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West Virginia Academy of Science

Newsletter- May 2000

Join the WVAS E-Mail List!

Dr. Ron Canterbury will develop a WVAS e-mail list for all individuals interested in keeping in touch with the Academy in this format. The list will be used to send announcements, dues notices, and web page updates. The list will also provide an opportunity for members to send messages of mutual interest to the entire lists. Subscription information can be found at <http://www.marshall.edu/wvas> (WVAS web site).

Charlie Pitrolo WVAS Teacher-of-the-Year

Charlie Pitrolo currently teaches fifth grade science and other subjects at Dunbar Middle School in Fairmont, WV. He has taught in public schools since 1980. He holds a Master's degree in Education Administration from West Virginia University, and a Master's Degree Specialization in Educational Technology Leadership from Salem-Teikyo University. He has also attended Fairmont State College and Alderson-Broadus College.

Charlie is the Systems Operator at Dunbar Middle School. He has worked as a Teacher Trainer with the West Virginia High Technology Consortium Foundation, Marion County schools, and the West Virginia State Department of Education, concentrating on Internet skills and technology integration into the curriculum.

Charlie's recent telecommunication project, E.C.H.O.E.S. (Enhancing Communications: Helping Out Every Student), has received funding from the Marion County Professional Staff Development Council. This project unites students, teachers, and parents and was formally implemented in Charlie's classroom this year. He distributes a weekly email to parents with a link to the [Tripod.com](http://www.Tripod.com) (E.C.H.O.E.S.) web site, where weekly assignments are posted. Parents may access their children's grades on the [ThinkWave.com](http://www.ThinkWave.com) web site, and students take quizzes at home on the [FunBrain.com](http://www.FunBrain.com) web site.

Charlie assigns out-of-the-ordinary

science projects to stimulate his students' imaginations. Charlie Pitrolo has been named WVAS science teacher of the year for his classroom innovations and excellent parent-teacher communication system.

Editor's Report

The following is a report from Dr. Ron Canterbury, Proceedings Editor:

1997, Volume 69, Numbers 2-4: Three papers have been externally reviewed and accepted.

1998, Volume 70, Numbers 2-4: I am working on proofs and some proofs have been sent to the authors. Four papers are ready for publication, and the issue probably will go to press by in summer 2000.

1999, Volume 71, Numbers 2-4: Six papers are being processed and some proofs have been mailed to authors. Issue will probably go to press in summer 2000.

2000, Volume 72, Numbers 1 (meeting abstracts): 70 abstracts. Issue sent to press.

2000, Volume 72, Numbers 2-4: Three papers in external review.

Dr. Donald D. Gray Publishes New Fluid Mechanics Textbook

WVAS Member Donald D. Gray has published a new textbook "A First Course in Fluid Mechanics for Civil Engineers". More information about the book is available on the web site of the publisher, Water Resources Publications, LLC, of Highlands Ranch, Colorado (<http://www.wrpllc.com/>). Dr. Gray is an Associate Professor in the Department of Civil and Environmental Engineering at West Virginia University.

Ed Keller Receives Award

Dr. Ed Keller, a West Virginia University biology professor received the Distinguished Service Award in Science Education from the 55,000 member National Science Teachers Association at their annual meeting.

Dr. Keller received his baccalaureate, masters, and doctoral degrees at Penn State. He is a Past-President of the WV Academy of Science and was its long-term Editor of the WVAS Proceedings. He has published and presented over 100 abstracts and some 20 publications. Dr. Keller is our representative to the American Association for the Advancement of Science. He also represents WVAS at the annual meetings of the National Association of Academies of Science. He currently serves as a member of the Abstracts of the Academies of Science, Inc. He is currently a biology professor, and former chairman, at West Virginia University. In addition to his teaching, research, and service activities at WVU, he is the Coordinator of the Coordinated and Thematic Science (CATS) program for Equity and Access in grades 6-10 in West Virginia. He is designing and working on two World Wide Web sites on ways to make science education more accessible to students with disabilities and to assure more equitable learning environments for others that are under represented in science. Partial funding for these projects is obtained from the WV Department of Education (project CATS) and the National Science Foundation.

In 1970, he received an honorary D. Sc. degree from Salem College for his efforts to help students with disabilities learn science. In 1991, WVU awarded him their Social Justice Award. He was also on the Mentor team of the DO-IT National Program (funded by the National Science Foundation) that was awarded the 1997 Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring for under represented groups in Science, Engineering, and Mathematics. The award was presented by the White House Office of Science and Technology and The National Science and Technology Council. This mentoring group was also awarded 1st Place in the 1997 National Infrastructure Champions of Cyberspace awards.

Dr. Keller was chairman of the West Virginia University Biology department until 1972, and about that time he began to

work on education in science for students with disabilities. He applied for and obtained funds from the National Science Foundation (NSF) to support summer programs in marine science for all types of students with disabilities. This was in addition to his regular teaching duties and research on aquatic ecology and pollution.

During his career as an educator, Dr. Keller has taken a special interest in ensuring that learning about science does not exclude students with disabilities. Over time, as his own types of disabilities have altered his access to the aquatic environments he studied, his research endeavors have shifted to studies of mortality/environmental associations and the study disability in West Virginia.

Dr. Keller has been physically impaired most of his life: polio at age 17, diabetes in his mid 40s, retinopathy in his early 50s, arterial sclerosis in his early 60s (5-way heart by pass), and, most recently, a stroke. Still, he teaches about 550 college students each year in his four classes at WVA. He also participates in a tele-course in Biology for in-service public school teachers of Physics, Earth Science, and Chemistry. Dr. Keller also does workshops for public school teachers on teaching students with disabilities and he exhibits and demonstrates assistive technology and materials throughout the nation in the summers. And all this from his wheelchair!

Dr. Keller is also currently working on two extensive web sites that provide strategies to assist teachers in their classrooms, laboratories, and field trips to help structure individualized education programs for students with disabilities in the public school systems of the nation. The second site is concerned with aspects of equity for those students whose minority, rural, or economic status affects their opportunities in obtaining an equitable access to learning.

In addition to his numerous research publications, Keller has done many reports for governmental groups, other colleges and universities, and for industry. In his early research years, he worked on enzymatic inheritance, renovation of sewage, poultry use of sewage renovation by-products, genetic stability in algal systems under stress, and space biology (as co-investigator of the lysogenic bacteria project on America's first biological space program --- Biosatellite). He was also selected to represent all of the experimenters at the Control Center at Goddard Space Flight

Center during the program.

In his mid-research career, he worked on acid mine drainage problems and their impact on natural aquatic ecosystems in West Virginia. Later, he focused on environmental influences in cancer and cardiovascular mortalities and their distributions in West Virginia populations.

He was an environmental/statistical consultant for the Environmental Protection Agency in the landmark case of Tacomite pollution in Lake Superior, the Ocean Dumping by the City of Philadelphia, on procedural aspects of Pesticide Certification Program when the program was shifted to the EPA from the USDA. He was also employed by the American Petroleum Institute (e.g., off shore drilling and deck drainage, refinery classification, and regulation, and analyses of air pollution monitoring procedures). In addition, he worked on determining placement of nuclear and coal power plants, liquefied gas plants, assessment of the Valdez oil spill and ecosystem recovery plans.

Dr. Keller was member of the West Virginia delegation to the White House Conference on Persons with Disabilities. He has also served the NSF as an expert in disability, was co-writer of the NSF report on Science and Engineering Education for Persons with Disabilities, and was a member of the focus groups on disability aspects of the National Science Educational Standards done by the National Academy of Sciences. He has served on the NSF Committee on Equal Opportunity in Science and Engineering for two terms and also served on the NSF Advisory Committee in the Science and Engineering Education Division. The NSTA has three times appointed him to chair its Advisory Board for Special Education.

Marshall University Hosts the West Virginia State Science and Engineering Fair

On April 1, the College of Science at Marshall University hosted the WV State Science and Engineering Fair (WVSSEF) for the first time. Sponsored in part by the West Virginia Academy of Science and Marshall University, the Fair competition featured 70 presentation from students throughout West Virginia. Top winners in each category received \$100. The two top winners overall received grand prize and grand prize runner up awards of \$750 and

\$350, respectively, and an all-expense paid trip to the Intel International Science and Engineering Fair (Intel ISEF) in Detroit, MI, as participants. The Intel ISEF is the world's largest pre-college science competition. It brings together more than 1,100 students from more than 45 countries to share ideas, showcase cutting-edge science, and compete for over \$1.5 million in awards and scholarships. This year's WVSSEF grand prize sponsor was the Hewlett Packard Company.

Top 10 Awards at the WVSSEF

- 1. Ashley Mulroy** (Linsly) Correlating Residual Antibiotic Levels in Public Water to in-situ Drug Resistant Escherichia coli: Is Remediation an Option?
- 2. Paul Biedler** (Musselman) Polyethylene Mulch Effects on the Physiology of *Phaseolus vulgaris*
- 3. Julie Humeas** (Jefferson) A Study of Redundancy and Entropy in the English Language and How It Leads to Data Compression.
- 4. Tim McDonald** (Jefferson) Aqua Shock
- 5. Mark Biedler** (Musselman) Power Averaging of Capacitors' Energy Supplies
- 6. Jonathan Stocking** (Hedgesville) The Cardiological Effects of Classical Music
- 7. Rachel Wiechman** (Wheeling Park) Antibiotic Resistance of *Staphylococcus epidermidis* to Vancomycin
- 8. Eli Perrone** (Musselman) The K.I.S.S. Project- A Study of Submersible Propulsion Systems
- 9. Joseph Saboe** (St. Joseph) OIL SPILL!
- 10. Lindsey Koliscak & Kelly Sickler** (Pendleton) Kansas vs. OZ

Newsletter Submissions

Newsletter submissions may be sent anytime to Marcia Harrison, Newsletter editor, either by mail or e-mail to wvas@marshall.edu. The WVAS Newsletter will be mailed to all members periodically as news warrants.

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ABSTRACTS 2000 ANNUAL MEETING

WETLANDS SYMPOSIUM

RALPH W. TINER, National Wetlands Inventory Project, U.S. Fish and Wildlife Service, Northeast Region, Handley, MA 01035. A big picture view of wetlands for the next century: integrating and enhancing geospatial information for assessing wetlands at the watershed level.

To date, most wetland evaluations have been performed at the site-specific level for individual wetlands or individual projects. While such work will continue to be required for regulatory purposes and specific project planning, there is great need for a broader perspective of wetland functions that demonstrates and emphasizes the interrelationships among wetlands in performing various functions (e.g., wetlands working as a system). Over the past two decades, significant technological developments have taken place to permit assessment of wetlands at the landscape level (e.g., watersheds and regions). The availability of desktop geographic information systems (GIS) has facilitated the use of GIS technology to aid in resource characterization and assessment. The U.S. Fish and Wildlife Service's National Wetlands Inventory Project (NWI) has produced much geospatial wetland information based on its map products. To date, digital map data are available for more than 40% of the conterminous U.S. and 13% of Alaska. This makes it possible to assess wetlands over wide geographic areas. The presentation will explain how the Service is enhancing NWI data to perform watershed-wide preliminary assessments of wetland functions. This process creates a series of topical maps and accompanying statistical data highlighting wetlands that likely have a high potential for performing numerous wetland functions. The NWI is doing this work on a pilot basis, mostly in the northeastern United States. The analysis

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provides a holistic view of wetlands within a watershed and is a great tool for resource managers and planners to aid in formulating wetland conservation and management strategies. It can also be used to further the general public understanding of the interrelationships between wetland characteristics and their functions and the significant roles wetlands play within a watershed.

ROBERT E. BEHLING, Dept. of Geology and Geography, West Virginia University, Morgantown, WV 26506. Observations on the birth, life, and death of wetlands in the Unglaciated Appalachian Region.

At the 1982 Symposium on Wetlands, John Diehl and I shared our understanding of natural wetland formation in the Unglaciated Appalachian Region. Subsequent years of study of both natural and man-made wetlands in West Virginia lead me to suggest that wetland formation, good health, and destruction is a function of six factors: $W = f(k,s,b,c,t,m)$. Where W = wetland; k = knickpoint in drainage; s = substrate; b = biologic activity; c = climate; t = time; m = mass movement/erosion. Truly old organic material (i.e., radiocarbon dead) in the region only reflects late Paleozoic coal deposits. Even if the factors of wetland formation persisted on the landscape during the past 800,000 years of record, the organic component of wetlands did not survive. This is consistent with the concept of wetlands being "forever young". Climate changes during the past million years, I believe, triggered a destruction-mode of then existent wetlands: accumulated organic debris was returned to the carbon cycle and unconsolidated sediments were selectively relocated. If we are to find any vestiges of truly old wetlands, we would have to drill/ excavate a thick colluvium mantle along the sides of valley floors. The packages of diamict triggered by fluctuations in climate

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offer the only viable mechanism to bury and preserve "old" wetlands. I have previously reported the details of one such location in Tucker County, West Virginia.

JOHN C. SENCINDIVER, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV. 26506-6108. Wetland soils in West Virginia.

Wetland determinations are based upon hydrology, vegetation and soils. Wetland soils typically have aquic moisture conditions. Soils with aquic conditions are those that currently undergo continuous or periodic saturation and reduction. The presence of these conditions is indicated by redoximorphic features. These features consist of redox concentrations, redox depletions, and reduced matrix. Redox concentrations are zones or spots in the soil of apparent accumulation of Fe-Mn oxides, while redox depletions are zones or spots where either Fe-Mn oxides alone or both oxides and clay have been stripped out. Depletions have a chroma of <2 (grayish colors). A reduced matrix means that the dominant color of a soil horizon is low chroma in situ but undergoes a change in hue or chroma within 30 minutes after exposure to air. Many soils with aquic conditions are hydric soils. A hydric soil formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Fifteen soil series have been identified as hydric soils in West Virginia. These soils are classified into five different orders of Soil Taxonomy: 1 Mollisol, 3 Inceptisols, 3 Alfisols, 4 Entisols, and 4 Ultisols. Caution must be used when comparing the list of hydric soil series to soil survey maps. Many of the soils on the list have ranges in water table depths that allow the soil to range from hydric to nonhydric depending on the location. Lists of hydric soils along with soil survey maps are good off-site ancillary tools to

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assist in wetland determinations, but they are not a substitute for on-site investigations.

WILLIAM GRAFTON, Div. of Forestry and Wildlife, West Virginia University, Morgantown, WV 26506, **RODNEY BARTGIS**, The Nature Conservancy, Elkins, WV 26241, **RONALD FORTNEY**, Div. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV, and **DAN EVANS**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Floristics of wetlands in West Virginia.

Wetland habitats and floristics in West Virginia are diverse. Although several plant species occur pervasively throughout the state, each ecological region supports a unique combination. In this paper, we treat the floristics of wetlands in the state based on three general regions, high elevation, western and southern low elevation, and eastern Ridge and Valley and Blue Ridge. Generally, high elevation wetlands consist of bogs, swamps, seeps, and wet meadows. Most high elevation wetlands are relatively undisturbed, supporting a high percentage of native species. Rare native species are frequent in high elevation wetlands, whereas they occur less frequent at lower elevations. A distinctive flora characterizes high elevation wetlands fed by circum-neutral groundwater usually associated with the Greenbrier limestone or the Mauch Chunk. At this latitude, many globally rare and northern species are restricted to these wetlands. Wetlands in the lower, western, and southern portions of the state consist of swamps, seeps, wet meadows, old oxbows of large rivers, and margins of impoundments. These wetlands, which are frequently highly disturbed, commonly support numerous weeds and invasive exotics, but they can also support rare species that are near the limit of their ranges. Most wetlands of the Ridge and Valley Province

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are in the valleys and have species typical of lower elevation.

RONALD FORTNEY, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Plant communities of West Virginia Wetlands.

Plant communities in West Virginia wetlands are highly diverse because of variability in topography, substrate characteristics, and water quality. Of equal importance are anthropocentric activities influences creating and maintaining early successional communities. Forested communities are commonly associated with streams and rivers as either bottomland overflow or swamp wetlands. At low elevations, *Acer saccharinum* and *A. negundo* are frequent dominants, with *Picea rubens*, *Tsuga canadensis* and *Betula allegheniensis* dominants at high elevations. Swamp and overflow forests are best represented along the Kanawha and Meadow Rivers. Frequent dominants in shrub communities are *Alnus rugosa*, *A. serrulata*, *Spiraea alba*, *Hypericum densiflorum*, *Vaccinium* spp. and *Viburnum* spp., with *A. rugosa* and *Vaccinium* spp. occurring mostly above 750 m. Herbaceous-dominated wetlands are more variable, with dominants correlated with hydrologic regime and soil characteristics. The most frequently occurring herbaceous species on mineral soils are *Typha latifolia*, *Juncus effusus*, *Leersia oryzoides*, *Phalaris arundinacea* and various species of *Carex* spp. and *Scirpus* spp. On acidic peatlands in high elevations, *Sphagnum* spp. and *Polytrichum* spp. mosses characteristically form a continuous ground cover. Except for the major wetlands areas of the state, e.g., Cranberry Glades, plant communities are little studied. To better understand the functional aspects of wetlands, the species diversity and phytosociological aspects of smaller, lesser-known wetlands should be studied.

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THOMAS K. PAULEY, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Amphibians and reptiles in wetland habitats in the Central Appalachians.

Wetland habitats are used extensively by amphibians and reptiles for life functions such as shelter, foraging, breeding and egg deposition and larval development. Wetland habitats used by amphibians and reptiles include riverine floodplains, permanent ponds, beaver ponds, bogs and fens, ephemeral pools, and roadside ditches. Amphibians that commonly use these wetlands include ambystomatid salamanders, newts, four-toed salamanders, mud and red salamanders, spadefoot toads, American and Fowler's toads, cricket frogs, gray treefrogs, chorus frogs, spring peeper, bullfrog, green frog, wood frog, leopard frog, and pickerel frog. Reptiles frequently found in wetlands during some time in their life histories include the snapping turtle, spotted turtle, painted turtle, stinkpot, water snakes, and ribbon snakes. This paper will describe amphibian and reptile species that use particular habitats for the various life functions. Future research priorities should include life histories, distribution patterns, how amphibians and reptiles use different wetland types, and protection and management of wetland habitats to maintain population densities of amphibians and reptiles.

BRUCE EDINGER, Dept. of Bioscience, Salem-Teikyo University, Salem, WV 26426. Wetland and riparian birds of West Virginia: status, future research, and guidelines for constructed wetlands.

Birds, along with amphibians, are excellent vertebrate indicators of wetland functioning and values. Wetland birds, often specialist predators high on the food web, indicate an intact trophic pyramid. They are also sensitive to vegetation type and other landscape parameters. The

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absence or rarity of wetland birds can indicate problems with wetland quantity or quality. To determine the status of WV wetland birds, a review of existing records (Hall, 1983; Buckelew and Hall, 1994; lists assembled by bird clubs and state and federal agencies, etc.) and of conservation and management sources (journal articles, Partners in Flight Abstracts of The Nature Conservancy, Birds of North America, etc.) was conducted. Also, from 1996 through 1999, plot censuses of six natural and created wetland habitats in north-central WV, and similar studies in riparian communities along five rivers, allowed up to date (if local) data on wetland bird densities. This study provides an overview of the general status of wetland bird communities, important wetland habitat characteristics, long-term population changes, problematic wetland species, recommendations for future wetland bird research, and recommendations for constructed wetlands. West Virginia wetland communities are riverine, lacustrine (reservoirs and lakes), and palustrine (wet meadow, emergent, shrub-scrub, forested, and beaver pond) systems, and the bird community varied from one wetland type to another. For example, isolated and ephemeral beaver ponds, support a high diversity of secondary cavity nesters (high quantity of snags) and black ducks (possibly lessened competition with mallards who threaten hybridization and genetic swamping). Wetlands lacking a shrub layer, either naturally or because a constructed wetland was in an early stage of succession, lacked species such as Empidonax flycatchers. In sum, WV wetland bird species were sensitive to surrounding habitat, type of wetland vegetation, proportion and depth of open water, and availability of mud margin. Threats to wetland-dependant birds in WV continue to be habitat fragmentation, loss and degradation. Quantified, long-term studies of breeding and non-breeding bird usage of some of WV larger wetlands are needed to adequately assess population trends. Breeding

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Bird Survey studies poorly monitor wetland species. At the same time, given the high diversity of migratory wetland birds found in some WV wetlands, additional research is needed into the value of WV wetlands, despite their small size, as stopover sites for migratory species. Ecotonal and seasonal use of wetlands by "non-wetland" bird species is a third area needing attention. In the same way red-shouldered hawks have territories that allow feeding in forested wetlands, but are also found in other habitats, several other species of birds may be found to have "habitat mosaic" needs that include wetlands. Finally, since constructed wetlands are a growing part of the wetland mix in WV, mitigation wetlands can be improved as wetland bird habitat if they are sufficiently large, hydrologically joined to rivers, allowed to undergo wetland succession to develop shrub-scrub and organic soils, and surrounded by plant communities complementary to needs of the wetland bird species. (This work was partially supported by the WV Department of Transportation, Division of Highways.)

EDWIN D. MICHAEL, Division of Forestry, West Virginia University, Morgantown, WV 26506. Wetland mammals of the Central Appalachians.

The primary objective of this paper is to identify those mammals within the Central Appalachians that are wetland dependent. The secondary objective is to describe the population status and research priorities for each wetland mammal. Five mammals are wetland dependent: northern water shrew (*Sorex palustris*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), and river otter (*Lutra canadensis*). Muskrats are dependent on palustrine wetlands, river otters and water shrews are dependent on riverine wetlands, and beaver and muskrats are dependent on riparian habitats. Beaver, muskrat, mink, and river otter

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are classified as obligate, while the water shrew is classified as facultative. Certain other mammals could possibly be classified as facultative, but specific habitat requirements are unknown; examples include the bog lemming (*Synaptomys cooperi*), star-nosed mole (*Condylura cristata*), and certain bat species. Population status ranges from abundant with wide distribution (beaver and muskrat) to rare with limited distribution (water shrew and river otter). The status of mink is unknown. Research priorities include: (1) develop methods to control damage (beaver and muskrat) and (2) determine population density and distribution (water shrew, mink, and river otter).

NEAL CARTE, West Virginia Division of Highways, Charleston, WV 25305; **CHARLES RILING**, West Virginia Division of Highways, Charleston, WV 25305; and **RONALD FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. Methods for constructing wetland mitigation sites used by the West Virginia Division of Highways.

Creating wetland replacement sites (mitigation wetlands) to compensate for unavoidable impacts to existing wetlands is now commonplace in highway construction projects. This presentation reviews the current concepts and techniques used by the West Virginia Division of Highways (WVDOH) to fulfill wetland mitigation requirements under Section 404 of the Clean Water Act. For about ten years, WVDOH has gained valuable experience in the three critical areas of wetland mitigation: site selection, design, and construction. Successfully integrating these three areas requires a multidisciplinary approach that incorporates understanding ecological processes and physical environmental features (geology, soils, and hydrology), and the application of engineering principles. Site selection is the

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most critical step in the process. An artificial wetland system imposed on the landscape without regard to hydrological morphology of the larger watershed, geology, and soils has a dubious long-term viability. Ideally, replacement wetlands should be constructed to mimic natural systems present in the same physiographic province, with the restoration of historic wetlands the preferred option. Among important design criteria is establishing elevations that permit hydrologic inflows/outflows and a grading plan that incorporates variations in the relief and habitat diversity. Having the flexibility to alter the design during construction is important in achieving a best fit condition, and ultimately a naturally functioning wetland.

BIOCHEMISTRY / CHEMISTRY

JENNIFER A. SHOOK and **ROBERT KREISBERG**, Division of Biology, West Liberty State College, West Liberty, WV 26074. Monoclonal antibody production and applications to cancer research/therapy.

The purpose of this project was to study the production of monoclonal antibodies to green fluorescent protein and research the applications of this procedure to cancer research and cancer therapy. The monoclonal antibodies were produced by immunizing mice with recombinant green fluorescent protein (GFP) as the antigen. The GFP was purified and injected into a Balb/c strain of laboratory mice, which produced an antibody to the protein. During the immunization protocol serum was collected (orbital) and screened by Enzyme Linked Immunosorbant Assay (ELISA) for the presence of anti-GFP produced by the b-lymphocytes of the mice. Mice showing high titers to GFP were sacrificed and their spleen cells fused with myeloma cells. Fused cells (hybridomas) were screened for production of anti-GFP by ELISA. Positive hybridoma clones (displaying high

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antibody titer to GFP) were isolated and cultivated. Applications to cancer research and therapy were researched in a secondary fashion utilizing books, journals, and internet resources.

SHYLAJA AKKARAJU, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. DNA thermal profiles: signal or noise for conservation biology?

The theoretical basis for derivative DNA thermal denaturation profiles (DNA thermal profiles) was worked out in the 1970s. However, with the advent of Nucleotide sequencing, this technique was no longer used to make DNA comparisons across taxa. I propose the use of DNA thermal profiles in determination of parentage and kinship in vertebrates. Total genomic DNA was melted from 60°C to 100°C at C increments using a spectrophotometer fitted with a thermocuvette and a thermoprogrammer. Second derivative DNA thermal profiles were generated and comparisons were made using parsimony. In each case, it was possible to determine kinship and parentage. This method was also used to confirm Cuban Crocodile hybrids (as part of the Cuban Crocodile Species Survival Plan) that were identified based on morphological and circumstantial evidence.

ERICA HARVEY and **ROBERT SWEENEY**, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554. Determination of pentane-water partitioning coefficients using gas chromatography-mass spectrometry: A new equilibrium experiment for general chemistry.

In the introductory chemistry laboratory at Fairmont State College, students use gas chromatography-mass spectrometry (GC-MS) to determine equilibrium constants for the partitioning of hydrophobic organic compounds between water and pentane. Students select

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three organic alcohols and predict their relative partitioning coefficients based on structural considerations. A pentane standard solution containing approximately one drop of each of the alcohols is then prepared. Two-milliliter aliquots of the pentane solution are added to vials containing 2.0, 4.0 or 6.0 mL of water. After mixing to allow equilibration of the organic solute between the two phases, the pentane layer is removed and analyzed by GC-MS, along with the standard solution. Peaks in the chromatogram are identified by retention time and/or use of the mass spectral library. Using peak areas and mass balance considerations, students calculate the relative concentrations of each alcohol in the pentane and water layers, and finally the equilibrium constant for partitioning between the two layers. The differences in equilibrium constants for the three alcohols are rationalized by comparing their intermolecular forces. Partial support for this work was provided by the National Science Foundation's Division of Undergraduate Education through grant DUE #9851183.

BIOLOGY

ALAN D. SMITH, Dept. of Quantitative and Natural Sciences, Robert Morris College, 600th 5th Avenue, Pittsburgh, PA 15219-3099. Marketability of frozen drink products in the Pittsburgh SMSA.

A large, regional ice cream manufacturer and distributor located in Pittsburgh, Pennsylvania, which manufactures over 100 different flavors of ice cream, sherbet, sorbet, and yogurt, is moving into nutritional milkshakes designed for people having trouble gaining or maintaining weight. The company is currently expanding the market share in the frozen drink category, specifically, the low calorie, low fat, lactose-free, sugar-free milkshake. Many smaller firms find themselves fluctuating between both internally cooperative and internally

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competitive in their visions in marketing their products and services. The introduction of a product-line that is similar to this firm's traditional manufacturing into the frozen drink category, specifically the low calorie, low fat, lactose-free, sugar-free milkshake, is an entrepreneurial and opportunistic niche approach that is very different than its traditional approaches. This regional ice cream manufacturer tests the marketability and profitability of moving into the frozen drink category, first-hand observations of 100 independent potential customers were allowed to sample a scoop of the new low-fat frozen drink and were interviewed, and their responses to a number of questions were analyzed. An analysis of a number of variables indicated a high customer acceptability and profitability from such a venture. Distribution by mail is probably a bad idea unless Internet marketing is implemented. Most people aren't as health conscious as you think (only 59%). This percentage can most likely be further reduced as many people admit they are health conscious but really are not. However, most potential customers are not in favor of purchasing the product through mail, are health conscious, and would most likely purchase the product for desert, not as a snack or meal replacement.

ERIN MCKEE, Dept. of Biology, Shepherd College, Shepherdstown, WV 25443 and
CLIFFORD E. STARLIPER, USGS Leetown Science Center, National Fish Health Research Laboratory, Kearneysville, WV 25430. The effect of quarantine of freshwater bivalves (e.g. *Amblema plicata*) to control transmission of the fish pathogen *Aeromonas salmonicida* to salmonid fishes.

Freshwater bivalves are very susceptible to environmental and biological factors that impact their existence. Factors such as dams, construction, siltation and most recently the unwanted introduction of zebra mussels

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(*Dreissena polymorpha*) have resulted in greater than 70% of the animals native to North America to become listed as threatened, endangered or of special concern. Bivalves require, as part of their life cycle, an intermediate fish host for development of glochidia into the juvenile stage. Therefore, impacts on the fish directly affect survival of mussels. In 1995, the U.S. Fish and Wildlife Service with private, state and other federal partners initiated efforts to conserve native mussels. One of these conservation efforts was a relocation program whereby animals would be collected and propagated at facilities free of their natural threats. Facilities include those that already rear salmonid fishes. With relocation, questions arose regarding the potential to introduce fish pathogens with the mussels. According to standard protocol, prior to relocation mussels must undergo a 30-day quarantine to ensure zebra mussels are not present and inadvertently spread. The study presented here was done to determine if quarantine in pathogen-free water would also provide for the mussels to depurate fish bacterial pathogens they might be harboring from being in their natural environment. There are no bacterial pathogens known to cause disease to both mussels and fish, therefore, a model system was developed using the bivalve *Amblema plicata*, the salmonid fish Arctic char (*Salvelinus alpinus*) and *Aeromonas salmonicida*, a Gram-negative bacterium that is pathogenic to salmonids. An artificial epizootic was established by injecting (IP) two groups of Arctic char with 2.26×10^2 cfu and 2.26×10^0 cfu viable *A. salmonicida* per fish. These fish were placed in a tank with non-injected char, which became infected via cohabitation. The injected fish died and after the non-injected fish began to die, 120 *A. plicata* were placed in the tank. When the *A. plicata* had become carriers of, and potential vectors for *A. salmonicida*, as determined by bacteriological culture, the animals were transferred to four different tanks

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and pathogen-free Arctic char were added after 1, 5, 15 and 30 day quarantine periods. Transmission of *A. salmonicida* from the mussels to the "clean" char was evaluated through subsequent disease and mortality followed by bacteriological isolation and characterization of *A. salmonicida* from mucus and kidney tissues. In those groups where disease did not develop bacterial culture of *A. salmonicida* from fish and mussel tissues was done to determine if the bacterium was present and it's prevalence in both hosts. A quarantine period in pathogen-free water is effective to prevent transmission of *A. salmonicida*, but effectiveness is dependant on the length of the quarantine.

BRADLEY YEAKLE, Dept. of Biology, Shepherd College, Shepherdstown, WV 25443 and **CLIFFORD E. STARLIPER**, USGS Leetown Science Center, National Fish Health Research Laboratory, Kearneysville, WV 25430. A susceptibility comparison of two strains of Arctic char and rainbow and brook trout to experimental challenge with the fish pathogen *Yersinia ruckeri*.

Yersinia ruckeri is a Gram-negative, enteric bacterium that causes redmouth disease (ERM), a very serious disease that affects salmonid fishes and may result in high mortality. The two salmonid species that are the most frequently intensively cultured in the United States are rainbow (*Oncorhynchus mykiss*) and brook (*Salvelinus fontinalis*) trout. Previous disease case histories and experimental challenge data have shown that rainbow trout are relatively more susceptible to *Y. ruckeri* than brook trout, about a 1,000-fold difference. The study we present was done to experimentally evaluate and compare the susceptibility to *Y. ruckeri* of the Nauyuk and Labrador strains of Arctic char (*S. alpinus*), to each other, and to rainbow and brook trout. Arctic char are naturally a northern,

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cold-climate species. In recent years culturists have increasingly begun to intensively rear Arctic char in the warmer waters of more southern geographic areas as the species is becoming more commercially important in aquaculture because of their very favorable conversion rate to convert fish feed into edible filets. Little is known of the susceptibility of Arctic char to the major, primary bacterial pathogens of salmonids, however, with increased intensive culture diseases may be predicted to emerge caused by recognized salmonid pathogens or perhaps, to yet to be described pathogens. We artificially challenged groups of fingerlings of each of the four hosts by an intraperitoneal (IP) injection and by waterborne (bath) exposure. Then, the fish were observed, mortality was recorded and dead fish were necropsed to show death was a result of *Y. ruckeri* infection. The bacterium was isolated by streak culture of kidney tissues onto brain heart infusion (BHI) agar; bacterial isolates were characterized using standard biochemical methods and media. For the IP challenges, each *Y. ruckeri* was grown in BHI then ten-fold dilutions were prepared and 0.1 mL of each dilution was injected per fish. For the waterborne challenge, isolates were grown in BHI and fish were exposed for 1 min to full strength and 10^{-1} concentrations of viable cells. All groups (of 15 fish each) were maintained in flow through tanks fed with 12 °C pathogen-free spring water at about 1.5 L per minute. Six *Y. ruckeri* isolates were utilized, three were of the biotype I (sorbitol fermentation negative) and three were biotype II (sorbitol positive). The two biotypes were examined because some earlier reports in the literature noted that biotype II strains were significantly less virulent than biotype I strains. Both strains of Arctic char were very susceptible to both biotypes of *Y. ruckeri* by both challenge methods of exposure. With some challenges the Nauyuk strain was

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minimally more susceptible at the higher dilutions than the Labradors in terms of mortality and time to mortality. The susceptibility of the rainbow trout was similar to that for the two Arctic char hosts. Of the four hosts, brook trout were relatively far more resistant to *Y. ruckeri* challenge, regardless of method.

CLIFFORD E. STARLIPER, USGS
Leetown Science Center, National Fish
Health Research Laboratory, Kearneysville,
WV 25430. Effectiveness of windrow
composting to control bacterial pathogens.

During the summer of 1998, an epizootic occurred in Atlantic salmon (*Salmo salar*) being reared as part of a genetics research program at the Leetown Science Center, Kearneysville, WV. The disease was diagnosed as furunculosis for which the etiological agent is *Aeromonas salmonicida*, a Gram-negative bacterium. Furunculosis is a very serious disease of salmonid fishes and in particular, the salmon species. *Aeromonas salmonicida* is highly virulent, pathogenic and contagious; it is spread via horizontal transmission and disease survivors may harbor the bacterium in their mucus without expression of clinical disease signs. The strategy for control of the epizootic was integrated and included chemical and antimicrobial therapy and depopulation of affected lots of fish that were not essential for success of the genetics program. This resulted in about 4600 kg (25,000 carcasses) to be discarded. It was also imperative to dispose of the carcasses in such a way to not contaminate underground water or surrounding streams with *A. salmonicida*. Windrow composting was chosen as the method to dispose of the carcasses. The compost pile was constructed on a concrete pad using a rubber tire loader; it was shaped as a windrow that formed a peak along its longitudinal axis to facilitate the chimney

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effect. Carcasses were mixed one part to nine parts of bulking material that was spent, horse stable- and cow barn bedding. Components of the bedding included (in addition to manure) straw, wood chips and sawdust. In addition to this (large) pile, a smaller pile (250 kg of fish) was constructed in the fall of 1998 to again determine the fate of *A. salmonicida* and of equal importance to evaluate the killing effect on potential human pathogenic coliform bacteria (*Escherichia coli*) that originated from the bulking material. The temperature was monitored and after a maximum was achieved and the decline began, the pile was mixed and turned and reformed into the windrow shape. After turning, the temperature again rose to its maximum; this constituted a cycle. The compost process was considered complete when the temperature would no longer rise above ambient after turning, in our case, 5 turns. The material was considered to be "field ready" in about 1 year. With each turn, samples of the compost material were collected and subjected to bacterial isolation techniques for aerobic bacteria. It was determined that composting of the diseased fish carcasses proved to be extremely effective in achieving the containment and killing of *A. salmonicida* and *E. coli*. Pathogen killing was a result of the sustained high temperatures in the piles. A high of 73 °C (162 °F) was recorded and during the first cycle the temperatures remained above 60 °C (140 °F) for three weeks. Bacterial analyses of the kidneys of infected fish just prior to construction of the pile showed a 30% prevalence in the population having an average of 8.43 X 10⁷ cfu of *A. salmonicida* per g of kidney tissue and 8 of 8 compost samples were positive for, and contained an average of 2.18 X 10⁶ cfu *E. coli* per g. After only one temperature cycle (36 days) no *A. salmonicida* or *E. coli* were isolated and in fact, 38% (6 of 16) of the compost samples were sterile. Environmental bacteria were isolated, including

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members of the genera *Bacillus*, *Klebsiella*, *Serratia*, *Acintobacter* and *Pantoea*.

AMY LEECH, DAVID YEATER, RYAN MANCUSO, JAMIE WELLS, ROGER SEEBER, AND ROBERT KREISBERG,

Division of Biology, West Liberty State College, West Liberty, WV 26074.

Amplified restriction fragment polymorphism study to genetically sort tomato (*Lycopersicon esculentum*) varieties.

Currently, tomato (*Lycopersicon esculentum*) varieties are classified solely on their phenotypic characteristics (leaf size, size of fruit, texture of fruit). The problem with this type of identification is many of these tomatoes have different names but the same cultivar.

The Biotechnology Track in cooperation with the Biology Club, both at West Liberty State College, is in the process of using Amplified Restriction Fragment Polymorphism (AFLP) to genetically identify tomato varieties. AFLP is a DNA fingerprinting technique used to visualize DNA polymorphisms (variations at the genetic level). This sensitive technique can distinguish individual plants genetically and/or assess the evolutionary relatedness of various plant tissue samples. The analysis begins with enzymatic digestion of genomic DNA isolated chemically from tomato seedlings. The resulting DNA fragments will be ligated to adapters and Polymerase Chain Reaction-amplified using fluorescent-dye-labeled primers that anneal to the adapter sequences. The amplified DNA fragments will be resolved by gel electrophoresis on an ABI Prism Automated DNA Sequencer (Perkin Elmer). Amplified DNA binding patterns from the phenotypically defined tomato varieties will be compared for polymorphisms that will allow genetic characterization. The WLSC/NASA Consortium funds this project.

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SHAWN M. CLARK, West Virginia Dept. of Agric., 1900 Kanawha Blvd. East, Charleston, WV 25305-0191. Color morphs of the larger elm leaf beetle, *Monocesta coryli* (Say), in West Virginia (Insecta: Coleoptera: Chrysomelidae).

In contrast to the boldly patterned beetles that are characteristic throughout much of the range of *Monocesta coryli* (Say), populations in some areas of West Virginia exhibit uniformly yellow elytra with, at most, vague dark markings. Mapping of localities from specimen labels clearly indicates that this pale form is distributed in the more northern and western parts of the state, while the boldly patterned form occurs in the more southern and eastern regions.

ROB STULL, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. Teaching in the wild: Effective environmental science education.

Many people express a love for the environment but rarely develop respect or an understanding of it. While the enjoyment and utilization of our natural resources are important aspects demonstrating the importance of our natural resources, providing the education of how natural systems function is a crucial component. Effective education provides the understanding that establishes long term values important for commitment to preservation of natural resources. Through a teacher training workshop for the U.S. Fish & Wildlife Service, I developed a program to aid teachers in identifying the importance of teaching outside the traditional classroom while addressing the importance of how different learning styles impact the education process. Teachers were grouped according to learning styles, instructed to describe an aspect of river ecology, and assess the relationship between learning styles and transfer of ecological

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information.

RACHEL SEARS, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. Surface water use and reservoirs in Puerto Rico: the effects of land use, sedimentation and population growth.

Seven surface-water reservoirs are used to meet public water-supply demands of 73 percent of the 3.9 million inhabitants of Puerto Rico. Past and present land-use practices within the reservoir drainage basins have substantially reduced the storage capacities of the reservoirs. High rates of soil erosion and transport of fluvial sediment typical of montane humid tropical environments have resulted in excessive reservoir sedimentation. The objective of this study was to assess the degree to which land use may have contributed to increased reservoir sedimentation and thus, reduced storage capacities. Analysis of digital land-cover maps (available for 1977 and 1995) revealed changing land use practices for the eighteen year period. Forested lands, increased from 1 to 24 square kilometers in four basins. However, this has not diminished the high sedimentation rates observed in the drainage basins of these water-supply reservoirs. Additionally, during the 19th and early 20th centuries, large volumes of sediment eroded by intense subsistence agriculture were deposited on footslopes and floodplains, and are readily available for transport during periodic storms. Analysis reveals variable correlations between this sediment load to the reservoirs and land use practices.

BOTANY

SUSAN MOYLE STUDLAR, Dept. of Biology, West Virginia University, Morgantown, WV 26506, **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont

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State College, Fairmont, WV 26554, and **PAUL J. HARMON**, Dept. of Natural Resources, Elkins, WV 26241. Completion of a documented checklist of bryophytes for the West Virginia Curatorial Database System.

We have essentially completed, after 3 years, a checklist database for the bryophytes of West Virginia, based almost entirely on critical annotation (and curation) of decades-old voucher specimens in the West Virginia University Bryophyte Herbarium by Studlar. The bryophyte flora consists of 377 species (383 taxa, including varieties): 3 species of hornworts, 105 species of liverworts, and 269 species of mosses. About 45 species are represented by only one or two collections and about 5 by none (literature citations). Many of these under-collected species may well be rare. They tend to be clustered in particular habitats, such as spruce forests, sphagnum wetlands, and cool moist caves. (Sponsored by the West Virginia Department of Natural Resources and West Virginia University.)

ROGER G. SEEBER, JR. and **ROBERT KREISBERG**, Division of Biology, West Liberty State College, West Liberty, WV 26074. Development of a tomato (*Lycopersicon esulentum*) gene bank.

The development of this project stems from an effort to accumulate a stock of tomato seeds for use by the West Liberty State College Biology Club. A short review of seed-saving literature quickly indicates that there is an alarming loss of variation in all crop areas. Varieties of seeds have declined over the past century due to the domination of a relatively few large seed supply companies. Currently, only three companies handle 75% of all the packet seed sold in the US. Plant patent laws have made it profitable to create and market hybrids, which do not produce their own seeds. According to the

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fourth edition of the Seed Savers Exchange book, *The Garden Seed Inventory*, 90% of the types of food crops grown at the turn of the century are no longer commercially available today. In fact, two-thirds of the open-pollinated seeds available in 1984 were gone by 1994. There is a growing "grass roots" movement to save some of this genetic heritage. This led to the development of the West Liberty State College Tomato Genetics Project dedicated to the preservation of tomato seeds both in general and more specifically to save "locally" bred or grown tomatoes. The number of seed savers is small and there is a small number of "family" varieties that have been propagated for many decades which may have important "local" genetic traits which could be easily lost. The collection, begun in the fall of 1998, now contains over 750 samples. Approximately a quarter of these have been donated by individuals from all over West Virginia and it's neighboring states. Samples are being stored dry and frozen and attempts are underway to secure land for the regular regeneration of the seed stock, thus allowing for the perpetuation of these endangered varieties.

DEWEY SANDERSON, Dept. of Geology, Marshall University, Huntington, WV 25755. Dispersion of *Nelumbo lutea* (American Lotus) in the Green Bottom mitigated wetland, Cabell County, West Virginia.

The construction of the new Gallipolis Locks and Dam destroyed wetlands on the floodplain of the Ohio River that necessitated creating new wetlands by mandate of federal law. A mitigated wetland was created at Green Bottom in northernmost Cabell County on the flood plain of the Ohio River. One of the two parts of the mitigated wetland was excavated and the other is situated in an abandoned channel of the river that has been contained by dikes; the diked area, when at high water, covers nearly 18

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hectares. Construction of the wetlands took place in 1972 and by 1994 the wetlands were flooded. This paper follows the development and dispersion of *Nelumbo lutea* (American lotus) in the diked pond. Photographic record indicates the lotus had established itself in 1994, initially covering an area of 0.3 hectares at the west end of the pond. By 1996, the lotus spread to 1.5 hectares about its original area. No photographic record has yet been found for 1997 which appears to have been a most significant year for the dispersion of the lotus. In 1998 GPS was used to map the extent of the lotus which had spread to over 5 hectares. At the end of the 1999 growing season coverage was nearly 6.5 hectares completely filling the western half of the pond and expanding into the eastern half. Dispersion appears to be both by floating seedpods and rhizomes. The ecology of the pond will be undergoing a major change as the lotus take over the pond

ECOLOGY

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **JOHN C. LANDOLT**, Dept. of Biology, Shepherd College, Shepherdstown, WV 25443, **DONNA L. MOORE**, Biology Department, Hamilton College, Clinton, NY 13323, and **GARY A LAURSEN**, Institute of Arctic Biology, University of Alaska, Fairbanks, AK 99775. Mycetozoans associated with high-latitude boreal forest and tundra ecosystems of Alaska

Most of what is known about the assemblages of mycetozoans (protostelids, dictyostelids, and myxomycetes) associated with particular types of terrestrial ecosystems has been derived from studies carried out in temperate regions of the world. The mycetozoans associated with high-latitude boreal forest and tundra ecosystems have received relatively little study. During the past decade (1989 to 1999), a considerable body

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of data on the distribution and ecology of mycetozoans in boreal forest and tundra ecosystems of Alaska has been accumulated as one component of a mycological survey that has been carried out at a number of localities throughout the state. The most intensively studied localities are Denali National Park and Preserve in interior (central) Alaska and the Bering Land Bridge National Preserve and adjacent areas of the Seward Peninsula in western Alaska. As a result of this effort, 8 species of protostelids, 9 species of dictyostelids, and at least 95 species of myxomycetes are known from Alaska. Although a few species of mycetozoans are sometimes surprisingly abundant in boreal forest and tundra ecosystems, overall species richness is lower in these high-latitude ecosystems than in temperate and subtropical/tropical ecosystems. (Supported in part by several grants from the National Park Service's Anchorage, Alaska, office.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422; and **DAVID M. LAWRENCE**, Virginia Department of Environmental Quality, 629 E. Main Street, P.O. Box 10009, Richmond, VA 23240. An ecological study of the Sweet Briar College old-growth white oak forest.

Quantitative data on the composition and structure of all strata of vegetation were collected from an old-growth white oak (*Quercus alba*) forest on the campus of Sweet Briar College in Amherst County, Virginia. In addition, increment growth cores were extracted from representative larger white oak trees for age determination. White oak, with an importance value (IV) of 32.8 was clearly the dominant species present in the tree stratum

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(stems ≥ 10 cm DBH), with tulip-tree (*Liriodendron tulipifera*), sourwood (*Oxydendrum arboreum*), and beech (*Fagus grandifolia*) the most important associates. White oak was conspicuously absent from the small tree (stems < 10 but ≥ 2.5 cm DBH) and sapling (stems < 2.5 cm DBH but ≥ 1.0 m tall) strata but had a higher importance value than any other species in the seedling stratum. The oldest cored trees dated back to the 1770s.

MARTIN SCHNITTLER and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554, and **JOHN C. ZAK**, Dept. of Biological Sciences, Texas Tech University, Lubbock, TX 79409. Myxomycetes of Big Bend National Park in Texas.

Although the low moisture levels and high summer temperatures characteristic of warm deserts would seem to place severe constraints on the occurrence of myxomycetes (plasmodial slime molds), more than 60 species have been reported from this type of ecosystem, and a few species are sometimes surprisingly abundant in certain microhabitats. The objective of the present study, which is still ongoing, is to characterize the distribution patterns and ecology of myxomycetes in the Pine Canyon Watershed of Big Bend National Park in Texas. The Pine Canyon Watershed covers approximately 7,800 ha and encompasses five different vegetation types. These are (1) high-elevation forests dominated by pinyon pine [*Pinus cembroides*] and live oak [*Quercus emoryi*], (2) closed canopy oak [*Quercus gravesii*] woodlands, (3) sotol [*Dasyllirion leiophyllum*] grasslands (4) foothills desert shrublands dominated by Big Bend silverleaf [*Leucophyllum* spp.] and *Agave lechuguilla*, and (5) lowland desert shrublands dominated by creosote bush [*Larrea tridentata*]. Preliminary data obtained on two visits to the Park (one in April of 1996 and the other in January of 1999)

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suggest that distinct differences exist in the assemblages of myxomycetes associated with each of these vegetation types. A particularly productive microhabitat for field collections is represented by the decaying pads of *Opuntia* spp., which support a distinctive assemblage of myxomycetes, with *Badhamia gracilis* the dominant species present. Based upon the results obtained thus far from 225 moist chamber cultures, samples of most types of organic debris can be expected to yield myxomycetes. (Supported in part by a West Virginia Space Grant Consortium Research Capability Enhancement Mini-Grant.)

HAROLD S. ADAMS, Division of Arts and Science, Dabney S. Lancaster Community College, Clifton Forge, VA 24422. A Governor's School in Field Ecology at Dabney S. Lancaster Community College, Virginia.

The Governor's School Regional Center in Field Ecology at Dabney S. Lancaster Community College, sponsored by the Virginia State Department of Education, has operated successfully since 1985. The program currently serves twenty gifted and talented eighth and ninth grade youth from the service area of the college for three weeks each summer. The aim of the Center is to awaken an awareness and interest in the native plant and animal life of Virginia as a rich and varied natural resource. As such, emphasis is placed on the relationship between organisms and their natural environment, and on the role and impact of humans on these ecosystems. Through participation in the program, students develop a better understanding of how science works by participating in all activities engaged in by research scientists. They are challenged to use their creativity by asking questions, formulating experimental approaches, executing experiments, analyzing data, and communicating results. Further, by working

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cooperatively in research teams, students become aware of the importance of social interaction, group collaboration, etiquette, and ethics during scientific research.

AMANDA SAPPINGTON, Dept. of Bioscience, Salem-Teikyo University, Salem, WV 26426, **RONALD FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506, and **JAKE OTT**, Dept. of Bioscience, Salem-Teikyo University, Salem, WV 26426. Composition and structure of plant communities on four islands in the upper mid-Ohio River Valley.

The vegetation of the Ohio River Islands have been greatly impacted by past anthropocentric activities. Of specific interest are bottomland overflow hardwoods forests, which have been largely reduced to a vestige of their original prominence. This study evaluates the composition and structure of the forest and associated non-forest communities on four upper mid-Ohio River islands. All major plant communities were quantitatively sampled using 0.1 ha. quadrats. A composite soil sample was collected in each quadrat and analyzed by an independent lab. Most mature bottomland forests occur on the nose, foot, and lateral margins of the islands where flooding occurs annually. *Acer saccharinum* occurs as a dominant or co-dominant species in most stands. Other important canopy species include *Plantanus occidentalis*, and *Aesculus octandra*, with *Populus deltoides* occurring mostly on the lowest elevations. In the same area, *Polygonum cuspidatum* frequently forms dense tall herbaceous understories. In old field communities, dominance is a varying mixture of herbaceous species. *Glechoma hederacea*, *Phalaris arundinacea*, and *Verbesina alternifolia* are frequent dominants. Where *P. cuspidatum* forms a dense understory, species

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diversity is low and recruitment of overstory woody species is limited. For old field communities, invasion of woody species appears to be limited, even though site abandonment occurred 15 to 25 years earlier. Generally, forested sites have higher pH and exchangeable cation values than non-forested sites.

DAVID M. LAWRENCE, Virginia Department of Environmental Quality, 629 E. Main Street, P.O. Box 10009, Richmond, VA 23240, **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554, **HAROLD S. ADAMS**, Division of Arts and Science, Dabney S. Lancaster Community College, Clifton Forge, VA 24422, and **ROBERT B. COXE**, Western Pennsylvania Conservancy, 209 Fourth Avenue, Pittsburgh, PA 15222. Geography of West Virginia forests.

Geographic patterns in forest community composition in West Virginia were evaluated using overstory data from more than 400 stands sampled by the authors during the past 30 years. Three major groups of forest communities are revealed: spruce-fir; northern hardwood, and mixed oak. Both indirect and direct gradient analyses supported identification of these groups by segregation of forest types within each group in more or less distinct regions of ordination space. Gradients in community composition were related to gradients in regional factors (latitude, longitude), local factors (elevation, aspect, slope steepness, slope position, and site moisture), and temporal factors (stand basal area and density, as these two parameters reflect successional status). Both direct and indirect gradient analyses revealed that local factors (primarily elevation, aspect/site moisture and slope steepness) were the strongest influences on overstory composition.

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JOHN C. LANDOLT AND ELIZABETH KANE, Dept. of Biology, Shepherd College, Shepherdstown, WV 25443, and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Dictyostelid cellular slime molds from the Yucatan of Mexico.

Soil and litter samples, from eight different study sites in the semi-deciduous lowland forests of the states of Quintana Roo and Yucatan on the Yucatan Peninsula in southern Mexico, were collected in the summer of 1990 and in the fall of 1999. A few additional samples were obtained from a site in the state of Thaxcala. These samples were processed in the laboratory by standard methods to recover dictyostelid cellular slime molds. At least 14 different species were recovered, along with several as yet unidentified forms. All identified species recovered are either cosmopolitan forms or those with distributions centered in tropical and subtropical regions of the world. The single most common species was *Dictyostelium purpureum*. One or more species of the *Polysphondylium pallidum* complex also were among the most commonly isolated forms. Several of the species recovered are known from only a few other localities worldwide. (Supported in part by a grant from the National Science Foundation.)

JAMES RENTCH and RAY HICKS, Jr., Div. of Forestry, West Virginia University, Morgantown, WV 26506. Radial growth of five Central Hardwood Forest tree species during a severe summer drought.

The structure and function of forest communities are often greatly influenced by air temperature and water availability, and forest regions are often broadly defined by climate. This study examined 30-year tree ring responses to moisture and temperature for five Central Hardwood species (*Quercus alba*, *Q. rubra*,

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Liriodendron tulipifera, *Fraxinus americana*, and *Acer saccharum*) in two second-growth forests in southeastern Ohio. Patterns of species' climatic responses were then compared to radial growth during the 1999 growing season, which was characterized by lower than average precipitation and higher than average temperatures. Eighty-seven mature, dominant or codominant trees (dbh > 25 cm) were cored and fitted with dendrometers on May 1, 1999. Dendrometer readings from a smaller sample of trees (20 total, 4 of each species) were recorded weekly from May 20 through October 14, 1999. The most recent 30 years of average annual ring widths for each species were then correlated with the monthly Palmer Drought Severity Indices (PSI) and average maximum temperature (AMT). Growth during 1999 generally followed species' historic climatic responses. Dendrometer readings revealed that *L. tulipifera* consistently showed the greatest weekly and total radial growth, followed by *Q. rubra*, *Q. alba*, and *A. saccharum*. *F. americana* showed the greatest drought response, producing virtually no radial growth. Historically, *F. americana* showed high negative correlation with June AMT, and high positive correlations with precipitation during the growing season. *Quercus* spp., generally considered more drought tolerant, showed relatively lower correlations with precipitation. Although *L. tulipifera* is generally considered a mesic species, results from this study showed it was generally more sensitive to temperature than precipitation.

JASON A. MORGAN and **DONALD C. TARTER**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, and **JANET L. CLAYTON**, West Virginia Dept. of Natural Resources, Elkins, WV 26241. Food habits of *Salmo trutta* and *Salvelinus fontinalis* in relation to seasonal changes and mitigative liming effects in

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Dogway fork of the Cranberry River, West Virginia.

Dogway Fork, a tributary of the Cranberry River in West Virginia, is acidic due to poorly buffered soils and acid precipitation. This study is part of a long-term investigation involving the effects of continuous limestone neutralization on fishes and benthos of an acid stream. Prior to treatment in 1988, the stream had a pH of 4.5. Since treatment began, the pH has risen to 6.8. In 1988, brook and brown trout were collected seasonally by electrofishing and stomach contents were removed by flushing with a bulb pipette. Benthic samples were collected in duplicates using a modified Surber sampler. Statistical analysis were done to determine which taxa consumed by both trout species in the spring season were the most important. Mayfly nymphs and hymenopterans were the most important taxa consumed by both trout species in the summer and fall seasons. Mayfly nymphs, stonefly nymphs, and caddisfly larvae were the most important taxa consumed by both trout species in the winter. Mayfly nymphs, hymenopterans, and chironomid midges appeared to be the most important food items in the diet of both trout species for the year.

BENJAMIN LOWMAN, ERICH EMERY, and **DONALD TARTER**, Ohio River Valley Water Sanitation Commission (ORSANCO), Cincinnati, OH and Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Changes among Ohio River fish populations due to habitat conditions created by water quality improvement and high-lift dams.

The Ohio River Valley Water Sanitation Commission (ORSANCO) has been collecting biological data from the Ohio River since 1957. Over that 40 year period, major changes to the river system have occurred through the construction of high-lift navigational dams and

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control of waters discharged into the river. Ohio River fish populations have responded in two ways to habitat conditions created by these changes. In response to the replacement of low-head dams by high-lift dams (1959 - 1980), more than 25 species experienced a marked increase in abundance. These species have benefited from the introduction of streamside/overhanging vegetation—which provides diverse habitat—into the expanded channel. Many species have also responded to improvements in water quality—initiated by the Clean Water Act (1972)—through gradual increases in abundance. Populations of species normally associated with higher water quality have grown due to a reduction in pollutants introduced into the river as well as a reduction in turbidity, caused by the "settling effect" of slower flowing navigational pools.

TERRY TOMASEK and DONALD TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Impacts to benthic macroinvertebrate communities and water chemistry from valley fill construction.

Downstream impact of surface mining and valley fill construction was evaluated utilizing both water chemistry and EPA approved Rapid Bio-assessment Protocol III. An un-named stream in southern West Virginia was sampled in February of 1999 before any mining perturbation. The watershed drains approximately 900 acres of deciduous forest. Five downstream stations were established and benthic macroinvertebrates were collected approximately once every two months. Water chemistry was analyzed by an approved EPA laboratory. Parameters determined at each station were pH, aluminum, calcium, iron, magnesium, manganese, sodium, total suspended solids (TSS), total dissolved solids (TDS), hardness, alkalinity, acidity, sulfates, and chloride. The initial pre-mining data

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showed low metals, acidity, conductivity, hardness, alkalinity, TSS, TDS, sulfates, and near neutral pH values. Based on these data, the stream is classified as a high fertility, low buffering capacity, soft water stream. Benthic macroinvertebrate communities were well balanced within the stream. There was a high abundance of EPT individuals compared to Chironomidae abundance. A fairly high number of shredders were collected. Comparisons were made among two year pre-mining data, two month pre-mining data and initial mining data over a one year time period.

PHIL YEAGER, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Differential microbial community structure and function on chironomid substrate, frass, and tubes in response to feeding pressure.

Despite decades of research, our understanding of the interactions between macrobenthic and microbial communities remains imperfect at best. We employed molecular and biochemical techniques to further understand this relationship using the midge *Chironomus tentans*. We studied microbial community organization on three phases of artificial substrate (frass, tubes, and unutilized) after chironomid development from second instar to emergence at three levels of feeding pressure. Shifts in microbial community structure were quantified using RAPD technology to assess patterns in genetic diversity between treatments and substrate phase. Microbial community function was measured through substrate utilization and enzyme activity. These techniques allowed us to quantify differences in microbial community organization between both treatments and substrate phases and shed new light on microbial invertebrate interaction.

MICHAEL J. DEMCHIK and VIRGINIA C. DEMCHIK, Jefferson High School,

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Shenandoah Junction, WV 25442. The effect of drought on streams.

The purpose of this study was to determine the water quality of three streams, Rocky March, Town Run and Elk Run in Jefferson County during drought conditions. The data were to be compared to previous five-year data. Standard limnological techniques for measuring the chemical properties were used and the biotic index measured by the Kimmel-Sharpe System. The results of the assessment indicated that the water level was down 80 to 85% of normal level and the coliform test was positive where in the past it was not. Biotic index, oxygen content, phosphates, and pH were lower than in the past. Nitrates remain the same in all cases. Water hardness increased significantly as did the carbon dioxide content. This program was supported through institutional funds but was initially supported through the Eastern Panhandle Soil Conservation Service.

JAMIE BLAKE, TOM JONES, SEAN LOUDIN, MATT GANT, JOSH HAGGERTY and JEFF SIMMONS,
Alderson Broaddus College, Bradley, WV 25818. Concentrations of selected metals in the Tygart Valley River Watershed.

The upper section of Tygart Valley River is listed on West Virginia's 303d list for violations of the iron, manganese, aluminum, and pH standards. The EPA is currently working on the Total Maximum Daily Load (TMDL) for this stream segment. To assist in the TMDL validation process, grab samples were collected near the mouths of tributaries and along the main channel. For this project, kicknet samples (RAPIDS) were taken at the grab sample sites to compare traditional water quality parameters with benthic invertebrate data. The sites varied from mine impacted stream segments (iron =16 mg/L, sulfate=1056 mg/L, pH=2.05) to near pristine stream segments (iron=0mg/L,

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sulfate=10mg/L, pH=7.85). No benthic insects were present at the two most impacted sites. Taxa richness varied from 0 to 23 among the other sites. Benthic data show strong correlation to water quality data. One site is an outlier to this trend. That site is an AMD reclamation project where water quality is recovering but the benthic community has not. This project is the initial phase of a larger project defining the specific impacts of metals on benthos.

ZACHARY LOUGHMAN, Dept. of Biology, West Liberty State College, West Liberty WV 26074 and **WILLIS "BOB" GORDON,** Dept. of Biology, West Liberty State College, West Liberty, WV 26074. Feeding behavior and biology of *Nerodia sipedon sipedon* (Northern Water Snake).

The purpose of this project was to witness and define various feeding behaviors that *Nerodia sipedon s.* perform while feeding and to document the species of prey the snakes fed upon. Sexual dimorphism was believed to be present within this species as far as the utilization of prey species was concerned. Data were collected in the field (Marshall County, WV) by the use of a mark-recapture study and by taking animals into the laboratory for behavioral observations. The results showed that a form of dimorphism was present with the females taking the larger fish species and the males taking the smaller fish species. Along with this, behaviors observed in the wild and in the laboratory were analyzed and defined.

GEOLOGY, MINING AND ENVIRONMENTAL SCIENCE

AVEN C. SIZEMORE, III and JAN WESTERIK, Dept. of Geography, Concord College, P.O. Box 1000, Athens, WV 24712-1000. Soil development and soil

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characteristics on a reclaimed surface mine site.

The mountain top removal mining controversy that was recently aired in the popular press aroused my interest in studying the likely ability of reclaimed surface mine sites to support a vegetation cover similar to that present prior to mining. Even though we located several reclaimed mine sites in Nicholas County, West Virginia, we were able to get permission to study only one of them. After an initial inspection of the reclaimed mountain top mine site (the study site), we decided to study the surface soil-like layer to determine its texture, temperature profile, water infiltration rate, compaction level, its chemical reaction, and its plant nutrient content status. The study site had the appearance of pastureland, so we decided to compare its properties to a tract (the control site) of similar appearance that had not been mined. Over a period of several weeks during the summer of 1999, we took readings at both sites of soil properties mentioned above, and collected soil samples to test the two soils for plant nutrient content.

When we analyzed my results, we found the study site soils to be much coarser in texture than the control site soils, and to show much higher compaction levels. Study site soil temperatures were usually above control site temperatures, although no consistent relationships were recognizable for relative soil moisture content. The soil chemistry results show the study site soils as having both a lower pH and a higher concentration of free aluminum ions. Both can contribute to soil pH problems. Also, calcium ion concentration in study site soils was at half the level of those in control site soils. The only plant nutrient elements for which the study site soils showed higher values than the control site soils were the two fertilizer elements, nitrate nitrogen and potassium. When we completed the study, we concluded that the study site soils would be unable to support

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significant tree growth for some time primarily because they were too coarsely textured and too compacted, and that they might not be able to adequately supply the range of plant nutrients needed.

XU JESSICA HUANG and **DONALD D. GRAY**, Dept. of Civil & Environmental Engineering, College of Engineering and Mineral Resources, West Virginia University, P.O. Box 6103, Morgantown, WV 26506. Magnetic effects on water chemistry and treatment.

Magnetic water treatment devices, which have as their main purpose the prevention of scale formation from hard water, are a world-wide, multi-million dollar industry. The manufacturers of these devices make significant claims for their effectiveness, and their customers are often technologically sophisticated industrial plants. Yet conventional water treatment textbooks make little or no mention of magnetic water treatment techniques, and the technology is often regarded with suspicion in academic circles. Is magnetic water treatment a hoax perpetrated by con artists or a valid technology which has been developed in the hard-nosed, practical world of industry without the need for assistance from academic theorists? This paper reviews the sometimes contradictory studies of magnetic water treatment which have appeared in the open literature in order to understand how magnetic water treatment might work and whether it is in fact effective.

MICHAEL GURSON, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. Application of Geographic Information Systems for monitoring large river aquatic systems.

The purpose of this project was to create an aquatic Geographic Information System for the

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bankfull channel section of the Potomac River that adjoins the U.S. Fish and Wildlife Service's National Conservation Training Center in Shepherdstown, WV. The data set was created by the field survey of 601 sample points during summer low water conditions. Differential GPS was used to record the position of each sample point. At each point, measures of depth, flow, substrate, temperature, dissolved oxygen, cover, and presence of freshwater mussels were recorded. Attribute data from the sample points were interpolated using ArcView Spatial Analyst to create surface maps and contours of the physical and biological parameters. The data layers illustrate the importance of GIS modeling for large river aquatic systems and they show the capabilities of GIS to riverine habitats and its applications for habitat restoration, protection, or biotic monitoring. The project was a collaborative effort between the U.S. Fish and Wildlife Service, the U.S. Geological Survey Biological Resources Division, and the Institute for Environmental Studies at Shepherd College.

PHYSICS

DOUGLAS O'NEAL, Dept. of Natural Sciences and Mathematics, West Liberty State College, West Liberty, WV 26074. Spectroscopic studies of starspots on magnetically active stars.

With my collaborators, I am carrying out an ongoing program of research on the properties of dark, cool starspots on magnetically active stars. Both young and old stars of the Sun's temperature or cooler may have, at some stages of their lives, abnormally strong magnetic fields leading to extremely hot coronae, powerful stellar flares, and huge starspots. Our goal is to develop and refine spectroscopic techniques for determining the temperature and area of the starspots. Our study includes visual and infrared high-resolution spectroscopic data

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obtained with telescopes at McDonald Observatory and Kitt Peak National Observatory. We find, in general, that starspot coverages are higher than those found by other techniques, including Doppler imaging and photometry. On extremely active stars, dark spots can cover up to 50% or more of the photosphere. I also describe how this program can provide an undergraduate science student possessing an aptitude for physics and computer skills with an opportunity to participate in important, significant astrophysical research.

GALEN J. HANSEN, Dept. of Physics, Fairmont State College, Fairmont, WV 26554. *Ex-situ* studies of electrode surfaces: work function and Fermi level effects.

The properties of the interphase between electrode and electrolyte are fundamental to electrochemical processes such as corrosion, passivation, catalysis, and thin film formation. While the chemical processes and atomic structure are usually the focus of such studies, it is important to recognize the physics which underlies these processes, and which affect the very measurements used to analyze surface chemical processes. Two classes of electrode removal for *ex-situ* studies are examined: (1) removal of electrodes from electrolyte with thin surface layers (e.g., passive oxide layers, polymer layers) and (2) emersion of the electrode with its electrochemical double layer intact. The data from various *ex-situ* studies of the gold double layer and Ti and Ni passive oxide layers are examined in an effort to separate out the effects of Fermi level and work function shifts from normal chemical effects such as changes in oxidation state.

ZOOLOGY

ROBERT SWEENEY and ERICA HARVEY, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554. Bird-

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friendly chemical analysis of feather lipids.

An experimental method has been developed for the noninvasive, quantitative analysis of surface lipids from bird plumage. Individual feathers are stripped with methanolic sodium methoxide to convert fatty-acid esters to fatty acid methyl esters (FAMES). Upon addition of water and pentane, FAMES partition into the pentane layer and are analyzed through gas chromatography-mass spectrometry (GC-MS). A capillary GC column efficiently separates all the saturated straight-chain FAMES with baseline resolution. Single-ion monitoring mass spectrometry at m/z 87 allows the specific detection of saturated straight-chain FAMES with a detection limit of 3 pg (equivalent to 10 ng FAME per feather sample). Total loadings of C_8 through C_{21} fatty acids on bird feathers range from 50 ppm to 4000 ppm, with palmitic and stearic acids predominating. Partial support for this work was provided by the National Science Foundation's Division of Undergraduate Education through grant DUE #9851183.

ROBERT SWEENEY and ERICA HARVEY, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554.
Extracting phylogenetic information from feather lipids.

Fatty-acid profiles of lipids on bird feathers constitute a potential new character for phylogenetic analysis. Quantitative analyses of surface lipids from bird feathers were performed using a combination of chemical derivation and gas chromatography-mass spectrometry. Relationships among fatty acid concentrations are consistent with kinetic predictions based on the known routes of fatty-acid biosynthesis. Plots of lauric (C_{12}) vs. myristic (C_{14}) methyl ester concentrations are linear for members within bird groups, and the linear plots for different groups are distinct from each other.

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Surface lipids have been successfully collected from the plumage of living birds, fresh and frozen carcasses, and older stuffed skins. The data presented will focus on Falconiformes, Psittaciformes, and Piciformes. Partial support for this work was provided by the National Science Foundation's Division of Undergraduate Education through grant DUE #9851183.

ANNE SCHOOLCRAFT and DONALD C. TARTER, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, and **DAN CINCOTTA**, West Virginia Dept. of Natural Resources, Elkins, WV 26241. Reproductive biology of the candy darter, *Etheostoma osburni*, in the Cherry Run, West Virginia, with an analysis of mitochondrial DNA.

Etheostoma osburni, the candy darter, is endemic to the lower New River drainage of West Virginia and Virginia. As a result of its endemism and evidence of declining population numbers, the species has been given the status of Special Concern in both states. Seasonal gonosomatic indices indicated a steady increase in females, with the peak (7.137) in April 1999. A peak GSI found for males in October 1998, rather than the following April, was probably indicative of the low number of adult males collected in the spring. By snorkeling, the female darters were observed exhibiting behaviors of possible nest guarding on five occasions beginning early June 1999. A fecundity analysis showed females to contain a low average of 170 mature ova. Larval candy darters collected in the summer of 1999 were measured and their lengths plotted against Julian days. A regression equation showed the approximate date of spawning to be between April 21 and 22. Combined reproductive studies indicated that candy darters spawn in the late spring, probably from mid-April to mid-May. A mitochondrial DNA analysis of candy

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arters from the two provinces will be discussed.

ROBERT E. ACCIAVATTI, Carnegie Museum of Natural History, Pittsburgh, PA 15213, **RALPH F. KIRCHNER**, Dept. of the Army, Huntington District Corps of Engineers, Apple Grove, WV 25502, **THOMAS J. ALLEN**, West Virginia Division of Natural Resources, Elkins, WV 26241, and **COURTNEY KERNS**, Morgantown, WV 26505. The current status of rare West Virginia tiger beetle species (Coleoptera: Cicindelidae).

New information, both published and unpublished, for six rare tiger beetle species permits an accurate review of their current status in West Virginia. An earlier comprehensive treatment of West Virginia Cicindelidae in 1992 presented information about the taxonomy, life history and ecology of seventeen species recorded from the state. Five species occur in very specific habitats along the Ohio River and its larger tributaries. These habitat specialists consequently were considered rare enough to justify their recognition as species of special concern threatened by habitat alteration. Additional West Virginia surveys for these five tiger beetle species since 1992 concentrated on specific habitats along the Ohio River and the Big Sandy River. Unexpectedly, *Cicindela cursitans* LeConte, a small species previously unknown in West Virginia, was discovered on an eroded clay bank covered with fescue grass in Mason County within the Ohio River flood plain. Remarkably, *Cicindela marginipennis* Dejean, a species thought to be eliminated from West Virginia was rediscovered on cobblestone beaches and island heads at a few localities in Wood and Pleasants Counties. By contrast, *Cicindela hirticollis*, a species restricted to sand bars, could not be located and most likely has been extirpated from the upper Ohio River as the result of navigation projects

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or locks and dams. *Cicindela formosa generosa* Dejean and *C. scutellaris lecontei* Haldeman, specializing in deep, dry sandy habitats away from water, were found at additional sites along the Ohio River and the lower reach of the Big Sandy River in Wayne County. Observations indicate that large sandy areas are significant in maintaining viable populations for these two species. *Cicindela cuprascens* LeConte, a species associated with the damp, sandy shorelines and islands of the Ohio River, was found farther up the Ohio River in Jackson and Pleasants counties. The six species considered in this review still should be considered extremely rare in West Virginia based on the Natural Heritage State Rarity Ranking designations. Each of these habitat specialists is so closely associated with a specific habitat of limited distribution in West Virginia that any alteration of that habitat could adversely affect their survival. One species has been extirpated from West Virginia and the others appear very vulnerable. Further data on the life history and ecology of these rare species would improve any assessment of the risk that habitat alteration presents to each species. This information could be used to develop conservation practices to protect specific habitats for each rare tiger beetle species in West Virginia. The views of this author do not purport to reflect the position of the Department of the Army or the Department of Defense.

JAMES HAWKES and **DONALD TARTER**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, and **ERICH EMERY**, Ohio River Valley Sanitation Commission, Cincinnati, OH 45228. Habitat utilization of fish species on the Ohio River: Preliminary development of a multi-metric habitat index.

The development of a habitat index for the Ohio River has long been considered and is essential in assigning impaired and reference conditions

of habitat quality. Due to the complexity and size of the Ohio River, it has yet to be developed. Habitat is an integral part of aquatic systems; it is often used as a tool to assess fish communities and their well being. Likewise, fish are good indicators of water quality in that they are sensitive to most forms of human disturbance and indicators over wide temporal ranges. The loss of habitat quality in the United States has resulted in extinction, extirpations, and population reductions of many fish species and other aquatic organisms. A habitat index will allow for the comparison of expected to observed fish community structure in attempt to evaluate the Ohio River's water quality condition at selected sites. This index will help to create a better understanding of habitat utilization by fish species and the quality of habitat that exists on the Ohio River.

WILLIAM C. BOWEN, BRIAN D. FAULKNER, KIRK G. BARNETT, and **DONALD C. TARTER**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, and **DAN A. CINCOTTA** West Virginia Department of Natural Resources, Elkins, WV 26241. A baseline genetic study of the Redside Dace, *Clinostomus elongatus*, in West Virginia.

The WVDNR regards the status of *Clinostomus elongatus* as "undetermined" in their conservation documents due to limited distribution information available from state waters. Until recently, only five confirmable records were known in West Virginia and all were restricted to northern drainage (i.e. Monongahela and minor Ohio River tributaries). Recent distribution records in small cold water streams in the lower Kanawha river of West Virginia support evidence of a relict population. Presently habitat loss and degradation threaten these populations in the southern waters. The reidside dace is sporadically and disjunctly distributed in West Virginia and in the

northeastern United States. Having a high potential for genetically distinct populations, the purpose of this research is to establish baseline genetic characteristics of the northern and southern populations and to determine their degree of genetic similarity. These data will also add to the general knowledge of the species and assist future conservation and management decisions regarding this species in West Virginia. Analysis of the cytochrome b region of mitochondrial DNA using polymerase chain reaction were performed on the West Virginia population of reidside dace to establish this baseline for future reference.

KIRK G. BARNETT, MICHAEL L. LITTLE, and **DONALD C. TARTER**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. Preliminary observations on the DNA patterns and morphometrics of *Gambusia* sp. in the Green Bottom Wildlife Management Area, West Virginia.

Prior to 1988, two subspecies of the mosquitofish *Gambusia affinis* (*G. a. affinis* and *G. a. holbrooki*) were recognized in the warm southern waters along the gulf and Atlantic coasts of the United States. Based upon electrophoretic and morphometric analysis in 1988, *G. holbrooki* and *G. affinis* were determined to be distinct taxa. Populations west of Mobile Bay, Alabama, were established to be *G. affinis* and those east of Mobile Bay to be *G. holbrooki*. Only two populations of mosquitofish have been found in West Virginia: the Meadow River wetlands, Greenbrier County and the Green Bottom Wildlife Management Area, Cabell and Mason counties. Analyses of the cytochrome b region of mitochondrial DNA using polymerase chain reaction were performed on the West Virginia populations to determine appropriate classification. Mitochondrial DNA analysis as well as multivariate analysis of ten morphometric and

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meristic characters indicate that the Green Bottom population is a phenotypic variant of *G. affinis*.

POSTER

DENISE E. BINION, USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505. A preliminary report on the myxomycetes of the New York City Catskills Watershed.

Myxomycetes (plasmodial slime molds) are eukaryotic, phagotrophic bacterivores present and often abundant in terrestrial ecosystems. Most of what is known about the assemblages of myxomycetes associated with particular types of terrestrial ecosystems has been derived from studies carried out in temperate regions of the world. To date, limited study of the myxomycetes associated with the diverse habitats found within the Catskills area of the New York City watershed has taken place. During the preliminary phase of the present study, 28 species of myxomycetes have been recorded from moist chamber cultures of tree bark, litter, herbivore dung and herbaceous plant material collected in the Catskills Forest Preserve area of the New York City watershed.

DAWN R. BLACK and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. New records of myxomycetes from South Carolina.

The myxomycete biota of South Carolina has been poorly investigated. Except for a short paper (Batson 1955) listing 12 species for the Savannah River Project area, there appear to be no publications dealing specifically with the myxomycetes of the state. Hagelstein (1944) listed 18 species as occurring in South Carolina, Martin and Alexopoulos (1969) reported 13 species from the state, and a search of the

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collections deposited in the National Fungus Collections (BPI) yielded a few additional records. In the summer of 1999, the senior author initiated a survey of the myxomycetes of South Carolina. Species identified from specimens obtained as field collections and/or isolated from samples of plant debris placed in moist chamber cultures have included a number of new records for the state. Among these are such rarely collected species as *Cribraria violacea*, *Didymium ovoideum*, *Perichaena minor*, *Physarum aeneum*, and *Physarum melleum*.

JAMIE L. BREWER, Dept. of Microbiology and Immunology, West Virginia University, Morgantown, WV 26505 and **DONALD E. TRISEL**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. The effect of n-butyl acrylate spillage on aquatic organisms in West Virginia waters.

On October 23, 1998, a vehicular accident on West Virginia Route 50 resulted in the spillage of liquid n-butyl acrylate, a chemical used in the production of items such as plastic, food coloring, and finger nail polish. After the accident, a few dead fish were found, but it was uncertain if the chemical or the intense heat from the fire was responsible. We designed a simple laboratory experiment to test the effects of this chemical on aquatic organisms. Tadpoles and mayfly larvae were collected from a pond near Farmington, WV, and were placed individually in 25 ml petri dishes with 15 ml fresh pond water each. Based on available LD50 doses for rats, varying quantities of n-butyl acrylate were added to the dishes. Tadpoles which received 1 ul n-butyl acrylate/1 ml pond water were dead within 30 seconds of the chemical addition, 0.5 ul/ml resulted in death after approximately ten minutes, while the 0.3 ul/ml and 0.15 ul/ml treatments were fatal to most tadpoles within 48 hours. Mayfly survival

after 2 days was 100%, 100%, 20%, 13%, and 0% for the control, 0.07 ul/ml, 0.13ul/ml, 0.17ul/ml, and 0.3 ul/ml treatments, respectively. After 4 days, mayfly survival was 100%, 73%, 13%, 0%, and 0%. These results indicate that n-Butyl Acrylate is very toxic at low concentrations to the aquatic organisms tested here. More studies are needed to better understand the true consequences of this environmental disaster.

DENNIS A. BURNS AND BRUCE

EDINGER, Dept. of Bioscience, Salem-Teikyo University, Salem, WV 26426.

Effects of a highway bridge and vegetation on breeding bird communities along the Ohio River.

Construction and presence of highway bridges modifies the vegetation, structural profile, and noise levels in the immediate area. It is poorly known how bird communities, which may be sensitive to these changes, respond to the presence of bridges. Two locations were studied in 1998 and 1999, the I-77 bridge from Marietta, Ohio to Williamstown, WV and Blennerhassett Island and the adjacent WV shore as a control. For each of the three sites at the first location, and the two sites at the second, three one-hectare plots were established 1) underneath the bridge, 2) 100m away, and 3) 300m away from the bridge. Bird populations were determined by up to six standard identification and spotmap visits to the plots during the breeding season. Plant communities (trees - basal area, shrubs - stem count, and herbs - cover) were determined by standard sampling in a 50X25m plot within the bird census plot. One site on Buckley Island provided the best control of confounding habitat variables. For this site, birds classified as edge habitat species predominated. Maximum per visit densities of this guild varied little, from 42 to 58 birds/ha, with distance from the bridge. Overall densities of birds labeled as generalists

went from 16 to 10 to 5 per hectare, as one moved from near the bridge to more distant plots. Birds classified as forest or forest edge dwellers varied from 15 to 24 per hectare, showing little relationship with distance from bridge. In terms of individual species, nine showed higher densities away from the bridge, seven had higher densities near the bridge, and 20 species showed little preference. Of the first eight species, American crow, Chimney swift, and Red-tailed hawk densities could not be explained by more of their preferred vegetation found away from the bridge. Most differences in individual bird species densities could be attributed to greater amounts of their preferred vegetation near or far from the bridge. The bird community and vegetation of the Blennerhassett Island sites (lacking a bridge) will be compared to the Buckley Island bridge sites. This study was supported by the WV Department of Transportation, Division of Highways.

KIRK CAMMARATA, JACOB OTT, EDWARD VAN ORDER, and AMANDA SAPPINGTON, BioScience Dept., Salem-Teikyo University, Salem, WV 26426, **ROSA LEE MILLER and RONALD FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506, and **THOMAS JONES**, Biology Dept., Alderson-Broadus College, Philippi, WV 26416. Complementation of grab sample water chemistry measurements with semi-continuous monitoring: stream pH fluctuations due to algal photosynthesis.

We are monitoring water quality in ten West Virginia streams to document impacts on stream ecosystems from a major highway construction project (Appalachian Corridor H). Preconstruction baseline data are accumulated (monthly grab samples for at least 1 year, quarterly thereafter) for several streams in Hardy and Tucker Counties. Parameters

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monitored include flow, temperature, turbidity, suspended solids, pH, alkalinity, acidity, conductivity, sulfate, chloride, iron, calcium, hardness, nitrate, nitrite, ammonia, and phosphorous. Benthic macroinvertebrates and fish are also monitored. Periodic grab samples provide a good indication that the general ecological health of these streams is fair to very good, and thus suitable for assessing the impacts of highway construction. However, the majority of pollutant loading into streams occurs during storm events, and particularly during the "First Flush". Thus, a thorough understanding of a stream must necessarily include monitoring during storm events. Datasonde 4 multiprobes (Hydrolab, Austin, TX) provide semi-continuous monitoring of water depth, temperature, turbidity, pH, conductivity, and dissolved oxygen to obtain these data. We present a subset of data to illustrate the importance and complementarity of these measurements. Grab samples from streams from March through May occasionally exhibit abnormally high pH values up to 9.5.

Ammonia, a possible cause, is not found at elevated levels. Subsequent monitoring with the multiprobe reveals pronounced diurnal cycling of pH, conductivity, and dissolved oxygen. In particular, pH cycles between 7.5 and over 9.0. Temperature fluctuations do not account for the cycling. Observations appear to correlate the cycling with the presence of algal blooms, sunny days, and lack of riparian cover. We therefore postulate that algal photosynthesis is responsible for the > 30-fold daily variation in $[H^+]$. Funded by Contract X142-H-38.99 05 from the WV DOH.

MELISSA COBB and KIRK

CAMMARATA, BioScience Dept., Salem-Teikyo University, Salem, WV 26426.

Differential display - reverse transcriptase polymerase chain reaction to identify genes of interest for phytoremediation.

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Phytoremediation is the use of plants to render harmless various forms of environmental pollution. Known mechanisms of action include hyperaccumulation, rhizofiltration, phytovolatilization, and rhizostabilization. We are particularly interested in using and improving wetland plant species to remediate heavy metals in soil or water. Some plant species have adapted to tolerate unusually high levels of toxic metals. Elucidation of the mechanisms of plant tolerance is postulated to yield new strategies to enhance the phytoremediation process. Toward this end, we are using molecular techniques to identify genes from the wetland plant *Typha angustifolia* which are expressed differentially in response to a pollution shock. The first step is to obtain reproducible "fingerprints" which represent the particular set of genes being expressed. The differential display - reverse transcriptase polymerase chain reaction (DD - RT - PCR) technique allows comparison of fingerprints which are characteristic of the mRNA population of an organism or tissue. Total RNA is reverse transcribed into a cDNA replica. Fingerprints are then generated by selective PCR amplification of subsets of this cDNA replica by using various combinations of an anchored primer (5' dT₁₁ MM 3', where M = A, C, or G) and a random 10-mer primer. The fingerprints are analyzed on polyacrylamide gels. Bands unique to either untreated or treated plants represent differentially expressed genes which can be cloned from the gel. In this work, reproducible banding patterns have been generated with specific primer sets and RNA from untreated plants. The next phase will compare banding patterns for plants subjected to a metal pollution shock. *Typha angustifolia* plants are being cultured in a flowing hydroponic system using Hoagland's solution. The metal pollution shock consists of a pulse of FeSO₄ in Hoagland's solution. Supported in part by a NASA/WV Space Grant Consortium Research Capability Enhancement Mini-Grant

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and a Spectroscopy Society of Pittsburgh Instrumentation Grant to K.C.

ANGIE CONRAD, MICHELLE SHAW, KATRINA HULL, and JOHN HULL, Dept of Psychology, Bethany College, Bethany, WV 26032. Color my world - but only with "boy" colors, please.

Independent groups of male and female participants in preschool, elementary school, high school, college, and post-college age categories rated 25 colors on likeability, and on degree of "boyiness-girliness." Subsequent analysis showed that statistically significant and similar stereotypes about gender-appropriateness of colors existed in all age categories. Statistically significant and similar stereotypes about color likeability existed for all but the preschool participants. Further, there were statistically significant correlations between likeability and "boyiness" of colors for all but the preschool participants. Results were similar for both male and female participants. Apparently, preschoolers have acquired gender stereotypes about colors, but have not yet learned that "boy" colors are to be preferred to "girl" colors.

ROBERT B. COXE, Western Pennsylvania Conservancy, 209 Fourth Avenue, Pittsburgh, PA 15222, **STEVEN L. STEPHENSON,** Dept. of Biology, Fairmont State College, Fairmont, WV 26554, **MARTIN SCHNITTLER,** Dept. of Biology, Fairmont State College, Fairmont, WV 26554, and **GARY W. MILLER,** USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505. Vascular flora of the Fernow Experimental Forest in Tucker County, West Virginia.

The Fernow Experimental Forest was established in 1934 as a field laboratory for research relating to the forest ecosystems of the

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central Appalachians. With a total area of slightly more than 1,900 hectares and encompassing an elevation range of 533 to 1,112 meters, the Fernow Experiment Forest is located in Tucker County, just south of the city of Parsons. As a result of still ongoing floristic studies initiated in 1994, the total number of vascular plants documented as occurring on the Fernow is now known to include 318 species in 205 genera and 78 families. Twenty-seven of the 318 species (representing 8.5% of the total) are not native to North America. Families with the highest numbers of species are the Asteraceae (36 species), Liliaceae (23 species), Rosaceae (16 species), Poaceae (13 species), Cyperaceae (12 species), and Apiaceae (12 species). The genera represented by the most species are *Carex* (8 species), *Viola* (8 species), *Galium* (8 species), *Dichanthelium* (5 species), and *Dryopteris* (5 species). It seems likely that the number of species recorded for the Fernow will increase significantly as additional field surveys are carried out.

RANDY G. DARRAH and ADAM W. ROLLINS, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. The use of digital photography to enhance biological studies.

The use of digital photography allows the biologist greater flexibility in presenting visual data. Image quality is immediately known, allowing adjustments and/or repeat exposures. The use of digital imagery eliminates the waiting time for processing and no scanning is required to utilize the images. The images are immediately ready to be utilized (i.e., for e-mail, PowerPoint, and word-processing documents, etc). The merging of digital and computer software allows for the quick preparation of a report, poster, or web presentation. Hand held and microscope-mounted digital cameras have been used to record image data, including forest types and

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commonly encountered specimens not actually collected. These data have routinely been used to prepare posters and enhance web-based reports, as will be demonstrated in our presentation.

MARK FLOOD, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. Students with low ACT Science Reasoning scores are successful in a freshman biology majors course after taking one semester of non-majors biology.

A major challenge to science departments at colleges and universities is how to mesh students of diverse academic backgrounds into introductory courses. The Biology Department at Fairmont State College (FSC) has chosen to place students on the basis of their ACT Science Reasoning score, since this standardized exam is widely considered to be a better comparison than high school grade point average. Students pursuing a biology degree at FSC must have a minimum ACT Science Reasoning score of 21 or higher as a prerequisite to take the first year biology majors course, Principles of Zoology. Students that score 20 or lower on the Science Reasoning section of the ACT exam must first complete one semester of non-majors course, Principles of Biology, with a C grade or better as a prerequisite to Principles of Zoology. In this way, students with marginal science backgrounds develop a stronger basic science background and have better comprehension of theories taught in Principles of Zoology. To determine if this curriculum approach is successful, the correlation between ACT Science Reasoning scores and Principles of Zoology course grades was examined. If students with low ACT Science Reasoning scores are given a stronger background within the biology curriculum, then the average Principles of Zoology course grades should be similar to those of students with higher ACT Science Reasoning scores. The study period

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was six years long (1994-1999), during which there were a total of five instructors and 259 students who completed Principles of Zoology and had ACT Science Reasoning scores available. The eighty-four students required to take a semester of non-majors biology had an average Principles of Zoology course grade of 2.52 ± 0.95 (4=A, 3=B, 2=C, 1=D, 0=F), which was similar to the average Principles of Zoology course grade for the one hundred seventy-five students who had a high enough ACT Science Reasoning score (2.64 ± 1.18). Based on these data, students with marginal science backgrounds can be successful in freshman biology majors courses such as Principles of Zoology, if the proper biological background is provided to them within the context of the biology curriculum.

GARRY GLASPELL, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554, **W. WANG**, Dept. of Chemistry, Virginia Commonwealth University, Richmond, VA 23284, and **M. S. EL-SHALL**, Dept. of Chemistry, Virginia Commonwealth University, Richmond, VA 23284. Synthesis and characterization of nanoparticles of rare earth metals and oxides.

Recently, there has been growing interest in the synthesis and characterization of nanoparticles. Due to their small size nanoparticles can exhibit novel properties different from the corresponding bulk materials. Some of these properties offer opportunities for new applications particularly in the area of catalysis. Using the Laser Vaporization with Controlled Condensation (LVCC) method, nanoparticles of Ce, Gd, Sm, La, Er, Yb, CeO₂, Gd₂O₃, SmO₂, La₂O₃, Er₂O₃, Yb₂O₃ were synthesized. Powder X-ray diffraction verified that the nanoparticles maintained the bulk crystal structure. Scanning electron micrographs showed highly organized weblike aggregations of the particles with diameters of ~12 nm.

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Transmission electron microscopy was also used to verify the size and shape of the nanoparticles. These nanoparticles are currently being tested for novel electronic, optical, magnetic, photochemical, and catalytic properties.

AMANDA D. KERNS, KRISTAL A. KOLOZY, HEATHER M. ROBERTSON, MARIBETH OVERKING, DAWN R. BLACK, and STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554, and **LALA CHAMBERS,** Dept. of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996. Myxomycetes associated with the litter microhabitat in the Great Smoky Mountains National Park.

Samples of forest floor litter collected at 284 different study sites in the central portion of the Great Smoky Mountains National Park were used to prepare a total of 1070 moist chamber cultures for isolation of myxomycetes (plasmodial slime molds). Samples were assigned to six groups based upon the predominant forest type (coniferous or deciduous) and elevation (<1000 m, 1000 to 1700 m, and >1700 m). More than half (52.3%) of the 1070 cultures yielded plasmodia and/or fruiting bodies of myxomycetes. Samples from coniferous forests were less productive (45.1 to 52.1%) than those from deciduous forests. Collectively, samples collected from sites at elevations <1000 m were the most productive (55.7%), whereas samples from sites at elevations from 1000 to 1700 m were the least productive (48.9%). *Arcyria cinerea*, which appeared in approximately 25% of all cultures, was the single most abundant myxomycete recorded in the entire study. Other more common species included *Clastoderma debaryanum*, *Diderma effusum*, and *Physarum bivalve*. One unexpected result of our study was

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the appearance of several species not usually recorded from moist chamber cultures. Prominent examples are *Arcyria stipata*, *Hemitrichia serpula*, *Lycogala epidendrum*, and *Trichia favoginea*. (Funded in part by a grant from the West Virginia Space Grant Consortium Research Enhancement Awards Program.)

SETH MYERS and DONALD E. TRISEL, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. The effect of highway run-off on the water and soil quality of an artificial wetland.

This study was designed to determine in part the effect roadway run-off has on the water quality of an artificial wetland area. The automobiles which use the roadway leave many substances on the roadway. Contaminants accumulate in water flowing across the roadway and into the wetland. Of special interest are the following metals: lead, mercury, cadmium, and arsenic. These metals are on the EPA's list of top twenty most dangerous pollutants. Soil and water run-off flowing into the artificial wetland from I-79 Exit 123 are being tested to see if these metals are present. Some contaminants are expected to be found but the exact levels are unknown. The research determined the amounts of heavy metals flowing into this wetland and accumulating in the water and soil. High concentrations of heavy metals may warrant further study and efforts to reduce contamination of artificial and natural wetlands.

JAKE OTT, Dept. of Bioscience, Salem-Teikyo University, Salem, WV 26426, **RONALD FORTNEY,** Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506, and **AMANDA SAPPINGTON,** Dept. of Bioscience, Salem-Teikyo University, Salem, WV 26426. Distribution of vegetation cover types and land forms for

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four islands in the upper mid-Ohio River Valley.

Studies of the vegetation on bottomland habitats of the Ohio River Islands have been limited. The purpose of this study is to evaluate the distribution of vegetation types and land forms on four islands in the upper mid-Ohio River Valley. Using full-color aerial photographs (U. S. Fish and Wildlife Service, 1993; 1:6000) and ArcView, we mapped the vegetation by cover types and constructed a cross-sectional profile for each island. The aerial photographs were scanned and georeferenced. Ground truthing included quantitatively sampling all major cover types using 0.1 ha quadrants and establishing cross-sectional elevations across the short axis of the islands. Ground cover was classified according to the U.S. Fish and Wildlife Service wetland classification system. Six cover classes were identified. Bottomland overflow forests occurred along the frequently flooded lower terraces of the nose, foot and lateral perimeters of the islands. Scrub/shrub thickets and old fields occurred in the better-drained middle portions of the islands. This pattern reflects past land use practices and recent trends of limited human activities, e.g., agricultural use and resource extraction. Cross-sectional profiles of the islands showed a consistent pattern for overall land form, with high, steep banks on the navigational channel side, level to concave surfaces across the middle, and moderately steep banks interrupted by one or two narrow terraces on the back channel side.

GENNAFER L. PATRICK and JOHN H. HULL, Dept. of Psychology, Bethany College, Bethany, WV 26032. A half-century of Dr. Seuss: Does The Cat in the Hat ever wear a bonnet?

Over the last several decades, new children's books generally have included more female and minority-group characters, and have portrayed

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male and female characters in less gender-stereotyped roles. A 1994 WVAS presentation, for example, noted such changes in the "Berenstain Bears" books published during the prior 30 years. One of the most popular series of children's books was authored between 1937 and 1990 by "Dr. Seuss" (Theodor Seuss Geisel), and includes 44 books. We read all the Dr. Seuss books, counting the number of appearances per book by female characters, male characters, and characters identifiably White, or members of racial and ethnic minority groups. We also recorded all occupations portrayed, and the genders of characters in those occupations. Across the 44 books, 88% of gender-identifiable characters were male (86% White, 2% nonwhite), and 12% were female (12% White, 0% nonwhite). Overall, there were statistically significantly more male characters than female characters. Further, correlations of year of book copyright with percent male characters and percent White characters were not statistically significant (-0.03 and -0.04, respectively), indicating no trends toward including more female or more nonwhite characters across the years the Dr. Seuss books came out. Finally, most females and males were portrayed in occupations stereotypic to their gender, with no significant change in gender-specificity of occupations across years of publication. These results have important implications for those concerned about what is portrayed as "normal" or "desirable" in the books their children are exposed to.

CHANDA RANJIT, JENNIFER ROBERTSON, and ROBERT SWEENEY, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554. Quantitative analysis of phenolic irritant found in poison ivy plants through the absorbance of phenolphthalein using uv-vis.

Urushiols, a family of penta- and hetadec(en)yl phenolic compounds, are present in the oils

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secreted by several plants of the *Rhus* genus, namely poison oak and poison ivy. The oils are secreted on the surface of the plant's leaves and are easily transferred to clothing and skin when the leaves are touched. The urushiol binds to the skin cell surface and triggers a series of allergic responses which ultimately result in an itchy rash. In this experiment, an efficient chemical procedure was developed which created a highly colored compound similar to phenolphthalein from the phenolic irritant found in poison ivy. The standards for the analysis of the phenolphthalein like compound were made using catechol. The quantitative analysis of the phenolic irritant found in the poison ivy samples was also performed using ultraviolet-visible spectroscopy. The percent composition of phenolic irritant in poison ivy was found to be 0.34%.

SHAWNA SCARFF and DONALD E. TRISEL, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. A survey of the benthic and littoral organisms of East Run prior to long-term environmental disturbances.

This study marks the initiation of a long-term study of the benthic and littoral organisms of East Run (a tributary of Buffalo Creek in Marion County). In the watershed of East Run (N39°29'56", W80°18'9"), a land owner is planning to open a strip mine to extract several seams of coal, change the grade of the landscape, and then build a golf course. This situation presents a unique opportunity to monitor the long-term effects of mining, golf course construction, and golf course maintenance on the aquatic biological diversity of East Run. We are currently using Hester-Dendy multiple plate samplers, Surber samplers, plankton nets, and aquatic kick nets as we survey and document the biological diversity. Our main sampling site

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is located approximately 500 m downstream from the future coal mine location (N39°30'16", W80°17'35").

BABS STEORTS and DONALD E. TRISEL, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. The water quality of East Run prior to long-term environmental disturbances.

This study marks the initiation of a long-term study of the water quality of East Run (a tributary of Buffalo Creek in Marion County). In the watershed of East Run (N39°29'56", W80°18'9"), a land owner is planning to open a strip mine to extract several seams of coal, change the grade of the landscape, and then build a golf course. This situation presents a unique opportunity to monitor the long-term effects of mining, golf course construction, and golf course maintenance on the water quality of East Run. We are currently monitoring the surface water parameters at five different sites, monthly rainfall, and daily air and water temperature. The first site is located upstream from the future mine operation, the second is immediately downstream from the mine, the third is located further downstream at the site of the biotic surveys, and the fourth and fifth sites are in Buffalo Creek above and below the junction with East Run. The water parameters being monitored include: flow, temperature, pH, ORP, turbidity, conductance, and dissolved oxygen.

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554 and **CAROLYN J. MCQUATTIE**, USDA Forest Service, 359 Main Road, Delaware, OH 43015. Assessing the potential use of myxomycetes as biomonitors of heavy metals in the environment.

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In their natural habitats, the plasmodia of myxomycetes obtain nutrients by ingesting solid food particles, primarily bacteria but also including fungal hyphae, fungal spores, and other bits of organic matter. Recently, a number of studies have reported that plasmodia have the capacity to bioaccumulate large quantities of heavy metals (e.g., Zn, Cu, Ni, Cr, Pb, Cd, Co, Fe, and Mn) from their immediate environment. Since myxomycetes are both widely distributed and highly resilient to the metals they bioaccumulate, these organisms would seem to have considerable potential for use as biomonitors of heavy metal contamination in terrestrial ecosystems. In the present study, specimens of myxomycetes collected in West Virginia, the Mountain Lake region of southwestern Virginia, and the Great Smoky Mountains National Park were analyzed to determine the levels of various metals present. Sample material was treated by nitric acid-perchloric acid digestion, modified slightly from the standard method in that a smaller sample weight and reduced acid amounts were utilized. Analysis of lead was carried out on a varian 220 zeeman graphite furnace atomic adsorption spectrophotometer in order to achieve low detection levels. All other trace metals were analyzed on a thermo jarell ash inductively coupled plasma spectrometer (ICP). Some samples also were prepared for transmission electron microscopy and energy-dispersive X-ray microanalysis to determine the specific location of heavy metals in myxomycete fruiting bodies. Levels of metals present in the specimens of myxomycetes examined in this study displayed considerable variation. Greater amounts of heavy metals were detected in the stalk region than in any other portion of the fruiting body. Metals (Fe, Cr, Si, Al) were found primarily as electron-dense precipitates within the stalk. Bacteria, often containing polyphosphate granules (P, Ca), were found in stalks but not elsewhere. Based upon data obtained thus far, myxomycetes show

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considerable differences in metal content, with members of the Physarales generally displaying the very highest levels. (Funded in part by a grant from the West Virginia Space Grant Consortium Research Enhancement Awards Program.)

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A comprehensive inventory of all life forms in the Great Smoky Mountains National Park in the southeastern United States is currently underway. This research effort, which has been termed an All Taxa Biodiversity Inventory (ATBI), will involve hundreds of scientists and many other individuals as active participants. One of the TWIGs (Taxonomic Working Groups) involved in the ATBI is attempting to document all of the species of mycetozoans in the park. Prior to the ATBI, 88 species of myxomycetes and 12 species of dictyostelids had been reported in the literature as occurring in the Great Smoky Mountains National Park. Field and laboratory studies carried out as a result of visits made in September of 1998 and April, July, September, and October of 1999 have yielded at least 40 additional species of myxomycetes and two species of dictyostelids not previously known from the Park. We are not aware of any previous records of protostelids from the Park, but 11 species were

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recovered from samples collected in September of 1999. In summary, at least 155 species of slime molds (myxomycetes, dictyostelids, and protostelids) are now known from the Great Smoky Mountains National Park. Fifty-six of these (representing 36% of the total) have been added to the mycoflora of the Park as a result of the sampling effort carried out during the present project. Because the park is a vast area (more than half a million acres) of rather diverse ecology, it seems likely that future collecting will yield many more records. (Supported in part by grants from Discover Life in America and the West Virginia Space Grant Consortium Research Enhancement Awards Program.)

measurements also reflected little statistical difference between growth habits.

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architecture as it affects nutrient uptake in
peach trees.

Architecture of tree roots was assessed to determine possible correlation with nutrient uptake. It was assumed that a greater frequency of root branching would lead to a higher concentration of nutrients within the leaves. If a more efficient root structure can be found less fertilizer could be commercially necessary thus reducing artificial nutrient load in the environment. The roots of four growth habits of peach trees (compact, dwarf, pillar, and standard) were investigated. Whole root systems were evaluated and quantified using A.H. Fitter, et al. Trees grown in a green house setting were fertilized late in the growing season and harvested after six weeks of treatment. Roots were assessed for root growth patterns and leaves were analyzed for nitrogen and phosphate concentration. The longest observed root length occurred in compact trees with a length of 185 cm standard growth habit had 100 more root links than compact. Statistical analysis indicates no correlation between nutrient uptake and growth habits. The nutrient