbon Redistribution in Agricultural Ecosystems

Jerry C. Ritchie, Gregory W. McCarty, Erik R. Venteris, and Thomas C. Kaspar

United States Department of Agriculture-Agriculture Research Service;
jritchie@hydrolab.arsusda.gov

Patterns of soil organic carbon (SOC) vary widely across the landscape leading to large uncertainties in the SOC budget of agricultural systems especially for landscapes where water, tillage, and wind erosion redistributes soil and SOC across the landscape. It is often assumed that soil erosion results in a loss of SOC from the agricultural ecosystem, but recent studies indicate that soil erosion and its subsequent redistribution within fields can stimulate carbon sequestration in agricultural ecosystems. This study investigates the relationship between SOC and soil redistribution patterns on agricultural landscapes. Soil redistribution (erosion and deposition) patterns were estimated in three tilled agricultural fields using the fallout ^{137}Cesium technique. ^{137}Cs and SOC concentrations of upland soils are significantly correlated in our study areas. Soils in upland areas (eroding) have significantly less SOC than soils in deposition areas. SOC decreased as gradient slope increases and soils on concave slopes had higher SOC than soils on convex slopes. These data suggest that soil redistribution patterns and topographic patterns may be used to help understand SOC dynamics on the landscape. Different productivity and oxidation rates of SOC of eroded versus deposited soils also contribute to SOC spatial patterns. However, the strong significant relationships between soil redistribution and SOC concentrations in the upland soil suggest that soil and soil organic matter are transported along similar physical pathways in these systems. Our study also indicates that landscape position is important for understanding soil movement and redistribution patterns within a field or watershed. Such information can help develop or implement management systems to increase SOC in agricultural ecosystems.

Paper 46: Jornada Experimental Range and Sevilleta LTER: Unique Arid Rangelands for Experiments to Validate Satellite Systems for understanding different scales

Jerry C. Ritchie[1], Thomas J. Schmugge[2] and Albert Rango[3]

[1]USDA ARS Hydrology and Remote Sensing Lab., BARC-West, Beltsville, MD 20705; jritchie@hydrolab.arsusda.gov; [2]Gerald W. Thomas Professor of Water Resources, New Mexico State Univ., Las Cruces NM 88003; 3USDA ARS Jornada Experimental Range, Las Cruces, NM 88003

The ARS Jornada Experimental Range (Jornada) in southern New Mexico USA and the Sevilleta Long Term Ecological Research (LTER) in Central New Mexico provide unique opportunities to use remote sensing techniques to study arid rangeland and the responses of vegetation to changing hydrologic fluxes and atmospheric driving forces at different scales. Research at the Jornada has been conducted continuous since 1912 by the United States Department of Agriculture (USDA) Forest Service and USDA Agricultural Research Service and has been a National Science Foundation LTER site since 1981. Research at the Sevilleta LTER has been continuous since 1988. These long-term investigations provide unique ground data on vegetation characteristics, ecosystem dynamics, and vegetation response to changing physical and biological conditions. To complement the programs of ground measurements, a campaign called JORNEX (JORNada EXperiment) began in 1995 to collect remotely sensed data from aircraft and satellite platforms to provide spatial and temporal data on the physical and biological states of these arid rangelands. A wide range of ground, aircraft, and satellite data have been collected on the physical, vegetative, thermal, and radiometric properties of the ecosystems (grass, grass/shrub transition, and shrub) typical of arid rangeland of southwestern U.S. deserts. Spatial surface energy balance estimates were made from a combination of parameters and state variables estimated from satellite, aircraft and ground data. Landscape surface roughness was evaluated with the laser altimetry data and used to estimate aerodynamic roughness. Data from different platforms allowed the evaluation of the landscape at different scales. These measurements are being used to quantify hydrologic budgets and plant responses to change in components in the water and energy balance at the Jornada and Sevilleta. Surface energy fluxes have been observed since 2000 for several different surface conditions.

Paper 47: Vegetation patterns and percent-cover in a Mojave Desert piedmont from low-altitude visible and color-infrared imagery

Sarah Robinson and Sue Phillips

US Geological Survey; srobinson@usgs.gov

Commonly used vegetation indices (e.g. NDVI) are often not effective for quantifying desert vegetation because the indices are designed for measuring dense, green vegetation. Desert vegetation has a large component of non-photosynthetic vegetation (NPV) and usually occurs at low cover percentages. NDVI and SAVI significantly underestimated the percent vegetation cover in this study because they often missed the NPV, which comprises 25-50% of the vegetation aerial cover. This study created an algorithm using high-resolution remote sensing imagery to generate accurate vegetation maps that include both green vegetation and NPV. This project collected low-altitude, high-resolution visible and color infrared (CIR) imagery along distal to proximal fan transects. The visible imagery was collected from a balloon platform covering 0.15km^2, while the CIR imagery was collected from a helicopter platform and covers a much greater area of 2.34 km^2. Because of its small pixel size (7mm to 20cm), this imagery can be used to study the spatial distribution of individual plants and how the distribution varies with fan position, geologic unit and topography. By combining the finer detail and better ground control of visible photography with the greater coverage and vegetation sensitivity of CIR imagery, an expert classification system produced georeferenced raster maps of vegetation that discriminated individual plants. The expert classification uses two band ratios derived from the three original bands (NIR, Red, and Blue/Green) that discriminated the vegetation based on: 1) the concave shape of the vegetation spectra and 2) the Blue/Green band values >Red band values. This algorithm is sensitive to both green and NPV vegetation. In comparison with manually digitized polygons of vegetation, the automated vegetation map correctly identified ~90% of the pixels. In addition, CIR derived polygons of vegetation were compared to calculated footprints from field measurements (x and y axes) for individual plants and found to have a linear relationship with an R^2=.86. These automated vegetation maps use easily acquired CIR imagery and are sensitive to both NPV and green vegetation. Their high spatial resolution allows for discrimination of individual plants making them useful as basemaps for field studies, allowing for analysis of plant pattern with geologic unit, and provide detailed ground data for scaling up to platforms that have lower spatial resolution, but larger spatial coverage.

Paper 48: Hydraulic-unit and biotic diversities in urban and rural streams of the North Carolina Piedmont: a case study

Shoffner, D., Royall, D., and Henderson, A.

Department of Geography, The University of North Carolina at Greensboro, Greensboro, NC, 27403; pdroyall@uncg.edu

Stream health indices have often centered on water quality measures and stream stability rankings. Yet, many studies have found only weak correlations between such attributes and biotic assemblages. Hypothesizing that bedform-scale hydraulic factors may account for part of the unexplained variation, we examined the hydraulic-unit and biotic compositions of four stream reaches, two urban and two rural, near the city of Greensboro in the North Carolina Piedmont. We surveyed and described all hydraulic units in each study reach under winter baseflow conditions using a theodolite, meter tape and velocity meter. Based on areal coverage of hydraulic-unit classes as defined in the River Styles framework, the hydraulic-unit diversities of all reaches appear comparable. However, hydraulic-unit composition does not. Pools are most common in the urban reaches surveyed, whereas runs are more prominent in the rural reaches. Glides, which are often transitional between higher and lower energy environments, occur in similar proportions in each of the four reaches. Most unit classes are well-differentiated on the bases of roughness Reynolds number and shear velocity. Available data on aquatic macroinvertebrate assemblages in these reaches indicate a poor correlation between biotic and hydraulic-unit diversities. We interpret this result to confirm the necessity of using multiple criteria for assessing stream health, and suggest a combined input of hydraulic unit, stream stability, and water quality information as the next step in evaluation. However, there are many other complicating issues not yet addressed. These include the need for hydraulic-unit assessment at a variety of flow stages and seasons, the evaluation of hydraulic-unit spatial arrangement, synchronizing biotic and hydraulic-unit data gathering, the stratification of biotic data according to habitat sensitivities, and the need for larger data sets for all factors, including the number of different watersheds and reaches evaluated.

Paper 49: Lake Sediment Records of Terrestrial Phosphorus Cycling: Climatic and Geomorphic Controls

Catherine Souch and Gabriel Filippelli

Department of Geography; Indiana University-Purdue University at Indianapolis; csouch@iupui.edu

Phosphorus is an essential bio-limiting nutrient. The only new source of this element to global ecosystems results from weathering of continental material. Changes in the rate of phosphorus weathering as a function of climate and landscape stability are poorly understood, limiting reconstructions of past nutrient cycling and biotic responses. In appropriate settings (oligotrophic lakes in headwater systems), lake sediment records may provide integrated records of watershed-scale phosphorus cycling through time. When applied to high resolution lake sediment records, P studies can provide information on rapid changes in ecosystem response to climatic events providing important new insight to current understanding based largely on soil chronosequences. Here we present results from four contrasting regions (Kwoiek and Lower Joffre Lakes, BC; Dry Lake, CA; Jackson Pond and Anderson Pond, Appalachian Plateau; and Laguna Zoncho, Costa Rica) to illustrate the approach. A chemical sequential extraction technique adapted from soil fertility research is used to analyze lake sediments with depth to partition the dominant geochemical fractions into mineral P (the original lithic source of bioavailable P), occluded P (bound to soil oxides), and organic P (remains of organic matter production by plants). These fractions are shown to be a valid proxy for landscape-scale nutrient status by comparing P fractions of soil and recent lake sediment samples. The approach is then used to interpret changes in soil development for the watersheds based on the P fractions preserved in the basins' outlet lake sediments. The importance of soil and ecosystem development, changing sediment sources, and anthropogenic impact are illustrated at the four sites. Results from P geochemistry from Joffre Lake, BC, are highlighted to reveal the interplay between glacial- and slope-derived sediments and the nature of soil nutrient cycling on surrounding slopes. Implications for ecosystem development and stability are discussed.

Paper 50: Geo-Visualization of Human Induced Storm Pollution in a Natural Drainage Basin

Tao Tang, Ian Bruce, and Maria Dolce

Department of Geography and Planning; Buffalo State College; 1300 Elmwood Ave., Buffalo, NY 14222-1095; tangt@buffalostate.edu

Three challenges are exist in GIS based visualization study in the physical environment. First, large quantity of geospatial data is being generated, but not effectively interpolated. Secondly, how to incorporate fragmented field sampling and measurement data to estimate "what the elephant looks like"? Thirdly, studies of spatial quantifications of behaviors and interactions of human and ecosystem factors with morphological factors in a drainage basin need to be enhanced. This study demonstrates the spatial quantifications of the behaviors and effects of ecosystem and watershed factors, such as human land use activities, vegetation cover, slope, and soil type for potential pollution generation and accumulations. Spatial tools in GIS for data integration and visualization were applied. The lower Buffalo River watershed was used as a study area. The practical objective of this study is to provide two types of information to the local governments. (1) Where and how much urban storm water runoff is generated with respect to an average precipitation year? (2) Which of the five storm water management practice tools provided by U.S. EPA and New York State DEC is most suitable for the storm water clean up in a runoff catchment (or sub-basin) with respect to the five feasibility criteria established by the agencies? USGS 10 meter resolution DEMs were used to delineate the storm water catchments in the watershed. ArcGIS - ArcHydro module was applied to simulate runoff and pollutant generation and accumulation in the study area incorporating raster, vector, and field water pollutant sampling data. Land use classification scheme was developed using Land-Based Classification Standards (LBCS) by American Planning Association (APA). Impervious land uses were computed by relating land use categories to the impervious cover scheme (Cappiella and Brown, 2001). Topological connectivity of factor map layers was established. Weighted behaviors or effects of influential factors were computed. Storm water management tools and suitable locations were suggested for the catchments based on spatial computation and simulations. However, this study is preliminary. More researches are needed for improving both technological and spatial integration aspects of geo-visualization in natural watersheds.

Paper 51: Beyond the Bankfull Channel: Greenfield Development, Semi-Alluvial Channels and Natural Corridor Design

Paul Villard and P. Geo

Ph.D., Senior Geomorphologist, Geomorphic Solutions (A Member of The Sernas Group Inc.), 141 Brunel Road, Mississauga, ON, L4Z 1X3,
pvillard@geomorphicsolutions.ca

In the Southern Ontario context, the need for designs that move beyond the simple low flow or bankfull channel design and instead encompass other floodplain features, functions and linkages is growing as development moves into headwater systems and more applications for complete channel corridor realignment/lowering for servicing are proposed. Corridor lowering in Southern Ontario raises a number of issues: loss of developed soil horizons, impact to sediment supply due to lowering into glacial tills, and impact on the retention and detention of flows usually associated with natural floodplains. The last two issues are exacerbated by the fact that many channels in Southern Ontario are semi-alluvial and therefore limited availability of alluvium in many cases may already be a constraint on channel form and function. This poster presents examples of alternative restoration projects in Southern Ontario that have been designed to mimic the form and function of natural stream corridors.

Paper 52: Surface Control of Desert Pavement Pedologic Process, Vegetation Distribution, and Landscape Function, Cima Volcanic Field, Mojave Desert, California

Y. A. Wood[1], R. C. Graham[1], S. G. Wells[2]

[1]Soil and Water Sciences Program, Department of Environmental Sciences, University of California, Riverside, CA, U.S.A. 92521; Yvonne@ucr.edu; [2]Desert Research Institute, Reno, NV 89506, U.S.A.

Desert pavement, a surficial feature widespread throughout the world's arid lands, plays a dynamic role in geomorphic, hydrologic, and ecologic processes. The spatial patterning of desert pavement surfaces is generally barren stone (clast) covered expanses surrounding 'islands' of shrubs and bare soil, reflecting the dominant control of rainfall redistribution by the soil surface. Our objective was to determine the relation at a scale of meters between the physical surface characteristics of a single-aged desert pavement landscape, water movement, underlying soils and desert flora distributions. A desert pavement mantling a 580 ka basalt flow in the Mojave Desert of California was delineated into six large-scale surface map types, termed clast mosaics, using mean clast size, degree of clast sorting and percent of bare ground. Clast mosaics abut with sharp boundaries and capture subtle, yet consistent, variations in soil surface characteristics. Chemical and morphological characteristics of underlying soils (Aridisols), formed in eolian parent material, were compared within and between delineated clast mosaics and then related to percent surface cover by desert scrub. Soil properties are consistently more similar within, rather than between, clast mosaic map units and are strongly linked to measured biotic components. The differences between the soil properties of abutting mosaics are sufficient for their soil classifications to range from Typic Haplargids to Calcic Paleargids. Plant cover inversely relates to clast cover, reflecting the surface's control of available water. Surface cover by desert plants varies from scarce (0.4% cover by ephemerals) where clast cover and concentrated soil salts are high, to as much as 50% cover by vascular plants where clast cover is low and soils are leached to at least the 50 cm depth. While desert pavement may appear as a monotonous, barren feature, we find that instead desert pavement surfaces are complex associations of landscape elements. Strong linkages between the distribution of surface clasts, the genesis of underlying soils, and desert flora distributions have initiated and reinforced these distinct, yet intricately associated, landscape elements, which currently determine surficial processes, such as eolian deposition, and leaching regimes.

Paper 53: Altered Subsurface Hydrologic Response Drives Chronic Loss of Southern California's Coastal Sage Scrub Ecosystem under Conditions of Elevated N-Deposition

Y.A. Wood[1], T. Meixner[2], P. J. Shouse[3], and E. B. Allen[4]

[1]Soil and Water Sciences Program, Department of Environmental Sciences, University of California, Riverside, CA, U.S.A. 92521; **Yvonne@ucr.edu;** [2]Department of Hydrology and Water Resources; University of Arizona, Tucson, AZ, U.S.A. 85721; [3]USDA-ARS George E. Brown, Jr. Salinity Lab, 450 W Big Springs Rd., Riverside, CA, U.S.A. 92507; [4]Department of Botany, University of California, Riverside, CA, U.S.A. 92521

Many regions of Coastal Sage Scrub (CSS), a dominant native shrub community of southern California, have been replaced by exotic annual forbs and grasses over the last few decades. Historical reports from the 1770's describe this unique shrubland as covering the granitic Perris Plain's lower elevation foothills. Now, environmental pressures from a burgeoning human population, including high summer concentrations of nitrogenous air pollutants and increased fire frequency, have fostered its decline. Vegetation type conversion from native shrubs to grasslands has been suggested to decrease conduits capable of moving soil water to depth, which should alter both (1) the spatial patterning of subsurface water across the landscape and (2) soil water flux to depth. In addition to altering ecosystem functions, such subsurface hydrologic changes should impact landscape dynamics as the probability of frequent, shallow landslides across these hillslopes increases in response to large storm events. In this work, soil water and nutrient-N regimes were compared between a site where CSS has declined under a regime of high additions of anthropogenic N, and one where CSS remains dominant with predominantly background atmospheric additions of N. These two sites have similar climate, granitic bedrock lithology, soils, and topography, and had the same vegetation type (Riversidian CSS) thirty years ago. Soil cores to fresh bedrock were collected quarterly over a two-year period to measure (1) volumetric soil moisture, (2) regolith chloride (Cl) as a conservative tracer of soil water movement, (3) regolith nitrate-N, and (4) soil depth. We found that the depth and flux of rainwater percolation into wildland hillslope soils in response to early season storms was greatly reduced where the dominant vegetation type is invasive grassland. With decreased rainwater redistribution to soil depths of 100 to 150 cm, the predominant zone of soil water became the upper 25-cm. This shift exacerbates vegetation type conversion by (1) concentrating smog-produced nutrient-N in the uppermost soil, where it becomes readily available, along with soil water, to shallow-rooted grasses and (2) depriving native shrubs of deeper regolith water. This major shift in the subsurface hydrologic response could chronically suppress the ability of native shrubland to re-vegetate the landscape since nutrient availability and seedling establishment are determined by the spatial patterns of soil water. The soil depth at the degraded CSS site is ~50 cm shallower than at the relatively pristine site, further compromising the viability of re-established shrubs by reducing available storage for soil water.

Paper 54: Geosuccession - changes of morphogenetic domains as an amendment in the holistic theory of nature

Zbigniew Zwolinski

Institute of Paleogeography and Geoecology, Adam Mickiewicz University, Poznań, Poland; zbzw@amu.edu.pl

A morphogenetic domain is an undefined taxonomic spatial unit corresponding to a morphological landscape produced by strictly specified morphogenetic factors and processes. Seven types of domain can be distinguished: morphogenetic category, morphogenetic complex, morphogenetic pattern (=subsystem), morphogenetic system (=morphosystem), morphogenetic region, morphogenetic zone, and morphogenetic province. The causes and controls of change in a morphogenetic domain or domains affect the quality, range and stage of geosuccession. So, geosuccession is a complex and usually long-term phenomenon taking place in a certain taxonomic spatial unit and embracing a set of geographical processes transforming the morphogenetic domain existing in it thus far into a different one. Geosuccession results in overlapping qualitative and quantitative changes in geomorphic processes that occur at a spatio-temporal scale, and alter the style of functioning of the morphogenetic domain. The fact that the sequence of landscape changes is so widespread obliges one to formulate terminological foundations of geosuccession in order to systematise the observed, measured and described transformations of the relief. The exploration to date indicates that the most distinctive and spectacular geosuccession occur in the polar regions, but not only there. The rapid recession of glaciers observed in the polar regions and the research conducted in the Svalbard (the Arctic) and South Shetland (Antarctica) archipelagos indicate landscape metamorphosis to be widespread in paraglacial areas. Nowadays, the most dynamic property of glaciated regions is their shrinkage, a dwindling of area. Emerging from under the disappearing glacial landscapes are usually surfaces with a thick mineral cover, mainly regolith, morainic or weathered; less frequently rocky. The paraglacial concept emphasises the relatively rapid adjustment of postglacial landscapes to non-glaciated conditions through a heightened activity of a wide range of subaerial processes in a variety of environments. In this context, polar oases developing as a result of the retreat of glaciers due to global warming should be considered the most paraglacial areas today. The absolute condition for the existence of the polar oasis geoecosystems is a periodic occurrence of temperatures above freezing point which will allow the development of a network of streams and possibly bodies of water, which in turn will provide a sufficient starting point for the development of denudation processes (e.g., erosion or chemical denudation, etc.) and biogenic processes. These polar oasis geoecosystems are excellent example of geosuccession in statu nascendi. The sensitivity of morphogenetic domains is thus an attribute of geosuccession which manifests itself in the enrichment or depletion of their geodiversity. A crucial feature of geosuccession is that it precedes succession (in the sense of biological succession) in the natural environment which occurs just at the stage of a morphological climax, a top stage of geosuccession. This interpretation of geosuccession has its methodological roots in the holistic theory of nature, which perceives it as complementary to phenomena taking place in the biosphere.

ACCEPTED PRESENTERS UNABLE TO ATTEND

Paper 55: A comparative assessment of soil erosion using the Revised Universal Soil Loss Equation and the Revised Morgan, Morgan and Finney method in Phetchabun, Thailand

Y. Bamutaze[1,*] and D. P. Shrestha[2]

[1]Department of Geography, Makerere University PO Box 7062, Kampala, Uganda; bamutaze@arts.mak.ac.ug; [2]International Institute for Geo-information Science and Earth Observation (ITC); PO Box 6, 7500AA Enschede, The Netherlands; shrestha@itc.nl

Soil erosion is a serious environmental problem in Thailand and it requires adequate quantitative data in order to address the problem and design sound preventive measures. A comparative study was conducted to quantify soil losses under major land uses and landscapes in Lomkao District, Phetchabun Province, , Thailand. Aerial Photo Interpretation (API) and ground truthing were performed to classify the major landscapes and two revised soil loss models i.e. the Revised Morgan, Morgan and Finney (RMMF) model as well as the Revised Universal Soil Loss Equation (RUSLE) were applied in a GIS environment to estimate soil loss. Results showed a significant difference in estimates ($P< 0.05$) with RUSLE giving higher average values (6 t $ha^{-1}yr^{-1}$) than RMMF (2 t $ha^{-1}yr^{-1}$). In terms of land uses the RUSLE model predicted 24.9 t $ha^{-1}yr^{-1}$ for annuals, 6.9 t $ha^{-1}yr^{-1}$ for orchards and 3.3 t $ha^{-1}yr^{-1}$ for disturbed forest while, RMMF gave 9.7 t $ha^{-1}yr^{-1}$ for annuals, 2.8 t $ha^{-1}yr^{-1}$ for orchards and 0.3 t $ha^{-1}yr^{-1}$ for disturbed forest. With respect to landscape, the highest rates predicted for hillands were 28.8 t $ha^{-1}yr^{-1}$ and 9.4 t $ha^{-1}yr^{-1}$ by RUSLE and RMMF respectively, while the lowest rates predicted were in piedmont landscape by both RUSLE and RMMF models. Overall the performance of RUSLE model seems to be closer to soil losses reported in Thailand.

Paper 56: Nebkhas in the Southeast of Inner Mongolia: Morphology, Sediments, and Their Validity as Indicator of Desertification

Hasi Eerdun, Yue Xingling, and Zhuang Yanmei

College of Resources Science and Technology, Beijing Normal University
Beijing,100875, China; **hasi@bnu.edu.cn**

Nebkhas are mounds composed of wind-borne sediment within or around shrub canopies. These dunes distribute extensively in the arid and semi-arid regions of China, but little attention has been paid to them. Field investigations and experiments on the dunes have been made in the southeast of Inner Mongolian plateau, which include measurement of dune morphology (nebkhas size and shrub size), observation of the dune surface airflow and process, analysis of physical and chemical properties of the dune-interdune sediments and investigation of plant species. In this paper, the occurrences, morphology, sediment, airflow and the formation process of the dunes are represented, also the factors influencing the growth of nebkhas, the formation of fertile island. And whether nebkhas can be regarded as an indicator of desertification is discussed. The conclusions gotten as followed: Significant linear correlations exist among dune height, width and length at all sites, so the nebkhas in the study area is on the phase of growing. On a large scale, Nebkhas distributes in the downwind area of farmland and alluvial fan, degraded grassland and village circumference. The density and scale of nebkhas decrease downwind from the source areas. The nebkhas contains a highest proportion of fine sand and little gravel. The sands are transported a short distance but better sorted. Contrasting to the surrounding inter-dune soils, it is better sorted and contains more fine and medium sands. Nebkhas is regarded as a fertilized island which is enriched in organism and available inorganic nutrients. The nutrients come from sand sources contribute less to the enrichment of nutrient, while the feedbacks of the bush canopy are the main cause of the enrichment. Air flows become adverse at the lee of dune and bush and round the dune, congregate at the lee of the nebkhas. The change of airflow can contribute to the deposition of sand taken by sand flux. Also, the lee of nebkhas is the main growing part of nebkhas. Nebkhas is one of wind-borne physiognomies and it is also regarded as an indicator of desertification. However, the scale and density of the dunes are mainly depending on the abundance of sand sources, so we can't quantitatively judge the desertification degree with the scale of the dunes. Under the local climate conditions, Nebkhas develops as a consequence of human activities. Its development mainly depends on the abundance of sand sources. Sand is abundance in farmland and severely degenerative grassland, so anthropic activities are the main driving forces which contributing the growth of nebkhas. The nebkhas will turn to mobile sand sheet when ecosystem continues degenerate. If ecosystem becomes better, the sand source disappear, the nebkhas land will turn to grassland.

Paper 57: Using Sediment Scour Analysis to Design Floodplain Width in an Incised Flood Control Channel

Theodore A. Endreny

State University of New York; College of Environmental Science and Forestry; Syracuse, NY; te@esf.edu

River restoration of an urban incised channel should keep the 100-year flood from the occupied floodplain to protect property and life. This research uses sediment scour analysis to estimate a stable width for a new floodplain designed beneath an occupied terrace. The study site is 300-m of Onondaga Creek, Syracuse, New York and its incised trapezoidal channel that carries the 100-year flood (85 m^3 s^{-1}) beneath the occupied and abandoned floodplain. Design constraints for excavating channel floodplain included: flooding the floodplain area at the regional frequency, minimizing disruption of occupied terrace development, and keeping the 100-year water surface elevation from excessive bed material scour. Bankfull channel dimensions were obtained by field identified river pattern (e.g., sinuosity, radius of curvature), profile (bed slopes), and dimension (depths and shapes for pools and riffles) using Rosgen methods and geomorphic guidelines. Occupied terrace extents were identified through land parcel and Creek corridor map analysis. Methods to check for potential sediment scour included a) ACoE HEC-RAS simulation to determine shear followed by comparison with incipient shear for design bed material, b) USBR Generalized Sediment Transport for Alluvial River Simulation (GSTARS) simulation of bed and bank erosion and the resulting side slopes followed by the ARS Bank Stability Model simulation to examine channel evolution and floodplain widening. For each model, a range of floodplain widths were simulated to identify the predicted stable width. The research is ongoing, and it is hoped conference participants will critically comment and provide directed feedback.

Paper 58: The ecological role of hydrological connectivity in a dryland, anabranching floodplain river landscape.

H.M. McGinness et al.

CRC for Freshwater Ecology, University of Canberra, Australia

The major floodplain river systems of inland Australia flow for most of their length through semi-arid and arid zones. They traverse a landscape that is exceptionally dry, ancient and isolated, and relatively little is known about how they function. Few remain that are not affected in some way by European-style environmental change, despite its relatively short 200-year history. There are many challenges facing researchers wishing to describe their function and the nature, prevention, and alleviation of past, present and future impacts. Thorough understanding of how these systems function is essential and it is in this context that multi- and inter-disciplinary studies are of fundamental importance. This paper describes a study integrating principles and concepts from geomorphology, hydrology and ecology. The study investigates the ecological roles of hydrological connectivity in dryland river landscapes, as demonstrated by carbon dynamics during flow pulses between floodplain anabranch channels and the main river channel. Hydrological connectivity is the link between the geomorphology and the ecology of anabranching floodplain river systems. Geomorphology is represented by the river channel, anabranch channels and the floodplain; hydrology by connectivity through flow pulses and floods; and ecology by carbon availability and supply as a food source. Anabranch channels are significant physical patches in dryland river landscapes. Flow pulses are important hydrological events, more frequent than flood pulses, which connect usually fragmented physical patches in dryland river landscapes. Carbon is a fundamental and representative indicator of ecological function, transported and changed by flow pulses, and found in every physical patch of the landscape.

Paper 59: Modern shoreline changes along the Nile Delta coast as an impact of construction of the Aswan High Dam

M. Torab[1] and M. Azab[2]

[1]Department of Geography, Faculty of Arts at Damanhour, Alexandria University, Egypt; magdytorab@hotmail.com; [2]Department of Geography, Faculty of Arts, Zagazig University, Egypt.

Egypt, said the eminent Greek historian Herodotus, is "the gift of the Nile.", but The Aswan High Dam is perhaps one of the most controversial of the existing great dams in the world. The construction of the Aswan High Dam was started in 1960, and fully finished ten years later. The construction of the Dam has changed the hydraulic regime of the river downstream. The erosion of the Nile Delta coast was first observed in 1898, but accelerated after the construction of the Dam. One of the major environmental problems of the Dam was the potential drop in river channel downstream of the Dam become silt-free water, and coastal erosion in the Nile Delta coast. The study area is located on the northern coast of the Nile Delta, It has a length of about 170 km., it consists of 6 geomorphological units: the first unit is the mouths of Nile Delta braches in Rosetta and Domietta, the second unit is the lagoons unit in Edku, El Burolus and El manzala, the third unit is the coastal plain, the forth unit is the barriers, the fifth unit is the coastal dunes and the sixth unit is the coastal sabkhas. The major objective of this study would be to understand the regional evolution of the Nile Delta coast during the last 35 years as an impact of construction of the Aswan High Dam and major sedimentation processes controlling coastal geomorphology such as north winds of coastal erosion, sea-level changes during the period of the study, tectonic subsidence as well as chemical and biological processes. Some of the modern changing shoreline positions along the Nile Delta coast were determined by the following methods: comparing satellite images, aerial photographs and historical maps, field observation of the study units, samples will be collected for sediments characteristics analysis, include sediments size, sediments color, organic matter, carbonate contents and grain size analysis and finally analyze the collected data by GIS techniques.

Paper 60: Applications of Geomorphologic analysis on terrain planning: A study case placed at the wetlands northern Argentina using remote sensing and field techniques

Roberto Torra

Departamento de Geociencias. Universidad Nacional del Nordeste; Guemes 749, H3500CBO. Resistencia, Chaco. Argentina; roberto_torra@arnet.com.ar

Geomorphology constitutes a major science which is dedicated to many classes of studies, and it enhances all types of "plannification and restoration landscapes". It is particularly useful in lowland and wetland studies. This is appropriate when we employ geomorphological deterministic models associated to remote sensing methods. So, we obtain a powerful tool to help monitoring environment preservation as well as a reasonable good plannification. It is also very adequate to perform most studies on physical relief. This paper shows how digital image processing benefits researchers and managements in order to take critical decisions on land use and potential hazardous damages as flooding, desertification and deforestation processes. Our study area is placed at the northern Province of Chaco (Argentina). This region is located at the Paraná river alluvial distal terraces in the right margin. Other sectors are placed more westward. These lowlands are frequently floodable by the action of fluvial and/or pluvial recurrent heavy rain precipitations. So, the use of applied remote sensing techniques for cattle-rising, urban and periurban activities are analyzed within a small region of about 7,000 km^2. People sat up on the area at the Paraná river aluvial distal terraces because these lands are extremely inexpensive, just because they are lowlands, and all this because of one century of uncontrolled deforestation. So, it is notoriously significant that in order to improve the organization of urban, periurban and cattle-rising development, the study of this area by means of satellite imagery and field recognition must be done. In order to improve the organization of the urban, periurban and cattle-rising developments, we carried out the study of this area by means of satellite imagery and field recognitions. According to Landsat index world map images, we made a base-planimetric thematic cartography obtained from Landsat 5 Thematic Mapper images. We employed the 226/79 and 227/79 complete scenes after made a histogram matching and then via mosaic.We outlined typical geomorphic forms (rivers, terraces, lateral-crevasses). A first order extensional normal fault scarp (rifting-associated) was mapped. It divides the study area and marks the start of the terraces and alluvial distal backswamp geoforms. To the west, we outlined the lowland terrains which resemble wetlands areas. They are named as Esteros and Cañadas geoforms. These areas supported an active deforestation and erosional processes due to a rapid colonization and the increasing of cultivated lands. Our results indicated several interesting patterns. First, the Resistencia city and many agricultural activities as cotton, corn, soya were sat up in low terrains. So, they were expose to continuous damages caused by periodical flooding and associated contaminations. The remaining lands are mainly adapted to cattle-rising activities. In order to make clear the disorganization and diagnostics the main problems, we made a preliminary satellite cartography. Thus, we can be able to planning several actions based on a real knowledge of the terrains and also monitoring them in an ad hoc GIS system.

Paper 61: Morphology and Evolution of Blowouts in Sandy Grassland -A Case Study of Hulun Buir Grassland, Northeast China

Zhuang Yanmei and Hasi Eerdun

China Center of Desert Research at Beijing Normal University, Key Laboratory of Environmental Change and Natural Disaster of the Education Ministry of China,. Beijing 100875, China; **yanmei@ires.cn**

Along with the changes of climate and influences of human activities, wind erosion of sandy grassland becoming more and more intensity. The morphology and evolution of blowouts show the main surface forms and process of desertification of sandy grassland. It indicates the potential of desertification in the vicious coupling of climate, morphology and soil in Hulun Buir grassland and the probability of progressive development of grassland desertification under the disturbance of human illegitimate activities. The formation of blowout or sand patch also designates the deterioration of grassland ecosystem and it has become one of the new important aspects of Aeolian Geomorphology study. This paper gives a preliminary study of blowout in Hulun Buir grassland. It also provides theory foundation for the prevention of desertification in this kind of sandy grassland. Three typical fields were selected in this paper: one is Huhenoersmu, Chenbaerhu County where human activities are concentrated; one is Galabuersmu, Xinbaerhuzuo County where human activities are rare and grazing is conservative; and Zuogang farmland in Xinbaerhuzuo County, is over grazed. There are many kinds of blowouts distributed extensively in these three typical regions. In this study, the results are gotten through investigating the fossil of creature , historical remains of human and animal activities, vegetation cover and measuring morphology parameters of blowout, local erosion and deposition, sand deposition in end of blowout by GPS, spade and steel rule. Also, the 2001 air photo (scale=1:50,000) is collected and analyzed by Geographic Information System (GIS). Blowouts differences in size, shape, initiation, vegetation cover and position on sand dune can be gotten by ground survey and measurement. According to the investigation, blowouts in Hulun Buir grassland can be classified to two main types: ancient blowout and modern blowout. Then these two types can be classified to sand patch, incipient blowout, established blowout, extinct or stabilized blowout and reduced by roadway or ploughed fallow and so on in detail in response to development stage or initiation reasons. The measurement results of morphology parameters of 203 different types of blowouts indicate that there are great difference in morphology parameters relationship, erosion and deposition within blowout trough, vegetation cover and deposition form in end of blowout between different types of blowouts. It suggests the variation of morphology characteristic and development of this kind of aeolian geomorphology under difference condition. Despite difference in size, the morphological characteristics of all blowouts are similar. Blowout troughs are consistently oriented in the direction of the dominant wind. Blowouts migrating under the influence of the prevailing winds have an advancing nose of loose sand and trailing arms of sand which have been partially fixed and stabilized by vegetation. Series of consecutive blowouts developed in an unstable dune system often grade in to parabolic dunes. Blowouts may also evolve in various ways, the pattern depending on wind speeds, dominant wind direction, vegetation types and revegetation process. The relationship between the morphology parameters indicates the length of blowout deflation basins and blowout depositional lobes are quite strongly correlated(R=0.89). It reflects an evolutionary trend that the depositional lobe extends as the deflation extending. Blowout length is also correlated with mid-blowout width(R=0.78) and mid-blowout depth (R=0.76).Such that as blowout deflation basin length increases, blowout width increased by a ratio of around 2:1, while blowout depth have a ratio about 10:1. Again, this reflects an obvious evolutionary trend: as blowouts become longer, they generally become wider and deeper.

ATTENDEE CONTACT INFORMATION

(Registered Participants by October 5th 2005 only)

Abaci	Ozan	The University of Iowa, IIHR	IIHR, 107 Maxwell Stanley Hydraulics Lab Iowa City, IA 52242 USA	ozan-abaci@uiowa.edu
Abrahams	Athol	University at Buffalo	Department of Geography, 105 Wilkeson Quad, Buffalo, NY 14261 USA	abrahams@buffalo.edu
Bamutaze	Yazidhi	Makerere University	Department of Geography, PO Box 7062, Kampala, Uganda	bamutaze@arts.mak.ac.ug
Band	Lawrence	UNC Chapel Hill	CB#3220, University of North Carolina Chapel Hill, NC 27599 USA	lband@email.unc.edu
Bendix	Jacob	Syracuse University	Syracuse University/Geography, 144 Eggers Hall Syracuse, NY 13244-1020 USA	jbendix@syr.edu
Bennett	Sean	University at Buffalo	Department of Geography, 105 Wilkeson Quad, Buffalo, NY 14261 USA	seanb@buffalo.edu
Bergolc	Melanie	BGSU, Ohio	125 Clay Street, Apt B Bowling Green, OH 43402 USA	bergolc@bgnet.bgsu.edu
Beyer	Patricia	Bloomsburg University of Pennsylvania	Department of Geography & Geosciences, 243 Hartline Science Center Bloomsburg, PA 17815 USA	pbeyer@bloomu.edu
Bijhouwer	Paul	US Army Corps of Engineers, Buffalo District	CELRB-TD-HD, 1776 Niagara Street, Buffalo, NY 14207-3199	Paul.bijhouwer@usace.army.mil
Blumler	Mark	SUNY-Binghamton	443 Plaza Dr., #42, Vestal, NY 13850 USA	mablum@binghamton.edu

Bork	Hans-Rudolf	University of Kiel	Am Wohld 20c, Kiel, Schleswig-Holstein D-24109 Germany	mail@hans-rudolf-bork.de
Boulton	M.A. Lisa	University of Alabama	Box 870322, Dept. of Geography, Tuscaloosa, AL 35487, USA	maboulton@bama.ua.edu
Briner	Jason	University at Buffalo, Geology	876 NSC, Dept. of Geology Buffalo, NY 14260 US	jbriner@buffalo.edu
Bursik	Marcus	University at Buffalo, Geology	876 NSC, Dept. of Geology Buffalo, NY 14260 US	mib@buffalo.edu
Chadwick	Oliver	UCSB	Department of Geography, University of Calfornia Santa Barbara, CA 93106 USA	oac@geog.ucsb.edu
Collins	Daniel	MIT	MIT, 77 Massachusetts Ave Cambridge, MA 02139 USA	daniel_@mit.edu
Colucci	Liza	University of New Haven	5 Lower Fish Rd, Southbury, CT 06488, USA	l_colucci04@yahoo.com
Conyers	Mindy	Texas State University	1713 Bluebonnet Ln., Unit B Austin, Texas 78704 USA	mc1062@txstate.edu
Correa	Antonio Carlos de Barros	Universidade Federal de Pernambuco	Departamento de Ciências Geográficas –Recife, Pernambuco, Brazil	Dbiase2001@aol.com
Cuddahee	Rebecca	University at Buffalo	826 17th street, Niagara Falls, NY 14301, USA	gacudd@adelphia.net
Davis	R Laurence	University of New Haven	c/o Dept of Biology and Environmental Sciences, Univ. of New Haven-300 Boston Post Rd. West Haven, CT 06516 USA	rldavis@newhaven.edu
Distler	Matthew	SUNY-ESF	408 Fayette Street, Manlius, NY 13104 USA	mtdistle@syr.edu

Doyle	Martin	University of North Carolina	Dept of Geography, Chapel Hill, NC 27599	mwdoyle@email.unc.edu
Fisher	Stuart	Arizona State University	School of Life Science, Tempe, Arizona, 85287 USA	s.fisher@asu.edu
Fonstad	Mark	Texas State University	900 Peques St., Apt. 101 San Marcos, TX 78666 USA	mfonstad@txstate.edu
Fronckowiak	Megan	Binghamton University	5987 Laffler St., Burt, NY 14028 USA	meg1534@hotmail.com
Fuller	Randy	Colgate University	Biology Department, Colgate University Hamilton, NY 13346 USA	rfuller@mail.colgate.edu
Geertsema	Marten	BC Forest Service	1011 4th Ave, Prince George, BC V2L 3H9 Canada	marten.geertsema@gems3.gov.bc.ca
Ghitis	Eliza	Univeristy of Oxford	Worcester College, Oxford, Oxfordshire OX1 2HB UK	eghitis@ouce.ox.ac.uk
Goetz	Randy	Utah State University	314 East 200 South, Logan, UT 84321 US	rgoetz@cc.usu.edu
Gomezdelcampo	Enrique	BGSU Geology	Department of Geology, 190 Overman Hall - BGSU Bowling Green, OH 43403-0211 USA	egomezd@bgsu.edu
Gurnell	Angela	King's College London	Department of Geography, King's College London Strand, London WC2R 2LS United Kingdom	angela.gurnell@kcl.ac.uk
Hamilton	Stephen	Michigan State University	Kellogg Biological Station, 3700 E. Gull Lake Drive Hickory Corners, MI 49060 USA	sippel@kbs.msu.edu
Hamilton	Jorene	Binghamton University	139 Hawley St, Binghamton, NY 13901 USA	jhamilt1@binghamton.edu

Harden	Carol	University of Tennessee	5425 Neubert Springs Rd., Knoxville, TN 37920 USA	charden@utk.edu
Heath	Jane	Texas State University–San Marcos	Department of Geography, San Marcos, TX 78666 USA	jane.heath@gmail.com
Hernandez	Ana	University at Buffalo	97 Hewitt Avenue, Buffalo, NY 14215, USA	amh28@buffalo.edu
Hu	Shixiong	Esat Stroudsburg University of PA	333 Greentree Dr. #B1, East Stroudsburg, PA 18301 USA	shu@po-box.esu.edu
Hwang	Taehee	University of North Carolina at Chapel Hill	1800 Baity Hill Dr., Apt.# 312 Chapel Hill, NC 27514 USA	h7666@email.unc.edu
Inamdar	Shreeram	Buffalo State College	Department of Geography & Planning, 1300 Elmwood Ave., Buffalo, New York 14222-1095 USA	inamdasp@buffalostate.edu
Jackson	Nancy	New Jersey Institute of Technology	Dept of Chemistry & Environmental Science, New Jersey Institute of Technology Newark, New Jersey 07102 USA	jacksonn@njit.edu
James	Allan	Univ. South Carolina	Geography Dept, Univ. South Carolina Columbia, SC 29208 USA	AJames@sc.edu
King	Jeff	University of New Haven	24 Rita Drive, Bristol, CT 06010, USA	jwking@geoinc.com
Knuepfer	Peter L.K.	Binghamton University	Dept. of Geol. Sci. & Envi. Studies, Binghamton University Binghamton, NY 13902-6000 USA	Peter.Knuepfer@binghamton.edu
Mackay	Scott	University at Buffalo	105 Wilkeson Quadrangle, Dept. of Geography, Buffalo, NY 14261, USA	dsmackay@buffalo.edu

Magilligan	Francis	Dartmouth College	9 Abbott Street, Lebanon, NH 03766, USA	fjm@dartmouth.edu
Manners	Rebecca	University of North Carolina	216 Conner Drive, Apt 11 Chapel Hill, NC 27514 USA	manners@email.unc.edu
Marston	Richard	AAG and Kansas State University	Dept. of Geography, Kansas State University Manhattan, KS 66506-2904 USA	rmarston@ksu.edu
Mayer	Maureen	University at Buffalo	1071 Schopper Road, East Aurora, NY 14052, USA	mrmayer@buffalo.edu
McKnight	Diane	University of Colorado	INSTAAR, 1560 30th st Boulder, CO 80309 USA	diane.mcknight@colorado.edu
McTainsh	Grant	Griffith University	Centre for Riverine Landscapes, Brisbane, Queensland 4069 Australia	wendy.mctainsh@iinet.net.au
Minkowski	Martin	University at Buffalo	Dept. of Geography, 105 Wilkeson Quad Buffalo, NY 14261 USA	ixanon@gmail.com
Namikawa	Laercio	University at Buffalo	Dept. of Geography, 105 Wilkeson Quad Buffalo, NY 14261 USA	namikawa@buffalo.edu
Natel	Heidi	Binghamton University	1 Cypress Street, Binghamton, NY 13905 USA	heidi.natel@binghamton.edu
Neave	Melissa	University of Sydney	Division of Geography, School of Geosciences University of Sydney, NSW 2006 Australia	mneave@geosci.usyd.edu.au
Orr	Cailin	UNC- Chapel Hill	105 Fidelity Street, A-46 Carrboro, NC 27510 USA	csorr@wisc.edu
Pabst	Lea	University of New Haven	430 Meloy, Apt. 8, West Haven, CT 06516, USA	LeahPabst@hotmail.com
Page	George	University at Buffalo	Canandaigua, NY 14424 USA	gpage@buffalo.edu

Parsons	Melissa	University of the Witwatersrand	Centre for Water in the Environment, University of the Witwatersrand Private Bag 3, WITS 2050 South Africa	melissap@gecko.biol.wits.ac.za
Pavuk	Daniel	Bowling Green State University	217 Life Sciences Building, Department of Biological Sciences Bowling Green, Ohio 43403-0212 United States	dmpavuk@bgnet.bgsu.edu
Phillips	Jonathan	University of Kentucky	Department of Geography, University of Kentucky, University of Kentucky Lexington, KY 40506-0027 United States	jdp@uky.edu
Post	David	Yale University	Yale University, PO Box 208106 New Haven, CT 06520-8106 USA	david.post@yale.edu
Price	Jason	Millersville University	Department of Earth Sciences, Millersville PA 17551-0302 USA	Jason.Price@millersville.edu
Rayburg	Scott	University of Canberra	3/22-24 Terrace rd, Dulwich Hill, NSW 2203 Australia	scott.rayburg@canberra.edu.au
Renschler	Chris	University at Buffalo	NCGIA/Dept. of Geography, 105 Wilkeson Quad Buffalo, NY 14261 USA	rensch@buffalo.edu
Reynolds	Stephen	SUNY-ESF	162 Cambridge St., Syracuse, NY 13210 USA	sharrisonreynolds@hotmail.com
Riley	Christopher	Buffalo State College Great Lakes Center	461 N. Ivyhurst Rd., Apt. 2 Amherst, NY 14226 USA	cjriley@lycos.com

Ritchie	Jerry C	USDA ARS Hydrology Laboratory	BARC-West Building-007 Beltsville, Maryland 20705 US	jritchie@hydrolab.arsusda.gov
Robinson	Sarah	US Geological Survey	345 Middlefield Road, M/S 973 Menlo Park, CA 94025 USA	srobinson@usgs.gov
Rogers	Kevin	University fo the Witwatersrand	Centre for Water in the Environment, University of the Witwatersrand Johannesburg, Guateng 2194 South Africa	kevinr@gecko.biol.wits.ac.za
Rossiter	David G	ITC Enschede	ITC, Postbus 6 Enschede, OV 7500AA Netherlands	rossiter@itc.nl
Roussie	Sue	State University of New York at Buffalo	51 Kaymar Drive, Amherst, NY 14228 USA	sroussie@buffalo.edu
Royall	Dan	UNC-Greensboro	129 Graham Bldg, Dept. of Geography, Greensboro, NC 27402	pdroyall@uncg.edu
Rozo	Jose Max G.	Universidade Federal do Amazonas	528 Adam Ave., Ithaca, NY, NY 14850 USA	jmaxgr@ufam.edu.br
Rutherford	Ian	Cooperative Research Centre for Catchment Hydrology	School of Anthropology, Geography and Environmental Studies, The University of Melbourne, Australia, 3010	idruth@unimelb.edu.au
Sawyer	Carol	Department of Geography, Texas State University	Department of Geography, Texas State University, 601 University Drive San Marcos, TX 78666-4616 USA	cs1123@txstate.edu
Schneekloth	Lynda	School of Architecture and Planning, UB	601 west ferry st, buffalo, ny 14222 usa	lhs1@buffalo.edu

Shoffner	Deborah	UNC-Greensboro	1703 Brookcliff Drive, Greensboro, NC 27408 United States	dgshoffner@earthlink.net
Small	Melanie	University of North Carolina at Chapel Hill	University of North Carolina at Chapel Hill, Dept. of Geography CB # 3220 Chapel Hill, NC 27599 USA	mjsmall@email.unc.edu
Souch	Catherine	Indiana University	Dept Geography, Indiana University Indianapolis Indianapolis, IN 46202 USA	csouch@iupui.edu
Southwell	Mark	Univeristy of Canberra	L.P.O. Box 5129, Univeristy of Canberra Bruce, ACT 2617 Australia	m.southwell@student.canberra.edu.au
Splinter	Dale	Calvin College	1740 Knollcrest Circle SE, Dept. of Geoology, Geography, Environmental Studies Grand Rapids, Michigan 49546-4403 USA	dks5@calvin.edu
Stanley	Emily	University of Wisconsin	University of Wisconsin, Center for Limnology, 680 N. Park St. Madison, WI 53706 USA	ehstanley@wisc.edu
Stinton	Adam	University at Buffalo	876 Natural Sciences, Dept. of Geology, Buffalo, NY 14261, USA	astinton@geology.buffalo.edu
Szymanski	Jason	UB Geology Dept	68 Maple Ct Apt #2, Snyder, NY 14226 USA	js388@buffalo.edu
Tang	Tao	Buffalo State College	Department of Geography & Planning, 1300 Elmwood Ave. Buffalo, New York 14222-1095 USA	tangt@buffalostate.edu
Thoms	Martin	CRC for Freshwater Ecology	Water Research Centre, University of Canberra Canberra, ACT 2601 Australia	Martin.Thoms@canberra.edu.au

Tinkler	Keith	Brock University	Department of Earth Sciences, MC D-419, Brock University, St. Catharines, Ontario, Canada	ktinkler@brocku.ca
Tormey	Brian	Penn State University	RR2 Box 190 StoneView, Huntingdon, Pennsylvaia 16652-9016 USA	bbt1@psu.edu
Trask	William	UB Student	1333 Milestrip Rd, North Collins, NY 14111 US	wjtrask@buffalo.edu
Villard	Paul	Geomorphic Solutions (A Member of The Sernas Group Inc.)	141 Brunel Road, Mississauga, ON, L4Z 1X3, Canada	pvillard@geomorphicsolutions.ca
Warren	Dana	Cornell University	Department of Natural Resources, Ithaca, NY 14853, USA	drw23@cornell.edu
Woldenberg	Michael	University at Buffalo	Department of Geography, 105 Wilkeson Quad, Buffalo, NY 14261 USA	geomike@acsu.buffalo.edu
Wong	Corinne	University of New Haven	469 Edgewood, New Haven, CT 06511, USA	wongk22@yahoo.com
Wood	Yvonne	University of California-Riverside	3014 Redwood DR, Riverside, CA 92501 USA	yvonne.wood@ucr.edu
Wynne	Kristina	University of Colorado	1842 Canyon, Apt. 109 Boulder, CO 80302 USA	kristina.wynne@colorado.edu
Zwolinski	Zbigniew	Institute for Paleogeography and Geoecology	Adam Mickiewicz University, Dziegielowa 27 Poznan, Poznan 61-680 Poland	zbzw@amu.edu.pl