



# Hydropedology News

The Newsletter of the *Hydropedology Working Group* of  
Soil Science Society of America, Crop Science Society of America,  
and Agronomy Society of America



April 2005

Volume 3, No. 1

Issue 4

Dear Colleagues,

A glimpse of the Blue Marble and the Green Ball from space gives us a true perspective of the precious earth as a system and the “sustainable movement” towards protecting our “homeland” (a different sense of “homeland security”). The previous two issues of this newsletter shared the exciting exploration of Mars in search of signs of liquid water through investigations of rocks, soils and landscapes on the Red Planet. While there are continuing excitements such as Mars Express/OMEGA, this issue brings us back to earth to the grand challenge of fundamental understanding of our home planet and how it sustains life and human society. "What we don't know about our own planet far exceeds what we do," says Richard Anthes, president of the University Corporation for Atmospheric Research, who co-chaired the National Academies' National Research Council committee that produced *Earth Science and Applications from Space: Urgent Needs and Opportunities to Serve the Nation*. This report, released on April 27, 2005, leads to a profound question: *Is human life sustainable, and if so, what is the path to sustainability?*

Interestingly, on April 14, 2005, National Science Foundation released a report *Pathways to the Future: Complex Environmental Systems: Synthesis for Earth, Life and Society in the 21<sup>st</sup> Century*. “Now more than ever, scientists must address combinations of factors in their research, such as the interactions between human activities and natural cycles at different spatial and temporal scales,” the report says. Of particular interest is that the report also focuses on water as a complex environmental system and recommends NSF focus on water as a unifying theme for research on complex environmental systems.

Back to our hydropedology, here are some highlights of related activities reported in this issue:

- A special session on hydropedology at the AGU Spring 2005 Joint Assembly. More details on p. 2.
- A call for contributions to hydropedology symposium at the 18<sup>th</sup> World Congress of Soil Sci. See p. 5.
- Some food for thoughts – Hydropedology Polemics on p. 5 and Prediction of Ungauged Basins on p. 6.
- Forum on Hydropedology in Action on p. 10.

I hope you enjoy reading this newsletter. As always, I welcome your comments and contributions.

Sincerely,

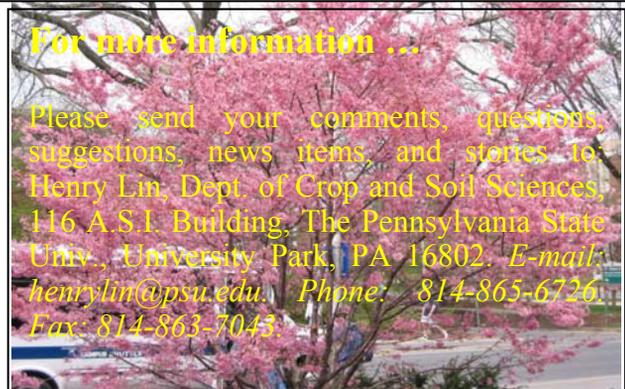
Henry Lin, *Editor*

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## For more information ...

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## AGU Spring 2005 Joint Assembly, May 26, New Orleans

0830h – 1000h: Multiscale Interdisciplinary Integration of Soil-Hydrology-Plant Interactions:

I. Landscape Hydropedologic Perspective.

Presiding: Henry Lin, Rick Hooper, Rien van Genuchten

First Author	Title
D. Hillel	<a href="#"><u>Soil as the Central Link in the Hydrological Cycle</u></a>
R. Sidle	<a href="#"><u>Spatial and Temporal Linkages Related to Hydrogeomorphic Processes: an Emerging Discipline</u></a>
M. Weiler	<a href="#"><u>Does Variability Matter? – Virtual and Field Experiments to Understand Runoff Generation</u></a>
K. Smettem	<a href="#"><u>Use of Time to Incipient Ponding as a Hydropedologic Index for Surface Soils</u></a>
M. van Genuchten	<a href="#"><u>Parameterizing Root Water Uptake as a Function of Water and Salinity Stress</u></a>

1030h – 1200h: Multiscale Interdisciplinary Integration of Soil-Hydrology-Plant Interactions:

II. Rhizosphere Solute Movement.

Presiding: Michael Celia, Lewis Gaston

First Author	Title
M. Celia	<a href="#"><u>Representation of Soil Moisture, Evapotranspiration, and Solute Transport Across Different Length and Time Scales</u></a>
L. Ma	<a href="#"><u>Nitrate losses in subsurface tile drainage as affected by tillage, crop rotation, and fertilizer management</u></a>
P. Wang	<a href="#"><u>Soil Moisture, Plant Nutrient Uptake, and Computer Simulation of Nutrient Export</u></a>
S. Manzoni	<a href="#"><u>Role of model structure on the response of soil biogeochemistry to hydro-climatic fluctuations</u></a>
R. Jacob	<a href="#"><u>The Vadose Zone's Dynamic Response to a Natural Precipitation Event: Water Migration Through the Unsaturated Subsurface Monitored by GPR</u></a>

1330h–1700h: Multiscale Interdisciplinary Integration of Soil-Hydrology-Plant Interactions:

III. Posters.

Presiding: Ping Wang, Henry Lin

First Author	Title
S. Assouline	<a href="#"><u>Modeling the Effect of Compaction on the Soil Hydraulic Properties</u></a>
J. Barrett	<a href="#"><u>Nutrient Cycling in Riparian Soils and Sediments Bordering Cold Desert Streams and Lakes</u></a>
F. Wang	<a href="#"><u>Scales and Uncertainties in Estimating Soil Carbon with STATSGO Database for Louisiana</u></a>
D. Chittleborough	<a href="#"><u>Novel Soil Amendment Technology for Minimising Nutrient Losses From Pastures for the Protection of Water Bodies</u></a>
H. Lin	<a href="#"><u>Role of Soils in Landscape Hydrology of a Forested Catchment</u></a>
B. Clothier	<a href="#"><u>Measuring and Modeling Solute Transport in the Rootzone: Protecting the Receiving Water Environments of the Coral Atolls of Tonga</u></a>
M. Kirkham	<a href="#"><u>Heavy Metal Displacement in Chelate-Assisted Phytoremediation of Biosolids Soil</u></a>
M. Scholl	<a href="#"><u>Recharge-Driven Sulfur Cycling and its Role in Natural Attenuation in an Alluvial Aquifer Riparian Zone Contaminated With Landfill Leachate</u></a>
R. Mandock	<a href="#"><u>Natural Advection In Porous Media: Transfer of Soil Moisture Beneath a Tree</u></a>
B. Allred	<a href="#"><u>Nitrate Mobility in Unsaturated Soil Affected by the Presence of Different Clay Mineral Types</u></a>
H. Liu	<a href="#"><u>Impact of vegetation root distribution and soil moisture on evaporation simulations</u></a>
J. Dittman	<a href="#"><u>Nitrogen Dynamics in a Northeast Forest Ecosystem – Spatial and Temporal Patterns in Stream Water and Soil Solution Chemistry.</u></a>

## Profiles of Colleagues Interested in Hydropedology

### **Phillip Owens**

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Phillip Owens joined the Purdue University Department of Agronomy in January of 2005 as a Soil Geomorphologist/Pedologist assistant professor. Owens received his B.S. and M.S from the University of Arkansas. His M.S. research focused on a method for loading septic system filter field effluent using soil morphology. He earned a Ph.D. from Texas A&M University in Pedology under the guidance of Dr. Larry Wilding. His dissertation research focused on monitoring hydromorphic soils and utilizing zero valent iron metal rods to estimate oxygen concentration in seasonally saturated soils. Following his Ph.D., Owens served a one year term in Washington, D.C. as the tri-societies Congressional Science Fellow in the Office of Senator Blanche Lincoln. Prior to arrival at Purdue, Owens was a Research Soil Scientist with USDA-ARS Waste Management and Forage Research Unit at Mississippi State, MS. He developed landscape scale studies to understand and quantify phosphorus runoff from poultry manure applications in Coastal Plain soils. His new responsibilities at Purdue will focus on teaching and conducting research in hydromorphic soils, landscape scale processes and soil geomorphology.

### **Thorsten Wagener**

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Dr. Wagener started as an Assistant Professor at PSU in the fall of 2004 after spending 2 years as a postdoctoral researcher at the NSF Science and Technology Center SAHRA (University of Arizona). He received his Ph.D. in 2002 from Imperial College London in the UK where he worked on predictions in ungauged basins. His research interests include the analysis and modeling of hydrologic systems, the application and development of systems tools for hydrologic model evaluation and improvement, integrated assessment, predictions in ungauged basins, and hydrologic forecasting in different hydroclimatic regions. He is also interested in improving the teaching of hydrology at the University level.

## Profiles of Colleagues Interested in Hydropedology

### David J. Chittleborough

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David is an Associate Professor of Pedology and Deputy Head of the School of Earth and Environmental Sciences and a member of two discipline groups at the University: Soil & Land Systems and Geology & Geophysics. His interests are in the origin, development and hydrology of soils, especially those salt-affected soils with strong texture contrast which are so dominant in Southern Australia. His research group is developing new imaging techniques to study the root growth in hostile subsoils and applying novel analytical techniques such as Field-flow Fractionation to the study of colloid transport in soils.

### Keith Smettern

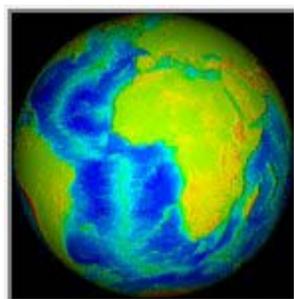
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Keith is an Associate Professor at the University of Western Australia. He is also Sub-Program Leader, CRC for Plant-Based Management of Dryland Salinity, UWA, and Acting Head of Group, Soil Science and Plant Nutrition. He has 25 years experience in soil physics and hydrology. Current interests include: development and application of field methods for measuring hydraulic properties, particularly in soils exhibiting preferential flow; Applications of geophysical techniques in soil hydrologic studies and catchment responses to changes in land use.



**A Call for Contributions to  
2006 World Congress of Soil Science Symposium on  
*Hydropedology: Fundamental Issues and Practical Applications*  
July 9-15, 2006, Philadelphia, PA, USA**

In recognizing appropriate interest and publication activity related to hydropedology, this symposium is intended to advance the awareness and appreciation of hydropedology among world soil science communities, and to identify the scope and niche areas of hydropedology through discussions on fundamental issues and practical applications of hydropedology. The symposium will include invited and volunteered oral and poster presentations. Selected papers from this symposium may be solicited for a potential collective publication. You are encouraged to submit an abstract to this symposium by September 15, 2005 at <http://www.colostate.edu/programs/IUSS/18wcss/index.html>. For more information, please contact symposium co-conveners Henry Lin ([henrylin@psu.edu](mailto:henrylin@psu.edu)) or Johan Bouma ([Johan.Bouma@Planet.nl](mailto:Johan.Bouma@Planet.nl)).

***HYDROPEDOLOGY POLEMICS***

By Dick Arnold

1. The heartbeat of Pedology is the genesis of soils in their landscapes
2. The major link to understanding a soil-landscape is hydropedology – think like water.
3. The truth about soils is in the soils themselves, but exogenous techniques provide new relationships and insights among facts
4. Soils, as we know them, are scale-dependent – spatially and temporally
5. The human mind recognizes continua but works with discrete segments whose boundaries are matters of opinion
6. Classification abstracts the state of knowledge at a point in time
7. Where genetic processes radiate from a point, factor interactions constrain their spatial growth
8. Scaling soil properties is one thing; scaling landscapes is quite another
9. Scale discontinuities still dominate soil-landscape modeling
10. The future needs hydropedology now! Water is essential for life.
11. The pedosphere doesn't understand good intentions; it only records the flow of energy
12. Thanks to the Great Being for the diversity of the pedosphere
13. Sustainability is the social acceptance of stewardship

## **PREDICTIONS IN UNGAUGED BASINS**

### **– Towards multi-disciplinary hydrology and a reduction of uncertainty in hydrologic predictions**

Thorsten Wagener\*, Department of Civil and Environmental Engineering, The Pennsylvania State University, [thorsten@enr.psu.edu](mailto:thorsten@enr.psu.edu)

\*Member PUB Scientific Steering Group and Organizer of the PUB Working Group on Uncertainty Analysis in Hydrologic Modeling

The IAHS Decade on Predictions in Ungauged Basins (PUB) is an initiative of the International Association of Hydrological Sciences (IAHS). It is aimed at formulating and implementing appropriate science programs to engage and energize the scientific community, in a coordinated manner, towards achieving major advances in the capacity to make reliable predictions in ungauged basins (Sivapalan et al., 2003; Wagener et al., 2004). The ungauged basins problem is seen as a vehicle to bring scientists together to work in a multi-disciplinary framework on a common problem to advance the science of hydrology in research, community organization and education. The chosen measure of whether this will be achieved through the PUB initiative is an assessment of the reduction in prediction uncertainty due to improved understanding of the hydrologic system, improved data and an improved system representation in hydrologic models. The essence of the science in PUB has been formulated in two targets:

- **Target 1:** Examine and improve existing models in terms of their ability to predict in ungauged basins through appropriate measures of predictive uncertainty.
- **Target 2:** Develop new, innovative models to capture space-time variability of hydrological processes for making predictions in ungauged basins, with a concomitant reduction of predictive uncertainty.

PUB is literally a grassroots level movement, enabling open participation to everyone who is interested, and with a minimum of bureaucracy. Participation is possible for everybody through joining or creating working groups consisting of several scientists that tackle a certain aspect of the overall problem (e.g., a certain hydroclimatic region, a comparison of models or data sources). Further information can be obtained from the PUB website (<http://cee.uiuc.edu/research/pub/default.asp>), from the references listed at the bottom of this article or by e-mailing me directly.

#### **References**

- Sivapalan, M., Takeuchi, K., Franks, S.W., Gupta, V.K., Karambiri, H., Lakshmi, V., Liang, X., McDonnell, J.J., Mendiondo, E.M., O'Connell, P.E., Oki, T., Pomeroy, J.W., Schertzer, D., Uhlenbrook, S. and Zehe, E. 2003. IAHS Decade on Predictions in Ungauged Basins (PUB), 2003–2012: Shaping an exciting future for the hydrological sciences. *Hydrological Sciences Journal*, 48(6), 857-880.
- Wagener, T., Sivapalan, M., McDonnell, J.J., Hooper, R., Lakshmi, V., Liang, X. and Kumar, P. 2004. Predictions in Ungauged Basins (PUB) — A catalyst for multi-disciplinary hydrology. *EOS Trans. AGU*, 85(44), 451-452.

## Publications of Interest ...

- **Special Issue of *Geoderma* on Hydropedology:** This special issue includes 10 papers selected from the 2003 SSSA symposium on “*Hydropedology: Bridging Disciplines, Scales, and Data.*” Some of the corrected proofs have been posted on *Geoderma* web site. The papers collected in this special issue present the state-of-the-practice relevant to hydropedology, and suggest a shift of geology-rooted classical pedology to a hydrology-driven approach with a landscape perspective. It is hoped that, through this initiative, the potential of hydropedological perspective and approaches can be further realized in the near future. Henry Lin, Johan Bouma and Yakov Pachepsky are co-guest editors.
- **The Future of Hydrogeology:** A special volume of *Hydrogeology Journal*, released in March 2005, has published 30 articles on a variety of “future hydrogeology” subjects considered from a variety of viewpoints ranging from philosophical to highly quantitative. There are two article types: full length papers and four-page essays, and six categories of topics: History and Philosophy, Geology and Environment, Heterogeneity, Methods and Data, Quantity and Quality, and Society and Health. As the Editor, Clifford Voss, pointed out, the intent of this volume is not to predict the future but rather to instigate discussion and to inspire creative thinking about hydrogeology. This special issue provides an exciting view of potential developments in crucial aspects of hydrogeology.
- **Special Issue of *Vadose Zone Journal* on Landscape Processes:** A special issue of *Vadose Zone Journal* is ongoing to publish invited contributions from EGU symposia held in Nice in April 2004, the Landscape Symposium held Seattle in 2004 ASA-CSSA-SSSA annual meetings, and others. The special issue is entitled “From Field- to Landscape-scale Vadose Zone Processes: Scale Issues, Modeling, and Monitoring.” Dennis Corwin (USDA George E. Brown, Jr. Salinity Lab), Gerrit de Rooy (Wageningen Agricultural Univ.), and Jan Hopmans (UC-Davis) are guest editors.
- **Water for a Sustainable and Secure Future:** This new report from the National Council for Science and the Environment (NCSE) provides recommendations for closing the gap between water science and water policy. This report of the 4th National Conference on Science Policy and the Environment explores science-based strategies for achieving water sustainability. NCSE’s unique conference attracted more than 800 scientists, policymakers, business executives and civil society representatives from 46 states and 14 countries. The participants worked together to craft recommendations about the role of science in achieving sustainable relationships among water, people and the environment. As the conference chair, Craig M. Schiffrics, pointed out, “Water is at the root of many of society’s most pressing concerns -- from human health to food production to economic prosperity to environmental protection.” The whole report and additional information can be found at the NCSE web site.
- **Urban Soil Primer:** This new NRCS pub. is an introduction to urban soils for homeowners and renters, local planning boards, property managers, students, and educators. It is intended to give planning officials and people who live in urban areas an introduction to soils by providing information important in planning and managing land resources in a manner that helps to prevent or mitigate problems associated with sedimentation, contamination, runoff, and structural failure.
- **SOILS - Tools for Educators:** Produced by the NRCS, the new Version 3.0 of SOILS - Tools for educators is now available on CD-ROM. The CD includes rich information about soils: Soil Facts, Ten Key Messages, State Soils, Soil Orders, Lesson Plans, Soil Songs, Soil Quotations, Soil -- Fundamental Concepts, Urban Soil Primer, Understanding Soil Risks and Hazards, From the Surface Down, Soil Description Forms, Soil Biology Primer, Soil Biology: Key Educational Messages, Soil Biology Classroom Activities, Soil Quality Information Sheets, Using Published Soil Surveys, How to Find a Soil Survey, Regulations on Transporting Soil. View more info at: [http://soils.usda.gov/education/resources/k\\_12/tools.html](http://soils.usda.gov/education/resources/k_12/tools.html).

## Meetings and News Flashes ...

- **2005 National Cooperative Soil Survey (NCSS) National Conference:** The NCSS conference convenes every other year to discuss and develop solutions to issues of national concern. This year, the conference will be held in Corpus Christi, TX, May 21 - 26, 2005. The theme is "Planning the New Soil Survey—Personnel Development, Technology, Standards and Electronic Delivery." Participants of the NCSS include representatives from the 1862 land-grant universities experiment stations, NRCS, USFS, BLM, BIA, EPA, USFWS, National Association of State Conservation Agencies, National Association of Consulting Soil Scientists, the 1890 land-grant universities and western tribal colleges. Other interested foreign and domestic groups such as lead scientists from Canada, Mexico and South Africa are invited to participate as users of soil surveys. During the conference, there will be active committee discussions, including 3 standing committees (Research Agenda, NCSS Standards, New Technology) and 4 in-conference committees (WEB Soil Survey—Promoting Partnerships, Ecological Principles in Soil Survey, Recruitment and Retention of Soil Scientists in Soil Survey, and Water Movement and Water Table Monitoring in Soil Survey). Of particular interest to hydrogeology folks is perhaps the Committee on Water Movement and Water Table Monitoring in Soil Survey. For more information, visit the web site: [http://soils.usda.gov/partnerships/ncss/conferences/national\\_2005/](http://soils.usda.gov/partnerships/ncss/conferences/national_2005/).
- **NSF Sponsored Workshop on Frontiers in Exploration of the Critical Zone:** A National Science Foundation (NSF) sponsored workshop dealing with frontiers in critical zone research will be held at the Univ. of Delaware, October 24-26, 2005. The workshop will explore research needs and opportunities involving four major questions: 1) what processes in the Critical Zone control fluxes of carbon, particulates, and atmospherically reactive trace gases between the land surface and the atmosphere and how do these processes change over different timescales?; 2) how do important biogeochemical processes and mechanisms at Critical Zone interfaces govern long-term sustainability of soil and water resources?; 3) how do chemical and physical weathering processes impact the establishment of the Critical Zone and how is this weathering engine perturbed by global environmental change?; and 4) how do processes in the Critical Zone that nourish ecosystems change over geologic and human time scales? According to the workshop co-chairs, Don Sparks of Univ. of Delaware and Sue Brantley of Penn State, invited speakers from a range of disciplines including soil, geological, environmental and biological sciences and engineering will address the grand research challenges and opportunities related to the above questions. These presentations will be followed by panel discussions and breakout sessions to provide cross-disciplinary discussion and brainstorming. For more information, visit the web site: <http://ag.udel.edu/plsc/Conference/index.htm/>.
- **18<sup>th</sup> World Congress of Soil Science:** An exciting and rich program has been developed for the 18th World Congress of Soil Science to be held in Philadelphia, Pennsylvania, July 9-15, 2006. The deadline for submitting an abstracts for presentation at the congress is September 15, 2005. Online registration is now open (<http://www.colostate.edu/programs/IUSS/18wcsc/index.html>). To take advantage of significantly reduced registration fee, act by February 1, 2006.
- **2005 Soil and Water Conservation Society Annual International Conference:** To be held July 30 to Aug. 4, 2005 in Rochester, NY. This year's conference will focus on four key topics of concern for professionals working to conserve natural resources locally and globally: Managing Landscapes for Environmental Quality, Assessing and Communicating the Effectiveness of Conservation and Environmental Programs, The Growing Debate Around Water Use, and Consumer Demand and Policy Effects on Agricultural Resources. For more info, visit: <http://www.swcs.org/>.
- **SSSAJ SPECIAL TOPICS:** Beginning July 1, 2005, Soil Science Society of America Journal will accept manuscripts on two Special Topics outside of the current divisional structure and of contemporary interest: Urban Soils, and Landscape Management.

## Hydropedology In Action

Henry Lin, Penn State University

Two of the top ten scientific breakthroughs in 2004, as identified by *Science*, are worth of mentioning here. The champion was obviously the Mars twin rovers that sniffed out water and found the remains of ancient environments where life could have survived. In my view, this opens up our eyes on “extraterrestrial hydrogeology” and “extraterrestrial hydropedology.” The #8 in the list was the new discovery of water structure and chemical behavior that, if held up, could reshape fields from aqueous chemistry to atmospheric sciences (*Science*, Dec. 17, 2004). Synchrotron X-ray results suggest that many water molecules are bound to only two neighbors instead of four that we have believed. Other controversial disputes include 1) where ions in a large body of water hang out – reside at the surface or get sucked into the interior? and 2) how electrons and protons dissolve in water – and how water is bound to solid surface. Implications of these new findings to soil and water interactions are fundamental, I imagine, although the debates will likely rage through 2005 and beyond. After a century of intense scientific study, water still gives us much to scratch our heads about, especially when it interacts with complex and diverse soils ...

Down to local level and daily life, numerous practical applications call for expertise in integrated soil and water sciences including hydropedology. The following five important environmental regulations illustrate the point. I happen to have been involved in these issues in Pennsylvania, so I thought these concrete and practical examples could help raise the further awareness and appreciation of hydropedology in action.

### **Onlot Sewage Disposal**

The Pennsylvania Sewage Facilities Act (Act 537) of 1966 requires all municipalities to develop and maintain an up-to-date sewage facilities official plan to protect public health from diseases, prevent future sewage treatment problems and protect the quality of the state’s surface water and groundwater. As part of an official plan update, the municipality should consider developing a sewage management program. Such a program to ensure the operation and maintenance of onlot sewage systems should be established before malfunctions are widespread in an area. Malfunctioning onlot treatment systems endanger public health, degrade the environment and reduce property and community value by discharging onto public areas, private property or contaminating receiving waters including drinking water supplies. Septic systems (also called “onlot” disposal systems) are sewage systems located on the property of the homeowner. They treat and dispose of domestic sewage through natural processes. Liquid waste from a treatment tank percolates through the soil (absorption field), where it is neutralized and broken down further. For many Pennsylvanians, centralized sewage disposal is not an option. In fact, one-quarter of Pennsylvania residents currently depend on septic systems to treat their sewage. By law, anyone who intends to install a septic system with a flow of less than 10,000 gallons per day needs to apply for a permit through local Sewage Enforcement Officer (SEO) who will conduct soil profile examination and percolation tests to determine site suitability. A percolation (“perc”) test measures the rate at which water moves through soil after presoaking.

The soil is a critical component of an efficiently running system. Besides ensuring adequate drainage for properly working septic systems, the type of soil and its location in the landscape will also influence the quality of effluent which may still contain substances that can affect the groundwater, such as viruses, pathogens and nitrates. Depending on soil, site and operational conditions, various systems might be used (standard trench, seepage bed system, subsurface sand filter, elevated sand mound, and individual residential spray irrigation system). Pedologists have widely engaged in septic system studies in the past two decades or so because the major features SEOs rely on are soil morphological features (such as depth to redox). Nevertheless, failures of septic systems have been commonly seen, in part because of the lack of landscape perspective and uncertainties about perc tests. Currently, Pennsylvania Dept. of Environmental Protection (PADEP) is undergoing a major revision to its regulations of onlot sewage systems.

### ***Nutrient Management***

The Pennsylvania Nutrient Management Law (Act 6) of 1993 was designed to minimize surface and ground water nutrient pollution from agricultural operations. The nutrient management plans required under this law will address manure and fertilizer application as well as manure storage and runoff concerns from animal concentrated areas and farm fields. Each approved nutrient management plan is operation specific, yet the basic tenets of all plans are the same—balance crop nutrients to crop needs, and manage nutrients through best management practices to protect water quality. Major changes are being proposed for concentrated animal operations (CAOs). In May 2004, a new interim policy was adopted, requiring nutrient management plans to include a phosphorus application component – in addition to the existing nitrogen-based application – as determined by the Phosphorus Index (P-Index). This new regulation is expected to be finalized in spring 2005.

The P-Index is a Pennsylvania-specific field evaluation tool that combines indicators of phosphorus sources and phosphorus transport to identify and require action on areas that have a high risk of phosphorus loss to surface waters. The source indicators are the Mehlich-3 soil test, the fertilizer application rate and method, and the manure application rate, method and phosphorus availability. The transport indicators are erosion, runoff potential, subsurface drainage, distance to a water body (connectivity), and modified connectivity. Apparently, different types of soils and their distributions over the landscape would have significant impacts on the initial level of P and P-holding capacity. All transport factors link to water movement in the soil and over the landscape that are of interest to hydrogeologic studies.

### ***State Water Plan***

The Water Resources Planning Act (Act 220) of 2002 requires PADEP to update the state's 25-year-old water plan by March 2008 and then conduct updates every five years thereafter. The bill mandates PADEP to conduct a statewide water withdrawal and use registration and reporting program. The state's current water resources inventory doesn't tell what areas of the state have critical water needs. At the same time water resources are being stressed. In five of the last seven years Pennsylvania has been in drought emergency conditions. Since 1900 residential use of water has increased from 5 to 62 gallons a day per person and total water use has climbed to 10 billion gallons a day. Areas of the state are experiencing an increasing number of conflicts over the same source of water. It is expected that during the update, areas will be identified where the demand for water exceeds, or is projected to exceed, available supplies. These areas would be designated as Critical Water Planning Areas and identified on a multi-municipal watershed basis. Once established, Critical Water Planning Areas would serve as the planning boundary for the creation of a more detailed Critical Area Resource Plan or "water budget" for that area. The plans will include a water availability evaluation, assess water quality and water quantity issues, and identify existing and potential adverse impacts on water resources uses.

How does hydrogeology fit in here? Well, in both water quantity and quality aspects and in watershed-based planning. As we know, soil is an important fresh water reservoir and a living filter that impacts water quantity and quality as well as regional hydrologic cycle. Soil-landscape based land use planning could minimize the adverse effects from improper uses and management. New land-use plans and land development practices should consider the manner in which natural soils vary over the landscape, which offers clues as to "where, when, and how" water infiltrates into the soil, recharges the groundwater, or runs off to surface water. This bill recognizes that groundwater and surface water are linked, and must be considered together on a watershed basis. It makes clear that political subdivisions do not have the power to allocate or regulate water, while preserving the powers of local government to regulate land use under the Pennsylvania Municipalities Planning Act and other laws.

## ***Wetland Protection***

In Pennsylvania, wetlands are protected by both state and federal regulations and may also be protected by local (municipal) regulations or ordinances. Most activities in Pennsylvania water courses, water bodies or wetlands require some type of authorization or permit from the PADEP. Activities that change, expand or diminish the course, current or cross section of a watercourse, floodway or waterbody are termed encroachments (obstructions in certain cases) and are regulated by Chapter 105 regulations of 1923 in Pennsylvania. Most projects in PA waters and wetlands also require federal authorization (Clean Water Act, Section 404 permit). To ensure the protection of water quality, an erosion and sediment control plan also must be submitted with the permit registration.

Wetlands are the interfaces of living land and flowing water. Their environmental, ecological, and socio-economic benefits are well recognized. Hydric soil is one of the three essential factors in delineating wetlands. Pedologists have long been involved in wetland delineations and hydric soil studies. With current societal interest in the preservation of wetlands, there is much discussion on how to create new wetlands to improve water quality, to enhance wildlife habitat, or simply to replace wetlands that have been destroyed because of construction or other activities. Pedologists, working with engineers, soil physicists, hydrologists, ecologists, and others, are contributing to the best practices in building constructed wetlands. The term *pedotechnology* (analogous to biotechnology) has been coined to refer to deliberate or planned human involvement in the genesis of soils, by assessing and selecting the pool of materials from which soils are to be created, or by choosing soil manipulation procedures or amendments to promote the formation of soil for specific purposes. A goal of pedotechnology is to avoid undesirable environmental consequences from an ignorance of basic soil-forming factors and processes when the manipulation of earth surface materials occurs in agriculture, waste disposal, mining operation, construction of buildings and highways, dredging, etc. Whenever there is a large-scale land manipulation, new landscapes are needed as well as new soils. Hydropedology should offer clues as to “what” can best be done and “where” with the lowest risks and the greatest opportunities.

## ***Stormwater Management***

Recognizing the adverse effects of excessive stormwater runoff resulting from development, the Pennsylvania Stormwater Management Act 167 was enacted in 1978. Act 167 provides for the regulation of land and water use for flood control and stormwater management purposes. The Act requires the PADEP to designate watersheds, develop guidelines for stormwater management, and model stormwater ordinances. In some watersheds across the state, stormwater impacts appear to be on the increase, with a variety of stormwater-linked indicators showing water resource deterioration. Changing and improving the way stormwater is managed has become a priority for the state and its watersheds. Currently, PADEP is drafting Pennsylvania Stormwater Management Manual to improve stormwater management throughout Pennsylvania’s over 2,550 municipalities and 350 designated watersheds. Issued in 2002, PADEP’s new stormwater program integrates the existing Act 167 stormwater management planning program and the new National Pollution Discharge Elimination System Permit Program.

The most important elements of new Pennsylvania Stormwater Management Manual relate to the multiple ways in which land development impacts water resources through the generation of stormwater, including increased stormwater runoff volume, peak rates, and adverse stream impacts as well as decreased infiltration volume and groundwater recharge. One of the key approaches in the proposed comprehensive and integrated management is to integrate natural system-based BMP’s that use existing soils and vegetation, together with more conventionally-structured BMP’s. Appropriate understanding of soil infiltration rate, water holding capacity, water-restrictive layer, and subsurface flowpaths in different soils and landscapes is essential in wining this battle against stormwater damages.



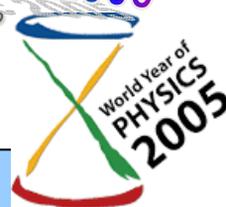


World Water Day

March 22nd



planetearth  
Earth Sciences for Society



**Earth Day and Soil, Water, and Air**

35 years ago, on April 22, 1970, Earth Day – one of the most remarkable happenings in the history of democracy – was born. 1970 was a remarkable year – a time when rivers caught fire and cities were hidden under dense clouds of smoke – USEPA was born, with a mission to protect the environment and public health, and Congress amended the Clean Air Act to set national air quality, auto emission, and anti-pollution standards. As the focus on environment has become increasingly global, more people than ever are celebrating Earth Day around the world. According to the *Columbia Electronic Encyclopedia* (6th ed., 2005), Earth Day is now observed in 140 nations with outdoor performances, exhibits, street fairs, and television programs that focus on environmental issues. Earth Day is truly a day to celebrate the environment, to promote the ideas of ecology, to encourage respect for life on earth, and to highlight growing concern over pollution of the soil, water, and air. (Source: <http://www.epa.gov/earthday/>)

**World Water Day and “Water for Life” 2005-2015**

The international observance of World Water Day is an initiative that grew out of the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro. The theme of World Water Day 2005 is: *Water for Life 2005 - 2015*. The UN General Assembly at its 58th session in December 2003 agreed to proclaim the years 2005 to 2015 as the International Decade for Action, "Water for Life", and beginning with World Water Day, March 22, 2005. The Water for Life decade sets the world's goals on "a greater focus on water-related issues, while striving to ensure the participation of women in water-related development efforts, and further cooperation at all levels to achieve water-related goals of the Millennium Declaration, Johannesburg Plan of Implementation of the World Summit for Sustainable Development and Agenda 21." The first water decade from 1981 to 1990 brought water to over a billion people and sanitation to almost 770 million. Today, there are still almost 1.1 billion people who have inadequate access to water and 2.4 billion without appropriate sanitation. (Source: <http://www.worldwaterday.org/>)

**An International Year of Planet Earth 2005-2007 and Earth Sciences for Society**

Initiated by the International Union of Geological Sciences (IUGS) in 2001, the International Year of Planet Earth was endorsed by UNESCO. The main aim is to demonstrate the great potential of the earth sciences to lay the foundations of a safer, healthier and wealthier society – explains the Year's subtitle: Earth Sciences for Society. We depend on only one Earth completely, because we evolved from it, remain forever part of it, and can exist only by courtesy of the self-sustaining Earth System. The more we learn, the more we understand that we must nurture the Earth as we would our children, for their sake. (Source: <http://www.esfs.org/initiative.htm>)

**World Year of Physics 2005 and Einstein in the 21<sup>st</sup> Century**

The World Year of Physics (WYP) 2005 is a United Nations endorsed, worldwide celebration of physics and its importance in our everyday lives. Physics not only plays an important role in the development of science and technology but also has a tremendous impact on our society. WYP aims to raise the worldwide awareness of physics and physical science. The year 2005 marks the 100th anniversary of Albert Einstein's "miraculous year" in which he published three important papers describing ideas that have since influenced all of modern physics. This year provides the opportunity to celebrate Einstein, his great ideas, and his influence on life in the 21st century. (Source: <http://www.physics2005.org/>)