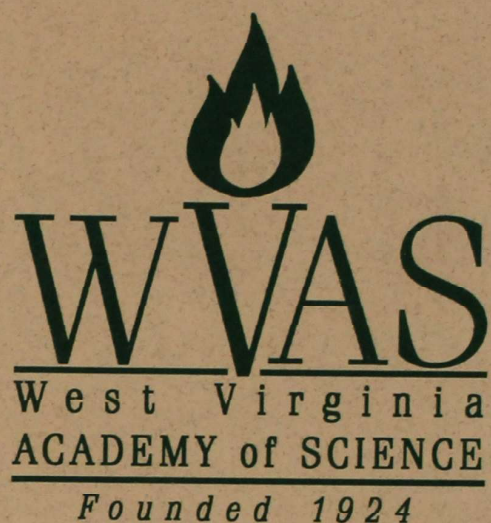


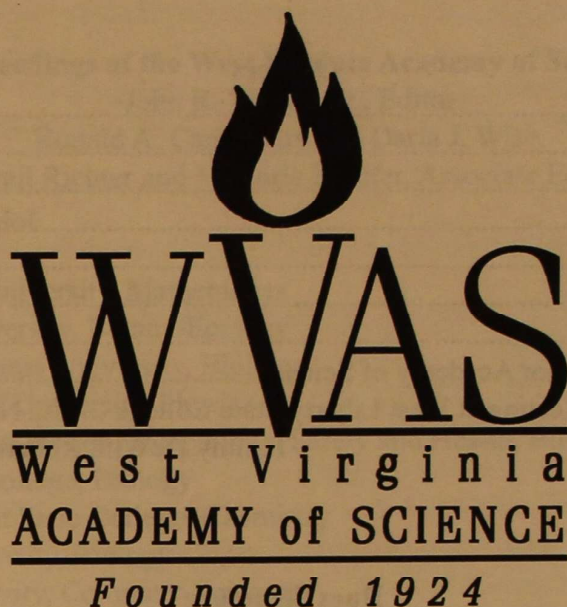
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Of the
West Virginia
Academy of Science**

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**Abstracts presented at the
Seventy-Sixth
Annual Session**



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1:00 P.M. – 4:00 P.M.

BIOLOGY

JOHN C. LANDOLT, Dept. of Biology, Shepherd College, Shepherdstown, WV 25443, **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont WV 26554, and **JAMES C. CAVENDER**, Dept. of Environmental and Plant Biology, Ohio University, Athens, OH 45701. **Cellular slime molds from diverse habitats of central Mexico.**

Samples of soil and litter were taken from several different habitats in central Mexico in the states of Tlaxcala and Veracruz. These sites ranged from a relatively high elevation fir forest on the slope of a volcano to a lowland tropical rain forest. Samples were processed to determine the occurrence and distribution of dictyostelid cellular slime molds. A total of 14 different identified species together with several as yet unidentified forms were recovered. Most identified species are either cosmopolitan forms or those with known tropical affinities. In addition, a few species isolated from the fir forest and from a "cloud" forest site are species more often found in temperate hardwood forests of North America. One species recovered has not previously been found in the New World. This study was supported in part by a grant from the National Science Foundation.

JAMES RENTCH and **RAY R. HICKS, Jr.**, Division of Forestry, West Virginia University, Morgantown, WV 26506-6125. **Standwide disturbance intervals of oak-dominated old-growth forests in the Central Hardwood Forest region.**

Oak (*Quercus* spp.) dominated forests have comprised the major cover type on all but the

most mesic sites in the Central Hardwood Forest region, from the presettlement (ca. 1780-1800) era to the present. However, current observations have noted declines in oak regeneration under oak canopies, and increasing dominance of more mesic tree species such as maples (*Acer* spp.) and beech (*Fagus grandifolia*). A variety of causes have been proposed to account for this decline: a change in the fire regime and other anthropogenic factors, increased herbivory, and climatic changes that result in lower rates of windthrow and gap creation. This study examined the frequency of canopy disturbances for eight old-growth forests from North Carolina to Ohio in order to determine if changes have occurred in return intervals between major, multi-tree disturbance events. Overstory strata of these forests are dominated by oak species (principally *Quercus alba*). Composition of the understory strata of the NC and KY sites is unknown. Of the remaining sites, all have understory and ground-layer strata consisting of mostly shade-tolerant, non-oak species. Individual-tree disturbance/release events were determined by decadal radial growth averaging of tree-ring series. The minimum threshold was defined as a percent growth change of 25%. Identification of major disturbance events, and the time interval between these events were determined graphically. Comparisons of disturbance intervals for three historical periods (1640-1800, 1801-1900, and 1901-1990) were made using FHX2[®] software that uses a Weibull distribution as a measure of central tendency. Data from four sites in WV, PA, and OH were pooled in order to increase sample size (minimum = 17 trees). The Weibull median interval between major, multi-tree disturbance events over all eight forests was 20.4 yr. (± 3.3 yr.). High values for presettlement-era intervals for Horner's Woods and Watter Smith State Park (WV) are primarily the result of small sample size. Inspection of trends did show an increase in disturbance interval for four forests in WV, PA, and OH when the periods 1801-1900 and 1901-1990

were compared, suggesting that the rate of canopy disturbance and gap formation has declined. However, analysis of variance showed no significant differences between historical periods or between stands. These results suggest that changes in species composition and dominance in these old-growth forests cannot be primarily attributed to alternations in their historic canopy disturbance regimes. That is, the rate of gap formation (by windthrow, pest-related defoliation, drought-induced mortality, or ice damage), critical for regeneration, crown-class advancement, and eventual canopy accession, has remained relatively constant over time. Thus, other factors, an altered fire regime, other human influences, and/or herbivory, for example, may be responsible.

JAMES RENTCH and RAY HICKS, Jr.
Division of Forestry, West Virginia University,
Morgantown, WV 26506-6125. **Comparison of
early growth rates and canopy accession
trends in an old-growth, oak-dominated
forest in Ritchie County, West Virginia.**

Oak (*Quercus* spp.) dominated forests comprise the major cover type on all but the most mesic sites in the Central Hardwood Forest region. These forests largely generated after the wholesale harvesting during the late 19th and early 20th centuries. For the past 50 years, observers have noted the failure of oak regeneration in second growth and old-growth forests, and the replacement of oaks by more mesic, shade-tolerant species such as maples (*Acer* spp.) and beech (*Fagus grandiflora*). This study examined early growth rates of five species of oaks in two 0.45 ha plots in an old growth forest in Ritchie County, WV, in order to determine the conditions under which trees reached upper canopy position. Growth chronologies and major canopy disturbance events that resulted in crown class advancement for 62 dominant and codominant canopy oaks were determined by radial growth

averaging of annual ring-widths. Four growth patterns were observed: 1) stems that originated in canopy gaps with above-average initial growth that underwent no noticeable release event; 2) stems that originated in canopy gaps with above-average annual growth, underwent temporary suppression, and eventual release; 3) stems that originated in the understory with below-average initial growth, and were then released either as sapling or pole-sized stems; and 4) stems that showed persistently low growth rates, no major releases, and whose origins were unclear. Red oaks (*Quercus rubra*, *Q. coccinea*, and *Q. velutina*, n=20) were more likely to have originated in canopy gaps in a free-to-growth position, while white oaks (*Q. alba* and *Q. prinus*, n=42) more often had origins as smaller stems in the shaded understory before undergoing release from above. For those stems that originated in the understory, mean understory residence times for white and red oaks were 73 yr. (± 52.1) and 46 yr. (± 28.9) respectively. White oaks that originated in gaps but underwent a period of suppression before eventual release averaged 77 yr. (± 22.0) to reach upper canopy position. Average dbh (inside bark) at final release was 9.8 cm for white oaks, and 8.2 cm for red oaks. These results are consistent with these species' shade tolerance and growth forms. However, current silvicultural management guidelines suggest that the failure of oak regeneration is at least partly the result of the abundance of low shade imposed by maple, beech, and black cherry understory strata, and a fire regime that is favorable to these latter species. These results suggest that presettlement era oak species, particularly white oak, were able to tolerate long periods of suppression before eventual release and canopy accession.

THOMAS P. BASSISTA, West Virginia Division
of Natural Resources, Wildlife Resource

Section, Natural Heritage Program, Elkins, WV 26241. **Evaluating the usefulness of an aquatic community classification system for West Virginia streams and rivers.**

In response to aquatic habitat degradation, rare and threatened aquatic species, and the high freshwater diversity found in the Cumberland Southern Ridge and Valley (CSRV) ecoregion portion of the Southeastern US, an aquatic ecoregion team was formed to help guide aquatic conservation issues. As part of The Nature Conservancy's (TNC) CSRV ecoregion plan an Aquatic Community Classification System was developed for stream and river systems within the coalfield region of West Virginia. This effort involves grouping stream and river segments based on physical features such as geology, size, gradient and elevation, using GIS technologies. The WVDNR's Natural Heritage Program investigated the usefulness of this classification of riverine systems within the Elk River drainage. Five stream/river types or macrohabitat's were identified from the Aquatic Community Classification System. Macrohabitat groups were assessed using fish community data to determine the effectiveness of this classification system. Small limestone coldwater stream systems and the mainstem of the Elk River below Sutton Reservoir both differed distinctly from the other three macrohabitats based on physical features and fish community structure. The remaining three macrohabitats, though distinct physically, tended to share similar fish communities with one another. Also, headwater streams (1st through 3rd order) of these three macrohabitats had fish community differences from larger (> 3rd order) down stream segments within the same macrohabitat classification. It was concluded that a finer classification scheme is needed for moderate size, non-limestone stream and river systems within the Elk River drainage. The Aquatic Community Classification System did provide valuable

insight into stream classification for WV and future projects will implement finer resolution.

VICTOR FET, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, **BENJAMIN GANTENBEIN**, Institute of Zoology, Division of Population Biology, University of Berne, CH-3012 Berne, Switzerland, and **MARK D. BARKER**, Dept of Biological Sciences, Marshall University, Huntington, WV 25755. **Mitochondrial DNA reveals a deep, divergent phylogeny in *Centruroides exilicauda* (Wood, 1863) (Scorpiones: Buthidae).**

Scorpions of the genus *Centruroides* (Scorpiones: Buthidae), especially many central Mexican species, are among the most toxic in the world to humans and other mammals. They are abundant in various natural habitats ranging from tropical forest to temperate deserts. The only medically important scorpion species in the United States, where it is mainly found in Arizona, is *Centruroides exilicauda* (Wood, 1863) (= *C. sculpturatus* Ewing). A molecular (16S rRNA mtDNA sequence) data set recovers a clear divergent phylogeny within *C. exilicauda* from Mexico and the USA. Three deep monophyletic clades are revealed: two distinct peninsular clades, southern Baja (SB) and northern Baja (NB), and a mainland clade, Sonora/Arizona (SO/AZ). Our mtDNA data indicate that there might be in fact more than one species currently united under *C. exilicauda*. Phylogenetic, taxonomic, and biogeographic implications are discussed.

VICTOR FET, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, **VLADIMIR I. OVTSHARENKO**, Division of Invertebrate Zoology, American Museum of Natural History, New York, NY 10024, and **W. IAN TOWLER**, Dept of Biological Sciences, Marshall University, Huntington, WV 25755. **Sequence analysis of 16S and 28S rRNA genes**

as a tool for resolving phylogeny of ground spiders (Araneae: Gnaphosidae).

We present the first data toward the phylogenetic DNA analysis of ground spiders (Araneae: Gnaphosidae). Fragments of mitochondrial 16S rRNA and nuclear 28S rRNA genes were amplified by PCR from five gnaphosid genera from North America, Europe, Asia and Australia (*Drassodes*, *Gnaphosa*, *Callilepis*, *Hemicloea* and *Parasyrisca*), and two outgroup spider taxa, *Clubiona* (Clubionidae) and *Tibellus* (Philodromidae). DNA sequence comparison analysis shows high-level divergence at family/subfamily level. For the variable domain of mitochondrial 16S rRNA (253 bp), genetic distance of 16 to 17% was found between gnaphosid genera *Drassodes* and *Gnaphosa*. For a more variable domain of nuclear 28S rRNA (369 bp), genetic distance of 16 to 19% was found between gnaphosid genera *Gnaphosa*, *Callilepis* and *Hemicloea*, while genus *Drassodes* formed an outgroup, 22 to 29% distant from these three genera. Addition of further 28S sequence (to total of 720 bp) did not increase genetic distance. Phylogenetic trees (Neighbor-Joining and Maximum Parsimony analyses) of four Gnaphosidae taxa followed expected topology. However, the genus *Parasyrisca* grouped outside of all Gnaphosidae with a genetic distance 29 to 37% (28S data).

FELICIA M. MORTON, Shepherd College and The Freshwater Institute, Shepherdstown, WV 25443, **CLIFFORD E. STARLIPER**, USGS National Fish Health Research Laboratory, Kearneysville, WV 25430, and **JULIE BEBAK-WILLIAMS**, The Freshwater Institute, Shepherdstown, WV 25443.

Furunculosis epidemics in arctic char: effects of density and culling.

Aeromonas salmonicida, a virulent bacterium, is the causal agent of furunculosis in salmonid fishes. An avoidance and management strategy

to reduce the severity of disease includes the daily removal of dead fish that have succumbed to the disease. Moribund fish, those individuals near death, are the most weakened and are carrying the heaviest load of viable bacteria. Moribund fish shed viable bacterial cells, as do dead fish, from mucus and feces into the water column which serves to re-infect the population; however, it is not routine practice to cull moribund fish prior to their death. It is reasonable to speculate that removing moribund individuals will have the benefit to the population that is afforded by picking of mortality. This study was done to evaluate the effects of loading density and culling of moribund fish on the severity of infection and mortality in the population. Arctic char (*Salvelinus alpinus*), a salmonid that is highly susceptible to *A. salmonicida*, were used in all studies. Initial challenges were done with three strains of *A. salmonicida* to determine LD₅₀ values following IP challenges; one, having the lowest LD₅₀ (2.4 cfu/fish) was selected for use in subsequent challenges. Tanks were loaded with pathogen-free char to initial loading densities of 25, 40 or 55 kg/m³ (optimum=52.1 kg/m³). Exceeding the optimum can lead to stressors to fish such as reduced dissolved oxygen, increased nitrogen-ammonia, and increased suspended solids. This density-related stress can leave fish far more susceptible to diseases should pathogens be encountered. Within each density, there was a group of fish with moribund culling and one not culled, which served as the control. All groups of fish were infected by cohabitation with ten fish (per group) that were injected IP with 8.0×10^3 cfu per fish. We previously determined that this challenge source (to the pathogen-free fish) would serve to infect, but not cause too high mortality. The results indicate that density and lack of moribund culling can affect the health of a population of fish.

CLIFFORD E. STARLIPER, USGS National Fish Health Research Laboratory, Kearneysville,

WV 25430. A synopsis of major bacterial pathogens and diseases of hatchery-reared trout.

Intensive culture of various species of trout encompasses a substantial effort within the United States. The U.S. Fish and Wildlife Service has an extensive national fish hatchery program with over 70 hatcheries; nearly all states, within the geographic range for rearing trout, have trout rearing facilities. Along with this hatchery program are the investments of administration and fish health maintenance to support the program. Many of the states also have extensive fish hatchery programs, primarily for stocking streams. West Virginia, for example, has eight state hatcheries and one federal hatchery. Private growers rear trout, primarily for human consumption as a table-dressed product or fish to be placed in ponds for customers to catch by hook and line. Health and disease concerns and losses of fish to mortality are major issue in intensively cultured trout. Intensive culture techniques can result in direct and indirect stressors to fish that predispose them to diseases. A variety of bacteria are pathogenic to trout. Diseases that are a major cause of mortality include: furunculosis, caused by *Aeromonas salmonicida*; kidney disease, caused by *Renibacterium salmoninarum*; coldwater disease, caused by *Flavobacterium psychrophilum*; gill disease, caused by *F. branchiophilum* and enteric redmouth disease, caused by *Yersinia ruckeri*. Some generalities on bacterial pathogens can be made: (1) most are horizontally transmitted, *R. salmoninarum* is also vertically transmitted and *F. psychrophilum* is suspected to be, (2) most produce systemic infections, (3) fish that survive an epizootic may continue to harbor the pathogen, (4) fish develop immunity that may aid in future challenges, and (5) diseases can often be effectively treated, however, avoidance is the best control. This presentation comprises two parts. First, optimum fish rearing parameters (e.g. density, water quality) will be compared

with sub-par conditions to identify stressors to fish that are frequently noted as contributors to disease. Second, some of the major diseases will be examined individually and will include for each: clinical signs of disease, etiology and biochemical characterization, diagnosis, treatment and control.

BOTANY/BIOCHEMISTRY

DANK. EVANS, Herbarium, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755, and **AMY C. KOKESH**, Dept. of Biology, West Virginia State College, Institute, West Virginia, 25112. **Riparian assessment and flora of the Kanawha River, West Virginia.**

A survey of vascular plants and assessment of riparian habitats of the Kanawha River were accomplished during 1999 and 2000. Sixty riparian sites in River Miles 0.0 (Point Pleasant, WV) to 90.6 (Alloy, West Virginia) were selected for study. A total of 702 vascular species comprising 117 families were recorded. Of these, 308 (44 percent) were wetland taxa, 550 (78 percent) were native taxa, and 16 species (2 percent) were considered sensitive elements in the West Virginia flora. Four species were recorded in the survey that are listed as noxious elements in the United States.

ROGER G. SEEGER, Jr. and **ROBERT KREISBERG**, Division of Biology, West Liberty State College, West Liberty, WV 26074. **Update on the development of a tomato (*Lycopersicon esculentum*) seed gene bank.**

The ongoing development of this project is an effort to accumulate a stock of local of regional tomato seeds for the West Liberty State College seed bank. A review of the seed saving literature indicates there is a large loss of variation in all crop areas in this century. The decline of seed

saving and the growth of big seed companies has greatly reduced the availability of many types of seeds. Additionally, the general trend of turning to the limited selections in the major catalogs instead of saving ones own seeds has meant the loss of significant local and regionally bred varieties. With the aging of the traditional seed savers, we will encounter a major loss of genetic variation.

The West Liberty State College Tomato Genetics Project is dedicated to the preservation of tomato seeds both in general and more specifically to save "locally" bred or grown tomatoes. The collection, begun in the fall of 1998, now contains over 820 samples. Approximately a quarter of these being donated by individuals from all over West Virginia and neighboring states. A major portion of the increase over last year's level is the production of the second generation seeds from the West Liberty tomato garden. It is suggested that seeds be replaced in dry storage every five years, thus allowing for the perpetuation of these endangered varieties.

RYAN MANCUSO, AMY LEECH, JIM TAYLOR, ROGER SEEGER, 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 (restriction-ligation enzymes Eco-R1 and Mse-1). 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 (*Eco*-RI -ACC and *Mse*-I -CTC). The amplified DNA fragments have been resolved by gel electrophoresis on an ABI Prism Automated DNA Sequencer (Perkin Elmer). Amplified DNA binding patterns from the phenotypically defined tomato varieties have been compared for polymorphisms that allow genetic characterization. The WLSC/NASA Consortium funds this project.

JAMES TAYLOR, DIANA WHALEY, and ROBERT KREISBERG, Division of Biology, West Liberty State College, West Liberty, WV 26074. **Electrophoresis of Shed Squamate Skin DNA as a Means of Identification.**

Currently, the only way to identify if a squamate species is present is to visually see the animal. This can often take extensive searching with no results. Often shed skins are found, but the specimen from which it came cannot be identified by the physical characteristics of the skin. The goal of this project is to determine the species by the restriction digestion pattern of the DNA isolated from shed skin with a uniform protocol. Using techniques of DNA extraction, DNA can be isolated from the sample. We have currently developed a protocol for isolation of DNA from shed snake skin.

JEREMY CHAMBERS, Dept. of Biology, West Liberty State College, West Liberty, WV 26074. **Optimizing acceleration of microbial activity in West Virginian landfills: Part I: Water to air ratios.**

The purpose of this study is to optimize the acceleration of microbial biodegradation by adding air and water. The optimization will be achieved by altering the air to water ratios; this will be done by using differential equations and testing varying ratios. The study will be done in a laboratory micro-landfill. To aid the optimization, characterization of microbes, composition of the soil, and soil characteristics must also be examined. The work of Dr. Terry C. Hazen demonstrates that the addition of water and air accelerates biodegradation. There is a definite optimal water to air ratio for West Virginian landfills.

BRIAN L. CRAWFORD, Dept. of Social and Behavioral Sciences, West Liberty State College, West Liberty, WV 26074. **Woody invasion on the surface-mined grasslands of Pike County, Indiana.**

In Pike County, Indiana, thousands of hectares of land were planted with non-native grasses following surface mining between 1968 and 1981. The artificial grasslands thus produced have some of the superficial appearance and functional characteristics of natural grasslands and provide habitat for numerous fauna. While normal vegetation succession in this region leads to forest communities, the severity of disturbance generated by surface mining makes the outcome of succession less certain for these sites. This research investigated the amount and nature of woody species invasion on the surface-mined grasslands and attempted to correlate variations in these measurements to reclamation processes and environmental factors.

A Geographic Information System was constructed using data provided by the Indiana Department of Natural Resources and used in conjunction with aerial photographs to classify surface-mined grassland sites in Pike County based upon age, size and glaciation history. Mined areas where vegetation succession has not been artificially controlled were identified

and randomly selected quadrats on these lands were sampled. The data collected in the field included soil pH and compaction, topographic characteristics and woody species measurements. Additional data were gathered from the public records of government agencies, mine records and interviews with landowners.

Statistical analyses indicate that, while there is a great deal of variability in both the amount and type of woody invasion, vegetation succession is occurring on these lands. It is apparent that, if left undisturbed, they will eventually become forested. No significant difference in terms of percent woody cover was detected between mines reclaimed under pre-Surface Mine Control and Reclamation Act (SMCRA) rules and those reclaimed after that federal law's passage in 1977, and no single environmental variable was identified as having significant impact on the succession process. A greater diversity of woody species was, however, found on the post-SMCRA mines, indicating the impact of using reserved topsoil in surface-mine reclamation.

ECOLOGY I

DAWN BLACK, MARTIN SCHNITTLER, and **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; **DENNIS A. BURNS**, Dept. of Bioscience, Salem International University, Salem, WV 26426; **ROBERT B. COXE**, Western Pennsylvania Conservancy, Pittsburgh, PA 15222; and **GARY W. MILLER**, USDA Forest Service, Morgantown, WV 26505. **The herbaceous vegetation of forest communities on the Fernow Experimental Forest in Tucker County, West Virginia.**

During June of 2000, quantitative data on the composition and structure of herbaceous vegetation were collected from 60 study plots representing examples of relatively undisturbed forest communities on the Fernow Experimental Forest in Tucker County, West Virginia. These data were obtained during the course of an intensive resampling of all strata of vegetation for a series of permanent 0.1 ha study plots established in 1994. Percent cover of herbaceous plants was determined in ten 1 by 1 m quadrats spaced at 5 m intervals along the center line of each 0.1 ha study plot. Cover values were estimated with a cover class rating scale. In addition, a complete tally was made of all vascular plants occurring in the entire 0.1 ha study plot. Both total herb cover and species richness displayed considerable variation among the 60 study plots, with forest communities on xeric sites usually characterized by much lower values than those on mesic sites.

Representatives of 43 families of vascular plants were recorded as herbaceous plants, with the Liliaceae (12 genera and 17 species), Asteraceae (8 and 14), Ranunculaceae (8 and 10), Rosaceae (5 and 7), and Apiaceae (4 and 7) the most diverse families. The largest genera were *Carex* (12 species), *Viola* (7), *Dryopteris* (5), and *Galium* (5). (Funded by the USDA Forest Service.)

DAWN BLACK and **MARIBETH OVERKING**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **DENNIS A. BURNS**, Dept. of Bioscience, Salem International University, Salem, WV 26426; **RONALD H. FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506; **WILLIAM N. GRAFTON**, Division of Forestry, West Virginia University, Morgantown, WV 26506; **ROBERT B. COXE**, Western Pennsylvania Conservancy, Pittsburgh, PA 15222; **MARTIN SCHNITTLER** and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV

26554; and **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422. **The vascular flora of West Virginia roadsides.**

During the 2000 field season, we carried out a survey of the assemblages of vascular plants occurring along highway corridors and roadsides throughout West Virginia. For four-lane and interstate highways, data were obtained from a series of 284 randomly selected 20 m wide transects, whereas species associated with populations of members of a "target" group of invasive plants (e.g., *Carduus acanthoides*, *Dipsacus laciniatus*, and *Phragmites australis*) were tallied at 438 infestation study sites located at various points along the entire US and state highway system within West Virginia. County roads were generally excluded from study. Three hundred and fifty species in 75 families have been identified to date. Members of the Asteraceae and Poaceae are especially prominent. A large proportion of the plants characteristically found in roadside habitats, particularly in more open areas, are not native to the state. These plants, some of which are quite aggressive, are able to exploit roadside habitats more successfully than native species. Shaded roadside habitats, which occur more commonly in mountainous areas of the state and less commonly elsewhere, are generally characterized by a higher proportion of native species. Particularly along more recently constructed highways, species planted for sediment/erosion controls (e.g., *Festuca arundinacea* and *Sericea lespedeza*) are often the most prominent components of roadside vegetation. (Funded by the West Virginia Division of Highways.)

MARIBETH OVERKING and **DAWN BLACK**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **SARAH MARR**, Dept. of Botany, University of Otago, Dunedin, New Zealand; **PETER JOHNSTON**, Landcare

Research, Auckland, New Zealand; and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. **Myxomycetes associated with snowbanks in alpine habitats of New Zealand.**

A distinctive ecological group of myxomycetes (plasmodial slime molds) is associated the melting snowbanks that occur during late spring and early summer in alpine regions of the temperate zone. The species that occupy this rather special and very limited microhabitat are usually referred to as "snowbank" myxomycetes, since they produce fruiting bodies only during the relatively brief period of time when the special microenvironmental conditions associated with melting snowbanks and apparently required for their growth and fruiting exist. Most species in such genera as *Lamproderma* and *Lepidoderma* apparently occur only in snowbank microhabitats. During the period of mid-November to mid-December of 2000, visits were made to a number of localities in the mountains of New Zealand where snowbank myxomycetes might be expected to occur. Eight different localities, all located between 42° and 45° S latitude in the Southern Alps on South Island, yielded a total of more than 150 collections. This is the largest series of collections of snowbank myxomycetes known for any region in the entire southern hemisphere. Because the treeline in New Zealand mountains is relatively low and usually does not extend into the alpine habitats where snowbanks occur, the species of snowbank myxomycetes typically associated with coarse woody debris were not represented among the specimens we collected. (Supported by a grant from the National Science Foundation.)

ROBERT B. COXE, Western Pennsylvania Conservancy, Pittsburgh, PA 15222; **DAWN BLACK**, **MARIBETH OVERKING**, **STEVEN L. STEPHENSON** and **MARTIN**

SCHNITTLE, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **DENNIS A. BURNS**, Dept. of Bioscience, Salem International University, Salem, WV 26426; **RONALD H. FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506; **WILLIAM N. GRAFTON**, Division of Forestry, West Virginia University, Morgantown, WV 26506; **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422; and **GARY W. MILLER**, USDA Forest Service, Morgantown, WV 26505. **A floristic comparison of roadsides and forests in West Virginia.**

During the summer of 2000, the assemblages of plants found along West Virginia roadsides were studied as part of an effort to determine the distribution and extent of populations of exotic invasive species. For the past six years, as one component of an ongoing study of forest communities on the USDA Fernow Experimental Forest in Tucker County, a checklist of all the plants present has been compiled. These two data sets were compared to assess the compositional and floristic differences that exist between a highly disturbed habitat (roadsides) and a relatively little disturbed habitat (forests). The total number and percentage of exotic plant species also were determined for each data set. The total number of families represented in each of the two habitats was rather comparable, with 75 families recorded from roadsides and 79 families recorded for the Fernow. The two predominant families along roadsides were the Asteraceae (76 species) and the Poaceae (40 species), whereas the Asteraceae (40 species) and the Liliaceae (23 species) were predominant on the Fernow. Along roadsides, the two genera represented by the greatest number of species were Aster (12 species) and Eupatorium (11 species). On the Fernow, the two largest genera were Carex (16 species) and Viola (11 species).

As might be expected, the percentage contribution of exotic plant species to the total flora was much higher for roadsides than for the Fernow. (Funded by the West Virginia Division of Highways and the USDA Forest Service.)

MARIBETH OVERKING and **DAWN BLACK**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **DENNIS A. BURNS**, Dept. of Bioscience, Salem International University, Salem, WV 26426; **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 **RONALD H. FORTNEY**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506. **Plant communities of West Virginia roadsides.**

During the 2000 field season, quantitative data on the structure and composition of roadside vegetation were obtained from 284 randomly selected study sites located along interstate and four-lane highways throughout West Virginia. At each site, data were collected from a 20 m wide transect that extended from the edge of the clear zone of the highway to the outer construction limit of roadside vegetation. Physical parameters measured or determined for each site included slope aspect, percent slope, and soil conditions. The plant communities of roadsides occur on three basic topographic situations: on grade (no major reconfiguration of the landscape), cut slopes (removal of soil and bedrock to allow construction of the highway), and fill slopes (addition of soil and rock to permit highway construction). Except for areas of very recent highway construction, most roadsides have a fairly complete cover of vegetation that usually consists of assemblages of naturally native and non-native invasive species. The non-native plant components include species planted for sediment/erosion

control and species naturally immigrating to roadside environments from off-site locations. Generally, the species making up roadside communities are characteristic of other types of disturbed habitats and/or species introduced for roadside soil stabilization. Furthermore, species diversity generally increases with highway age. (Funded by the West Virginia Division of Highways.)

RONALD H. FORTNEY, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506; **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **JAMES ANDERSON** and **WILLIAM N. GRAFTON**, Division of Forestry, West Virginia University, Morgantown, WV 26506; and **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422. **Assessment of West Virginia highways as habitats for invasive species.**

Broad concern over the ecological and financial impacts of invasive species in the United States led President Clinton to sign Executive Order #13112 on February 2, 1999. The order directs Federal agencies to expand and coordinate their efforts to combat the introduction and spread of plants and animals not native to the United States. As a result of this order, the Federal Highway Administration prepared a Guidance Memorandum to encourage state highway agencies to incorporate elements of the order and related regulation into their planning, construction, erosion control, landscaping, and maintenance practices. In response to this guidance, the West Virginia Division of Highways (WVDOH) contracted with the West Virginia University (WVU) Department of Civil and Environmental Engineering to assess highways in West Virginia as habitats for invasive species. Collaborating with Engineering were faculty from the WVU Division of Forestry, Fairmont State College,

and botanists from other institutions. This team of scientists and their students planned and carried out a study designed (1) to characterize roadside vegetation; (2) to inventory infestations of "up and coming" invasive plants along major highways (state, US, and interstate roads); and (3) to assess, through a literature review, the role highway corridors may be playing in providing vectors for the spread of invasive insects and microbes. Two hundred and eighty-four randomly selected vegetation plots were inventoried and 438 infestation sites were documented. The WVDOH will use the results of this study to develop vegetation management plans to encourage the establishment and spread of native vegetation along roadsides and to discourage the same for invasive species. The papers that follow present the findings of this statewide study.

SCOTT COPEN, DONALD D. GRAY, JUAN QUIROZ, and RONALD FORTNEY, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26507.
Preliminary Assessment of Clay Liners in Constructed Mitigation Wetlands.

In 1991, the West Virginia Division of Highways initiated the practice of constructing and restoring wetlands to mitigate for unavoidable impacts to wetland habitats. Many of the naturally existing wetlands in West Virginia are palustrine. Therefore, many of the constructed wetlands have been designed so that groundwater and occasional over bank flooding are primary sources of hydrologic inputs. The basic method for constructing wetlands has been to excavate and lower the base elevation to intercept groundwater, use berms to control surface flows, and to use clay liners to perch groundwater tables. The development of mitigation wetlands into fully functional wetlands is dependent on how well the clay liners were designed. This study evaluates the

position and the effectiveness of clay liners in achieving intended hydrologic regimes. This paper reports the data collected during the first phase of the study.

Two constructed wetlands and two contiguous or nearby reference natural wetlands in north central West Virginia were studied. Monitoring wells, piezometers, and automated water level data recording devices were placed along transects normal to the stream. Flow patterns and normal depth to the ground water table were then established. Preliminary results suggest that the major portions of the mitigation wetlands where clay liners were used have dryer hydrologic regimes than the reference wetlands. The clay liners may have been positioned at too high of an elevation or these could be groundwater discharge areas which would mean that the clay liner is actually capping the existing water table.

KAREN A. SACILOTTO, JAMES T. ANDERSON, Division of Forestry, West Virginia University, Morgantown, WV 26506.
Avian use and vegetative structure of islands on the Ohio River.

Islands on the Ohio River contain valuable habitats that are unique and irreplaceable on a national or ecoregion basis. Aquatic habitats connected with the islands and their back channels (areas where commercial traffic is prohibited), provide some of the area's highest quality riverine, wetland, and bottomland habitats, and are used by a diversity of birds, fishes, and mussels. The back channels provide protection from disturbances such as wind and commercial navigation and require further investigation; however, quantitative data on the importance of these areas are lacking. Islands and their back channels are under continuous threat of development, and data are needed to implement conservation plans. The objective of this study is to compare breeding bird abundance and quality of habitat for cavity-

nesting birds between back channel and navigational channel sides of islands.

We established two plots within mature bottomland hardwood stands on each of ten islands, one on the back channel side and one on the navigational channel side. Fixed-radius avian point counts were conducted between April and June. A total of 71 bird species was observed: 33 on the back channel side and 38 on the navigational side. Total bird abundance was similar between the back channel (MEAN=11.7/plot; SE=1.3) and navigational (MEAN=16.1/plot; SE=1.2) sides ($P=0.88$). The back channel side contained more cavities than the navigational channel side ($P=0.03$). Although the navigational side contains a greater diversity of vegetation types, bottomland hardwood areas are more abundant on the back channel side, which are more important for cavity-nesting birds.

ECOLOGY II

KRISTEN PEROS, EDGAR NULL, JAIME BLAKE, JOHN ENZ, and THOMAS JONES, Dept. of Biology, Alderson-Broaddus College, Philippi, WV 26416. **Survey of the dragonflies (Odonata: Anisoptera) of Barbour, Taylor, & Upshur Counties, West Virginia.**

The dragonflies (Odonata: Anisoptera) of West Virginia are an understudied and under-documented group as attested by the paucity of literature citations. In addition, information regarding the distribution of dragonflies in West Virginia is lacking and/or needs updating. The purpose of this study was to survey the dragonflies present in Barbour, Taylor, and Upshur counties, West Virginia. Several sites, both lotic and lentic, within each county were sampled for both larvae and adults during the time period 1 May 2000 through 1 September 2000. Larvae were surveyed using D-nets and Kick-nets and were then preserved in 70% ethyl alcohol. Two methods were employed to prepare captured adults for identification. To

preserve adult coloration, a portion of the adults were placed in glassine envelopes, soaked in acetone for 24 hours, dried, and placed in dragonfly museum envelopes for identification while others were killed using ethyl acetate and pinned for better viewing of wing venation. Identifications were made using keys found in *Dragonflies of North America*, by Needham et.al. (Revised 2000 edition) in conjunction with comparisons to museum collections.

Our study found 12 dragonfly species in Barbour County, 11 species in Upshur County, and nine species in Taylor County. The majority of the species found were members of the Family Libellulidae and there was a distinct scarcity of lotic species. However, bad weather hampered our survey throughout the study period with nearly fifty-percent of our scheduled sampling days not conducive to dragonfly activity. Thus, these low species numbers may be reflective of this particular season's unusual weather. Further long term monitoring is needed. This study was supported by the Nongame Wildlife and Natural Heritage Program of the West Virginia Department of Natural Resources.

HARRY A. KAHLER and JAMES T. ANDERSON, Division of Forestry, Wildlife and Fisheries Resources, West Virginia University, Morgantown, WV 26506. **An assessment of nest-site resources for secondary cavity-nesters of the Monongahela National Forest.**

Because secondary cavity-nesting birds may be limited by a lack of suitable nest sites, we compared the abundance and characteristics of available cavity trees among three common forest cover types in the Central Appalachians. For comparison, the following Society of American Foresters forest cover types were chosen: White oak - black oak - northern red oak; Black cherry - maple; and Red spruce - yellow birch. These types represent a central hardwood, northern hardwood, and spruce forest, respectively. The height, DBH, and decay state of cavity trees, as well as certain

cavity characteristics were measured on multiple 50-M radius plots within the Monongahela National Forest of West Virginia. Results to date indicate significantly higher cavity incidence in the White oak - black oak - northern red oak type ($X=19.3$, $SE=4.23$) as compared to the Black cherry - maple ($X=15.9$, $SE=5.55$) and Red spruce - yellow birch ($X=12.4$, $SE=3.44$) types ($P=0.0301$). American beech (*Fagus grandifolia*) and yellow birch (*Betula alleghaniensis*) had the highest frequency of cavities of all tree species observed, yet both are considered northern hardwood species. Also, cavities within beech and yellow birch trees were almost exclusively woodpecker-excavated, whereas oaks tend to harbor holes formed by fungal decay. Because the Central Appalachians are unique in containing central hardwood, northern hardwood, and remnant spruce forests, these results may aid the management of habitat for wildlife in this region.

GREG M. FORCEY, JAMES T. ANDERSON, and **FRANK K. AMMER**, Division of Forestry, West Virginia University, Morgantown, WV 26506. **A comparison of bird abundance within habitat types using two different point count methodologies.**

Traditional avian point count methodology calls for a single observer to survey point locations. However, the use of two observers permits detection probabilities to be calculated for each bird species. Estimates of bird abundance based on these detection probabilities are likely to be more robust than estimates from single-observer point counts. This study compares the abundances of 10 common bird species seen by one observer, to abundance estimates derived from the detection probabilities calculated from double-observer point counts. Double-observer point counts were conducted on 100 points in northern West Virginia during May-July 2000. Abundance estimates were calculated from the

double-observer technique for each point using the program DOBSERV. Single-observer data were taken from data recorded by the primary observer. A comparison of abundance estimates for all 100 points yielded significant differences in bird abundances between the two approaches ($P<0.001$). When abundance data from these two techniques were compared within general habitat types, significant differences were only present in forest edge ($P=0.003$) and reclaimed mine areas ($P=0.01$). Significant differences in abundance data were not present in forest interior, riparian, and developed areas ($P>0.05$). These data suggest that the use of the double-observer technique is justified more in open habitat types where observers are more likely to overlook individual birds because of high abundance and a larger area in which to visually scan. Therefore, studies that assess habitat use by birds based on data from single-observer point counts should be treated with caution, as abundance estimates in certain habitats may be inaccurate.

DAVID A. HELON and **JAMES T. ANDERSON**, Division of Forestry, Wildlife and Fisheries Resources, West Virginia University, Morgantown, WV 26506. **Evaluation of scent station placement to determine populations trends for predators.**

Furbearers and carnivores are important components of ecosystems and often need to be monitored for management purposes. Most monitoring relies on scent stations placed near roads. However, predator assemblages and visitation rates may be different between interior sites and road side sites. The objective of this study was to compare carnivore visitation rates between road side plots to interior plots to determine the most efficient and effective strategy of determining carnivore presence and relative abundance. Scent stations were monitored three times between August and October 2000 on the Camp Dawson Army

Training Site in north-central West Virginia. Scent stations were set at 26 road side sites and 26 interior sites by clearing a 1 m diameter circle, covering the bare ground with sand, and placing a predator scent tablet in the center. Scent stations were set 480 m apart. Tracks of seven species of carnivores were found on the scent stations. Raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and black bear (*Ursus americanus*) were most common. Overall, scent station visitation rates were similar between roadsides (19.2%) and interior areas (28.2%) for all predators combined ($P > 0.05$). However, coyote (*Canis latrans*) and weasel (*Mustela* spp.) were found only in interior sites, whereas domestic dog were found only along roads. To obtain an accurate description of the entire mammalian predator community both roadside and interior scent stations should be monitored.

JAMES T. ANDERSON, Division of Forestry, Wildlife and Fisheries Resources, West Virginia University, Morgantown, WV 26506. **Wetland management strategies for increasing potential carrying capacity of non-breeding waterfowl.**

Manipulation of water levels in wetlands through drawdowns is a technique commonly used to mimic historic hydroperiods and improve natural seed and invertebrate production for consumption by migratory birds. However, little work has been done on a regional basis to assess the impacts of drawdown rates on potential carrying capacity of non-breeding waterbirds. A study was developed to evaluate the impacts of a slow drawdown technique timed specifically for spring migrating shorebirds. We are conducting a follow-up study to assess the effect of this technique on non-breeding waterbird carrying capacity. The objective of this study is to evaluate the impacts of managing wetlands for spring migrating shorebirds, on subsequent

quality of habitat for fall migrating and wintering waterbirds, on 14 national wildlife refuges from Maine to Virginia. Results suggest that plant species diversity is generally higher on impoundments subjected to slow drawdown than those subjected to the traditional drawdown techniques. However, dominant plant species are similar between the two treatments, with Walteri millet (*Echinochloa walteri*), and various spikerushes (*Eleocharis* spp.), sedges (*Cyperus* spp.), and bulrushes (*Scirpus* spp.) being most common. Preliminary results suggest that seed biomass is two to six times greater on impoundments subjected to the slow drawdown technique than the traditional techniques. Invertebrate biomass is low and similar in both treatments and appears to have little influence on overall carrying capacity. These data suggest that a slow drawdown technique is favorable for spring migrating shorebirds and also for non-breeding waterbirds.

JOSEPH D. OSBOURNE and **JAMES T. ANDERSON**, Division of Forestry, Wildlife and Fisheries Resources, West Virginia University, Morgantown, WV 26505. **Effect of coarse woody debris manipulations on small mammal communities.**

Response of small mammal populations to manipulation of coarse woody debris (CWD) volume was tested in eastern hardwood forests in Preston County, West Virginia during the summer of 2000. Abundance and diversity measures of small mammals ($n=312$) captured on twelve experimental 60 x 60 meter live-trapping grids were compared. Grids were randomly distributed between addition sites (volume of CWD increased by 1/2), removal sites (volume of CWD reduced by 1/2), and control sites (no volume manipulation, but CWD disturbed). Preliminary results suggest abundance was higher on all plots after manipulation. This could possibly be due to the disturbance created by manipulation or simply

weather and seasonal patterns. Overall abundance of small mammals was highest on control sites, but no significant difference was detected between addition and removal sites. Species richness was relatively consistent throughout the study with no significant change after manipulations. No significant difference was observed before or after manipulations on any of the experimental plots using Simpson or Shannon-Weaver diversity indices. It appears that CWD manipulations have little short-term effect on abundance and diversity of small mammals other than an initial increase in abundance due to the disturbance event. Data from the 2001 field season will provide more information on whether any lasting effects or relationships exist.

WILLIAM N. GRAFTON, JAMES and ANN M. ANDERSON, and JAMES RENTCH, Division of Forestry, West Virginia University, Morgantown, WV 26506; **RONALD H. FORTNEY and JONELL FERDA**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506; **STEVEN L. STEPHENSON and MARTIN SCHNITTLER**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **EMILY K. GRAFTON**, Canaan Valley Institute, Davis WV 26260; **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422; **ROBERT B. COXE**, Western Pennsylvania Conservancy, 209 Fourth Ave., Pittsburgh, PA 15222; and **DENNIS A. BURNS**, Dept. of Bioscience, Salem International University, Salem, WV 26426. **Infestations of selected native and exotic plant species on West Virginia highway rights-of-way.**

Roadside infestations of selected invasive plants were surveyed along all interstate, US, and WV highways during the 2000 growing season. Plants were selected on the probability of possible control and/or extermination from

highway rights-of-way. Invasives that are pervasive in West Virginia were not surveyed. Data collected at infestation sites were exact location, elevation, aspect, soil moisture, right-of-way location, population size and numbers and associated plants. During the course of surveying *Miscanthus sinensis*, *Morus alba*, and *Rubus phoenicolasius* were dropped from the list and *Buddleja davidii*, *Lonicera fragrantissima*, *Pyrus calleryana* and *Betula pubescens* were added to the list. *Carduus acanthoides*, *Carduus nutans*, and *Eupatorium altissimum* were not surveyed east of the Allegheny front and *Pueraria montana*, *Eupatorium serotinum*, and *Dioscorea oppositifolia* were not surveyed south of the main stems of the New and Kanawha Rivers. Approximately 400 infestation sites were located with Monongalia (56), Wood (26), Kanawha (21), Braxton (20), Fayette (16), and Jackson (15) as the leading counties. Species with the leading infestation sites were *Typha angustifolia* (59), *Pueraria montana* (41), *Typha x glauca* (30), *Eupatorium altissimum* (27), *Lonicera maackii* (26), *Eupatorium serotinum* (24), *Clematis terniflora* (24), *Dioscorea oppositifolia* (23), and *Phragmites australis* (22). Three of the common associates were *Festuca arundinacea*, *Lespedeza cuneata*, and *Coronilla varia*, which are frequently used for roadside reclamation. Common invasive associates were *Rosa multiflora*, *Dipsacus fullonum*, *Galium mollugo*, *Lonicera japonica*, *Lonicera morrowi*, and *Bromus inermis*. Common natives invading roadsides were *Solidago altissima*, *Solidago canadensis*, *Typha latifolia*, *Aster pilosus*, *Acer negundo*, *Fraxinus americana*, and *Ulmus americana*.

KELLY A. WARREN, and JAMES T. ANDERSON, West Virginia University, Division of Forestry, Wildlife and Fisheries Resources, P. O. Box 6125, Morgantown, WV 26506-6125. **Use of idle farmland by grassland nesting bird species in West Virginia.**

DONALD TARTER, Dept. Biological Sciences, Marshall University, Huntington, WV 25755; and **DIANE NELSON**, Dept. of Biological Sciences, East Tennessee State University, Johnson City, TN. **Tardigrade fauna (Phylum: Tardigrada) from mosses in West Virginia.**

Twenty-seven species, including one new species, representing 11 genera (*Diphascon*, *Echiniscus*, *Hypechiniscus*, *Hypsibius*, *Isohypsibius*, *Itaquascon*, *Macrobiotus*, *Milnesium*, *Minibiotus*, *Pseudechiniscus*, *Ramazzottius*) were identified from 23 moss species in West Virginia. Tardigrades were collected from mosses between 1989-2000. The collecting sites were located in five major areas: Spruce Mountain, Dolly Sods Wilderness Area, Seneca Rocks, Cranberry Glades, and New River Gorge. The collecting sites were grouped into the following altitudes: 2000-2900 ft/610-884m, 3000-3900 ft/914-1189m, and 4000-4900 ft/1219-1494m. Only three species of tardigrades (*Macrobiotus hufelandi*, *Minibiotus intermedius*, *Milnesium tardigradum*) occurred in all five areas. Nine species (*Diphascon higginsi*, *D. pingue*, *D. scoticum*, *D. oculatus*, *Hypechiniscus gladiator*, *Hypsibius maculatus*, *Isohypsibius pappi*, *Macrobiotus occidentalis*, *Pseudechiniscus suillus*) were recorded from the lower altitudes. Only two species (*Diphascon prorsirostre* and *Macrobiotus tonollii*) were found at the higher altitudes. Four species (*Echiniscus virginicus*, *Macrobiotus pseudofurcatus*, *M. spallanzanii*, *M. spectabilis*) were noted only at the middle altitudes. Eight species were found at all three altitudes. The number of species were similar at the low (20) and mid-altitudes (17), while the number of species decreased at the higher altitudes (12 species). The majority of tardigrades (23 species) were more common on the north slope. Twelve eutardigrade species and all heterotardigrades were found only on the north slope. Only one species, *Macrobiotus tonollii*, was found on all four slopes (NEWS). Fifteen tardigrade species were found in the moss genus *Thuidium*. No tardigrade species was found in all moss species. The most abundant tardigrade in

the study, *Macrobiotus hufelandi*, was identified from 11 different moss species. Population density and species diversity of tardigrade vary greatly in apparently similar habitats. Possible limiting factors (e.g. temperature, moisture, light intensity, wind velocity, etc.) regulating tardigrade distribution will be discussed.

ZACHARY LOUGHMAN, Dept. of Biology, West Liberty State College, West Liberty, WV 26074. **Herpetofauna of Marshall, Ohio, and Brooke counties.**

Reptile and amphibian populations for the northern panhandle of West Virginia have been very poorly studied. The purpose of this paper was to document the various species of herptiles found within this geographical area. Populations of reptiles and amphibians were surveyed in Marshall, Ohio, and Brooke counties. County records were documented when found, and previously known populations were investigated also. County records when discovered were incorporated into a GIS and mapped to their exact location of capture.

ROBIN DOLIN and **DONALD TARTER**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755. **Preliminary observations on the natural succession of benthic populations in constructed sediment ponds in southwestern West Virginia.**

Surface mining of coal involves removing overlying soil and rock in order to explore the coal seam below. In some types of surface mining, the overburden is placed into nearby valleys that typically contain headwater for small streams. A critical feature of strip-mine ecology is the massive erosion and subsequent sedimentation in these streams. The amount of sediment flowing downstream in a valley fill can be controlled by sedimentation ponds. Seasonal benthic populations from kick samples (1m²) were

examined from three sedimentation ponds of various ages. Also, data from Hester-Dendy multiplate samplers (3) and gravel basket samplers (3) were used to compare benthic populations with kick samples from three additional sediment ponds. Benthic taxa were grouped according to the following pollution indicator classification: sensitive, facultative, tolerant, and unclassified. The Bray-Curtis similarity index, total density, taxa richness, evenness, and the Shannon diversity index were also used to compare benthic populations among ponds. Several water quality parameters (total alkalinity, acidity, sulfate, aluminum, iron, manganese, total suspended solids, total dissolved solids, and pH) were measured at each pond. Preliminary observations indicated that chironomid larvae (tolerant taxon) ranked first in percentage frequency of occurrence. Odonate taxa (tolerant) were also abundant.

JAMIE BLAKE and **DONALD TARTER**, Dept. of Biological Sciences, Marshall University, Huntington, WV 25755; **THOMAS JONES**, Dept. of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26506; and **JOHN ENZ**, Dept. of Biology, Alderson-Broaddus College, Phillippi, WV 26416. **The benthic communities found downstream from valley fills in southern West Virginia.**

A number of permit applications for mountain-top removal within West Virginia prompted the USEPA to develop an Environmental Impact Statement (EIS) prior to release of the permits. That study resulted in the collection of benthic macroinvertebrate samples, water quality, fish community data, and habitat data from reference and experimental sites. The experimental sites were located downstream from valley fills that ranged in age from current filling to fills that were 30 years old. A subset of the sites included Surber sampling, as well as kick sampling. The samples were collected for four seasons from summer of 1999 to the spring of 2000. Six Surber samples were collected from each site. All

macroinvertebrates were identified and enumerated to the lowest possible taxon with the exception of chironomids and oligochaete. The Surber diversity ranged from five to 46 taxa. Principle component analysis (PCA) exhibited strong seasonal and site clustering. Numerous outliers were identified and can be explained using water quality and/or habitat data. Several sites exhibited shifts in community structure especially below the settling ponds. A few pre-reclamations sites exhibited significant structural changes that remained throughout this data set. A general trend to more reference-like community structure was apparent with increasing valley fill age.

GEOLOGY/MISCELLANEOUS

JEREMY CHAMBERS, Dept. of Chemistry, West Liberty State College, West Liberty, WV 26074. **Determination of mechanism and synthesis of antimony dimethyldithiocarbamate.**

The purpose of this study was to determine the mechanism for the synthesis of antimony dimethyldithiocarbamate, and synthesize the compound for use in the rubber industry. The mechanism was derived from similar compounds, such as chromium (III) dithiocarbamate and bismuth dimethyldithiocarbamate. The synthesis was found to involve reduction, nucleophilic substitutions, and electrophilic substitution. The synthesis can be accomplished in standard laboratory conditions; however, its contributions to the rubber industry must be tested at a later time. The structural confirmation was provided by NMR, FTIR, and AA spectroscopy.

E. RAY GARTON, Curator, Museum of Geology & Natural History, WV Geological Survey, Morgantown, WV 26507 and **ROBERT PYLE**, Curator, Mason Dixon Park Museum,

Morgantown, WV 26505. The First Record of *Devonaster eucharis* Hall (fossil starfish) from West Virginia.

An extremely well-preserved sandstone impression of *Devonaster eucharis* Hall (fossil starfish) was brought to the attention of the museum. It was discovered in a tributary to Horse Shoe Run in Tucker County near Leadmine. While the exact geologic location cannot be determined, the specimen is surely Devonian and probably from the Chemung Series. Casts of the specimen are on exhibit at the museum and museum web site. The original specimen was returned to the family of the discoverer in hopes of its future donation to the museum.

E. RAY GARTON, Curator, Museum of Geology & Natural History, WV Geological Survey, Morgantown, WV 26507 and ROBERT PYLE, Curator, Mason Dixon Park Museum, Morgantown, WV 26505. The First Record of *Hydnoceras walcotti* Clarke (fossil sponge) from West Virginia.

An extremely well-preserved sandstone cast of *Hydnoceras walcotti* Clarke (fossil sponge) was brought to the attention of the museum. It was discovered in Horse Shoe Run of Tucker County. While the exact geologic location cannot be determined, the specimen is surely Devonian and probably from the Chemung Series. Casts of the specimen are on exhibit at the museum and museum web site. The original specimen was returned to the family of the discoverer in hopes of its future donation to the museum.

ROBERT PYLE, Curator, Mason Dixon Park Museum, Morgantown, WV 26505 and E. RAY GARTON, Curator, Museum of Geology & Natural History, WV Geological Survey, Morgantown, WV 26507. Hughes River Flint: Its Occurrence, Distribution, and Use by Prehistoric Peoples in West Virginia.

The objective of this study of the Hughes River Flint (Pennsylvanian Brush Creek Limestone) was to identify its lithic (stone tool) use by prehistoric peoples, its geological occurrence and composition at a newly discovered locality in Ritchie County, West Virginia. The study area had been recently disturbed by timbering, which resulted in several well-exposed flint and chert outcrops and lithic related sites. More than 7000 artifacts were collected, examined, and studied.

ALAN D. SMITH, Dept. of Quantitative and Natural Science, Robert Morris College, Pittsburgh, PA 15219. Authentication methods through the use of automatic identification and data capture technologies and systems.

Automatic identifications and data capture systems are probably one of the most widely used and under-recognized information technology (IT) strategic assets in use in the global economy. Data collection and integration strategies are essential to Enterprise Resource Management (ERP) systems as well as warehouse management systems. The concept of authentication in the world of e-commerce has always been a concern of IT and security professionals. Automatic identification and data capture systems, and their associated authentication and safeguard protocols, are the essential building blocks for sustainable competitive advantages and superior profitability. Without these technologies and safeguards, e-commerce as we know it simply would not exist. The relatively easy application of the software wedge, for example, the simplest method of data collection, which emulates keystroke on a standard workstation located between the scanner and CRI, can reduce data errors and speed up communications many magnitudes over human data entry methods. Although many wired LANs, MANs, and WANs are in typical use in bar coding, coding applications, there are much needed regulations

and standards in the growing wireless network applications of voice recognition and radio frequency applications and their integration configurations. Theoretical as well as applied frameworks are discussed to provide the basic concepts of authentication in terms of automatic identification and data capture technologies and systems.

SENA A. TEMPLETON and JOHN H. HULL, Dept. of Psychology, Bethany College, Bethany, WV 26032. **Discrimination learning in *Drosophila melanogaster*, wild type, as a function of food deprivation.**

Fruit fly subjects (n=909) initially were food-deprived for 0, 3, 6, 9, or 12 hours, then each food-deprivation group was split into two odorant conditions. Flies in one odorant condition received two pairings of the odorant DL-3-Octanol (OCT) with sucrose solution, alternating with two pairings of the odorant 2-Methylcyclohexanol (MCH) with distilled water. Flies in the second odorant condition received two pairings of OCT with distilled water, and two alternating pairings of MCH with sucrose solution. Thus, each odorant was paired with sucrose for about half of the flies (S+), and paired with distilled water (S-) for the others. Flies in each combination of food deprivation and odorant condition were trained as a group. After training, each group was exposed to a "Y" maze, with OCT odorant in one arm and MCH in the other. Each arm ended in an empty chamber, and numbers of flies flying to each arm were recorded.

Since initial analysis showed no significant difference between the odorants functioning as S+ or S-, data from the two odorants were grouped in "S+" and "S-" conditions. Subsequent Chi-square analysis showed a significant effect of food deprivation across conditions, $\chi^2(4) = 37.44, p < 0.001$. On the test trial, 47% of flies in the 0- and 3-hour food deprivation groups flew to the S+, 62% of

flies in the 6- and 9-hour groups flew to the S+, and 72% of flies in the 12-hour group flew to the S+. This study confirms previous reports of odorant-based "Y" maze learning in fruit flies, and provides evidence that such learning depends in part on length of food deprivation. Since one of the odorants, MCH, has not been used in prior studies, the present study also expands the range of potential odorants effective in studies of learning in fruit flies. Finally, this study provides a simple, inexpensive methodology for studying invertebrate learning.

JENNIFER L. WILDPRET and JOHN H. HULL, Dept. of Psychology, Bethany College, Bethany, WV 26032. **.com toys: What are they really selling?**

Research participants (n=42) were randomly divided into two groups. Participants in one group read brief descriptions of 55 toys sold online at a variety of .com sites; descriptions were copied verbatim from the websites. Participants in this group rated each description on 1-5 scales of masculine-feminine, passive-active, requires physical skill-does not require physical skill, and requires thought-does not require thought. Participants in a second group looked at full-color pictures of the 55 toys; pictures were copied from the websites. They rated each picture on the same four dimensions. An independent group of 16 participants looked at deliberately-blurred copies of the pictures of the 55 toys. Predominant toy colors were preserved, but the toys were not identifiable. These 16 participants rated the 55 blurred pictures on the same four scales as the other two groups used. Finally, mean ratings for each toy for each dimension were computed for the three experimental groups.

Statistical analysis involving Pearson correlations showed: Statistically significant correlations for the masculine-feminine dimension among toy pictures, descriptions, and colors; significant correlations for the active-

passive, the physical skill-no physical skill, and the thought-no thought dimensions between toy pictures and descriptions. The present study shows that .com toy shoppers receive consistent messages from the toy pictures, descriptions, and colors about which toys are "boy" toys, and which toys are "girl" toys, confirming a previous study involving a national toy store chain. However, unlike the previous study, toy colors in the present study did not correlate significantly with any dimension except masculine-feminine. Finally, .com toy descriptions and pictures give consistent messages about active-passive, physical skill-no physical skill, and thought-no thought qualities of the toys. This study thus has important implications for how toys are marketed and how people select toys.

DAVID R. LINDEN, Department of Social and Behavioral Science, West Liberty State College, West Liberty, WV 26074. **The Partial Reinforcement Extinction Effect as a Consequence of Appetitively Induced Learned Helplessness.**

This investigator (Linden 1974; 1976) once demonstrated that intermittent punishment increases resistance to extinction of a positively reinforced behavior. Rosellini and Seligman (1975) have suggested that this increased resistance to extinction is a form of learned helplessness in which animals fail to stop running into frustration. If this is true, then the increased resistance to extinction of the Partial Reinforcement Effect (PRE) may be due to Learned Helplessness. Three experiments are presented that attempted to demonstrate that the appetitive Partial Reinforcement procedure would produce a deficit in subsequent learning.

In Experiment 1, four groups of rats ($n = 10$) ran an alleyway or were placed in the goal box by hand, and received partial (50%) or continuous (100%) reinforcement. After four days of such training, all subjects were

administered one session of bar press acquisition. There was no difference in time to the first bar press response, but animals that had been partially reinforced took longer to reach their tenth response than those that had received continuous reinforcement. There were no differences in the times from the tenth to the fiftieth response. These results demonstrated a deficit in bar press acquisition, but not a motivational deficit. This interference in subsequent acquisition was due to the unpredictability, rather than uncontrollability, of reinforcement. Overmier (1985) and Minor, Dess, & Overmier (1991) have proposed that the more important aspect of the induction of learned helplessness is the unpredictability of the aversive event rather than its uncontrollability. They propose that unpredictability produces a cognitive deficit in subsequent learning situations.

In Experiment 2, forty rats were administered seven 10 trial alleyway sessions for continuous, 50% random, or 50% alternating reinforcement, and subsequently received operant bar press acquisition. Subjects on the 50% alternating schedule demonstrated patterned responding from the third through the seventh alleyway session. Animals that had received random, but not alternating, 50% reinforcement demonstrated a deficit in bar press acquisition. As in Experiment 1, this cognitive deficit was produced by the lack of predictability of reinforcement.

Finally in Experiment 3, rats that learned the pattern of an alternating 50% reinforcement schedule in an alleyway, did not differ from continuously reinforced subjects during alleyway extinction. Rats that did not demonstrate patterned responding on the alternating schedule demonstrated the same partial reinforcement extinction effect as subjects that had received 50% random reinforcement.

These studies indicate that the unpredictability of partial reinforcement produces a learning deficit in subsequent

learning situations. This deficit can account for the failure to learn to not continue responding in the face of frustration, thus producing the increased resistance to extinction of the PRE.

POSTERS

ELIZABETH J. ALEXANDER, DAWN R. BLACK, AMANDA D. KERNS, MARISA L. POSEY, and DONALD E. TRISEL, Department of Biology, Fairmont State College, Fairmont, WV 26554. **The effect of global warming on photosynthesis in crop plants.**

Downstream impacts of contour surface mining and valley fill construction were evaluated utilizing both water chemistry and EPA approved Rapid Bioassessment Protocol III. A first order stream in southern West Virginia was sampled in February of 1999 before mining perturbation. Five downstream stations were established with benthic macroinvertebrates and water collected seasonally over a sampling period of sixteen months. Pre-mining water chemistry data showed low alkalinity, acidity, sulfates, metals (aluminum, iron, manganese), total suspended solids (TSS), total dissolved solids (TDS), specific conductivity, and an average pH of 8.1. During the first twelve months of mining, pH values ranged from 6.88 to 8.21. Increases were seen for alkalinity, sulfates, TDS, TSS and specific conductivity. Manganese was the only metal to show sharp fluctuations. Initially, benthic macroinvertebrate communities were well balanced within the stream. There was a high abundance of EPT individuals compared to Chironomidae. Taxa richness ranged from 14 to 29 across the five sampling sites while the dominant families were Chironomidae, Nemouridae, Heptageniidae, and Elmidae. One year later, taxa richness ranged from 21 to 24 but the dominant family across all stations in the main channel of the stream was Chironomidae. The Modified HBI increased from an average of 3.3 to 4.5, while the percent shredders and filterer/collectors decreased.

JAMES T. ANDERSON, West Virginia University, Division of Forestry, Wildlife and Fisheries Resources, P.O. Box 6125, Morgantown, WV 26506-6125, and **RONALD H. FORTNEY**, West Virginia University, Department of Civil and Environmental Engineering, P.O. Box 6103, Morgantown, WV 26506-6125. **Exotic wildlife in West Virginia: The role of transportation corridors in species spread and dispersal.**

Invasive fish and wildlife species are colonizing North America from areas throughout the world. Invasive species are usually not problematic in their native range, but often cause serious environmental degradation in areas outside of their normal range. The rate of invasion of exotic species has increased drastically during the past century due to increased mobility of humans among continents. The objectives of this study are to identify fish and wildlife species capable of colonizing West Virginia, identify those species that could potentially have a high impact on species native to the state, and to identify species that are likely to become established in connection with transportation corridors (i.e., highways, airports, shipping ports, railroads). A total of 216 species of fish and wildlife (24 birds, 10 mammals, 20 reptiles, 4 amphibians, 148 fish, and 10 mollusks) was determined to potentially be capable of colonizing West Virginia. However, only 31.5% of species have a moderate or high potential to cause an impact in West Virginia. Few species (13.4%) are likely candidates to be introduced accidentally via transportation corridors based on past documentation. However, almost all invasive species introductions in North America probably involved transportation corridors in some manner. Efforts should be made to develop technologies to reduce the impacts of transportation corridors, particularly shipping ports and lanes, on the spread of invasive species.

SCOTT COPEN, JUAN QUIROZ, DONALD D. GRAY, and RONALD FORTNEY, Dept of Civil and Envr. Engr., West Virginia University, Morgantown, WV 26507. **A preliminary assessment of construction techniques for mitigation wetlands.**

Natural wetlands in the Appalachian Mountain region generally obtain water through groundwater discharge or recharge where water enters the wetland vertically and horizontally and through periodic over-bank flooding. The West Virginia Division of Highways (WVDOH) is currently designing mitigation wetlands with the goal of re-establishing wetland habitats to compensate for unavoidable impacts from highway construction and maintenance. A primary objective of WVDOH wetland program is to create or restore fully functional wetlands. The typical construction methods employed by WVDOH are as follows: excavate to lower the grade to the groundwater level or to a low hydraulic conductivity clay layer, or excavate to a lower grade and install a low hydraulic conductivity clay liner. Organic matter with a typical thickness of 12 in to 15 in is placed on top of the lowered grade in order to provide a viable root zone for wetland plant species. From an engineering perspective, the young, newly constructed wetland products appear to be a success; however, there are drawbacks with current design strategies. For instance, the lack of a smooth transition between the topsoil and clay liner is leaving the topsoil vulnerable to erosion during flood events. Further, a densely compacted clay liner appears to inhibit root penetration in some cases. The clay liner could also impede the vertical movement of groundwater from recharge sources. In support of these assertions, this study provides subsurface soil characterizations for one mitigation and one natural wetland and presents preliminary conceptual design approaches

to improve mitigation wetland construction.

RANDY G. DARRAH and MARTIN SCHNITTLER, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **DAVID MITCHELL**, Walton Cottage, Upper Hartfield, Sussex, England; **TED STAMPFER**, 20 Calle San Martin, Sante Fe, NM 87501; and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. **Recent studies of myxomycetes in the Great Smoky Mountains National Park.**

Prior to the start of the All Taxa Biodiversity Inventory (ATBI) that is currently being carried out in the Great Smoky Mountains National Park, 92 different species of myxomycetes had been reported from the Park, and the majority of these records were based upon specimens collected more than a half century ago. In the past three years, more than 75 species have been added to this total. The most surprising finds are four species of myxomycetes not previously known from North America. During September of 2000, field collecting carried out in high-elevation spruce-fir forests in the Park yielded several collections of *Eleomyxa cerifera*, an apparently rare species reported from only a few scattered localities in the northern hemisphere. Although the total number of species now known from the Park is as high or higher than those reported for other comparable regions of the world, it is anticipated that there are many more species to be found. In fact, based upon the results obtained thus far, the Great Smoky Mountains National Park appears to be one of the world's "hot spots" for myxomycetes, with as many species present in the Park as anywhere else on earth. (Supported in part by a grant from Discover Life in America.)

MELLICENT FRIDDELL, BRUCE EDINGER, Dept. of Bioscience, Salem International University, Salem, WV 26426, and

RONALD FORTNEY West Virginia University, Dept. of Civil and Environmental Engineering.
Evaluation of vegetation cover type use by land birds with spotmap data and fine-scale vegetation maps – a part of a study evaluating effects of bridges on wildlife.

Construction of highway bridges over rivers necessarily alters the original pre-construction vegetation of the surrounding areas. Many species of birds are habitat specific because of different food, shelter, and nest site requirements, with vegetation type being most important. To evaluate the effects of bridges on bird communities, it is necessary to separate any differences in bird communities found near and far from bridges that are caused by a bird's avoidance or attraction to the bridge and its traffic with the bird's avoidance or attraction to the different vegetation types found near the bridge. This report concentrates on two recently constructed bridges: the Middle Fork River and Tygart Valley River crossings of Corridor H/Route 33 between Buckhannon and Elkins. In 1998 and 1999, for each of the east and west shore locations at each bridge, birds were censused by spot mapping on transects within standardized 1 hectare plots that were placed (1) underneath the bridge, (2) 100 meter distant, and (3) 300 meters distant. Cover types for the plots were mapped and digitized using topographic maps and on-ground vegetation surveys. Final maps were scaled in ArcView and superimposed on the bird census spotmap datasheets. Proportional bird densities were calculated for the different cover types, and compared with the proportions of each cover type available. Forest dwelling species such as the scarlet tanager showed extreme preference for mixed hardwood forest, sometimes within 50 m of the bridge. American robins were more abundant in the plots nearest the bridge because of demonstrated preferences for scrub shrub, grass meadow, grass & forb meadow

and road cover types, which were predominantly found in the disturbed areas there. Song sparrows preferred edge associated with scrub shrub and stream sides. Barn swallows are not specialists on ground vegetation types because of their aerial insectivore feeding methods, present only underneath the Middle Fork River bridge, because of the presence of a nesting colony and feeding opportunities adjacent to the river. Funded by the West Virginia Department of Transportation, Division of Highways.

MINDY M. GIBSON, JEFFREY W. SHIPMAN, APRIL N. SMITH, HEATHER M. SMITH, JOSEPH P. VOZNIAK, and DONALD E. TRISEL, Department of Biology, Fairmont State College, Fairmont, WV 26554.
The photosynthetic response of *Zea mays* and *Lycopersicum esculentum* grown in nutrient deficient solutions.

This study is designed to determine some of the effects of nutrient deficiencies on the overall photosynthetic activity of corn (*Zea mays*) and tomato (*Lycopersicum esculentum*). The plants were grown hydroponically in complete or nutrient deficient solutions in the greenhouse at FSC. The nutrient deficiencies studied include: calcium, iron, magnesium, nitrogen, phosphorus, potassium, sulfur, and trace elements.

The photosynthetic responses of the plants were measured with the LICOR 6400 Portable Photosynthesis System. This system allows for precise measurement of CO₂ assimilation, transpiration, and leaf temperature while exposing the leaf to controlled environmental conditions such as humidity, light levels, temperature, and CO₂ concentration. Light response curves and A-Ci curves show the quantitative effects of nutrient deficiencies as compared to the traditional qualitative results

expressed in terms of overall plant health and leaf color.

LINDSEY KIRSTATTER, BRUCE EDINGER, Dept. of Bioscience, Salem International University, Salem, WV 26426, and **RONALD FORTNEY**, Department of Civil and Environmental Engineering, West Virginia University. **Effects of Corridor H Bridge Construction on Bird Communities: A Pre-construction and Post-construction Comparison.**

The construction of bridges can interfere with wildlife habitat by introducing noise, physical obstructions, and vegetation changes. In 1985, WV Division of Highways began a study to determine the effects of highway bridges on the habitat of wildlife at six bridge sites throughout the state. The study was continued during 1998, 1999, and 2000 by Salem International University (formerly Salem-Teikyo University), focusing mainly on birds, which are habitat sensitive. Only two sites allowed a comparison of bird communities shortly before and shortly after bridge construction: the Middle Fork River and Tygart Valley River crossings of Corridor H/Route 33 between Buckhannon and Elkins. In both the earlier and later studies, repeated censusing was performed along standardized 100 m transects that were placed (1) underneath the existing bridge (or planned bridge construction site), (2) 100 m distant from the bridge or bridge site, and (3) 300 meters distant. Pre- and post-construction bird communities were summarized and compared using a spreadsheet program. Maximum and average counts or densities from both time periods were compared, using a table format. Declines of more than one individual were recorded as a double negative (—). Declines of one were recorded as a negative (-). Increases of one individual were recorded as a plus sign (+). Increases of more than one were

recorded as a double positive (++) . With this table, trends could be examined. The hooded warbler, black and white warbler, American redstart, red-eyed vireo and other woodland-dependent species consistently decreased at the bridge site after construction. The American robin, cedar waxwing, barn swallow, brown-headed cowbird, rough-winged swallow and eastern phoebe increased at the bridge site, because of forest removal and addition of nest surfaces. The study was funded by the West Virginia Department of Transportation, Division of Highways.

MICHEAL STARKS and BRUCE EDINGER, Dept. of Bioscience, Salem International University, Salem, WV 26426. **Use of Bridges as Bird Nesting Sites in North Central West Virginia.**

Many species of birds use man-made structures for nesting habitat. While anecdotal evidence demonstrates use of WV bridges by several species, no systematic study is known. Such information is useful as part of a comprehensive study evaluating the effects of bridges on wildlife. We evaluated 38 bridges, largely in north-central WV, for active and inactive nests during June, 2000. Bridge length, width and height, and bridge type, were measured. The vegetation/habitat cover type directly under the bridge's foot print and in a 50 m radius of the center point of the bridge were estimated.

Nine species of birds used bridges as nesting sites: American robin, barn swallow, cliff swallow, domestic goose, Eastern phoebe, European starling, house finch, house sparrow, and rock dove. The greatest number of nests on one bridge was the Corridor-H/Route 33 bridge over the Middle Fork River (about seven years old) near Buckhannon, with a 20-nest colony of barn swallows. Eastern phoebe was the species most likely to be nesting on a bridge, found on 12 of 38 bridges. Rock doves and robins used nine and seven bridges, respectively. Sixteen of

38 bridges lacked nests. Neither bridge "footprint" habitat variables nor surrounding habitat variables correlated with the number or diversity of bird nests found. There was a positive, significant correlation between bridge size and total number of bird nests, but this correlation lost significance when the Middle Fork River bridge, a large bridge with the barn swallow colony, was excluded from the analysis. Bridges with more horizontal understructure surfaces supported more bird nests. These results are conservative, since repeated visits may have revealed additional nesting activity in April and May, and more bridges surveyed over a broader geographic area would have likely revealed additional nesting species. This project was partially funded by the West Virginia Department of Transportation, Division of Highways.

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **JEAN-MARC MONCALVO**, Dept. of Botany, Duke University, Durham, NC 27708; and **RAJENDRA P. BHATT**, Dept. of Botany, Garhwal University, Campus Pauri, Garhwal, U.P. 246001, India. **A comparative study of ectomycorrhizal fungi in eastern North America and northwestern India.**

Although geographically separated, the forests of eastern North America and northwestern India share a number of ecologically important ectomycorrhiza-forming tree genera in common. Prominent examples include *Quercus* (oak), *Pinus* (pine), *Picea* (spruce), and *Abies* (fir). The objectives of this still ongoing research project are (1) to compare the species composition, species diversity, taxonomic diversity, fruiting phenology, and sporocarp productivity of selected groups of ectomycorrhizal fungi (with particular emphasis being placed on members of the Amanitaceae, Boletaceae, Cantharellaceae, and Russulaceae) associated with upland coniferous and oak-

dominated forest communities in northwestern India and the mid-Appalachians of the eastern United States and (2) to infer, using morphological, anatomical, and molecular data, the biological and taxonomic relationships that exist between populations of fungi that appear to represent the same taxonomic entity (i.e., morphospecies, or species complexes) in these two different regions of the world. The primary study sites being used are the Narkanda and Dharamshala areas of Himachal Pradesh and the Garhwal area of Uttar Pradesh in northwestern India, and the USDA Fernow Experimental Forest near Parsons in Tucker County, West Virginia, in the United States. Collecting carried out at the three study sites in India and the study site in the eastern United States during portions of three field seasons yielded 57 and 74 species of ectomycorrhizal fungi, respectively. All of the fungi collected were representatives of genera that are common and widespread throughout the north temperate zone. Most species were encountered in only one of the two study areas, but ten species in the genera *Amanita*, *Cantharellus*, *Hebeloma*, *Hydnum*, and *Laccaria* were recorded from both study areas. (Supported by a grant from the National Science Foundation.)

JOSEPH VOZNIAK, STEVEN HOWARD, and PHIL YEAGER, Department of Biology, Fairmont State College, Fairmont WV 26554. **Water Quality on the Tygart and West Fork Rivers of West Virginia.**

A water quality comparison was conducted below the Tygart dam on the Tygart river near Grafton, WV and below the Stonewall Jackson dam on the West Fork river near Weston, WV. Water quality conditions needed for the stocked trout, Rainbow's (*Salmo gairdnerii*), Brown's (*Salmo trutta*), and Brook (*Salvelinus fontinalis*), were compared with the actual conditions found in each fishery. This was determined by researching what the suitable

conditions for trout were, and then collecting and analyzing data from each fishery. Water chemistry data collected with a Yellow Spring Instrument Multiprobe sonde and data units included pH, turbidity, temperature, salinity, and dissolved oxygen. These parameters indicated no difference in water quality between the West Fork and Tygart rivers. Biological data consisted of aquatic insect collections keyed to family, and then used to calculate the Hillsenhoff Biotic index and Ephemeroptera, Plecoptera, and Trichoptera index. The biological data showed the biodiversity of aquatic insects to be distinct in each fishery. Although the rivers appeared to be different chemically and biologically, these parameters fell within the ecological needs of the stocked trout.

SHYLAJA R. AKKARAJU and TERA CUNNINGHAM, Dept. of Biology, Fairmont State College, Fairmont, WV 26554. **Cigarette advertising and human nature.**

Culturalists argue that advertising campaigns use purely cultural signs (semiotics) in order to popularize their products. We believe that there might also be a strong evolutionary psychological aspect to these campaigns. We tested our assumption by examining cigarette-advertising campaigns carried out by three major companies and found that they do indeed capitalize on certain aspects of human nature. Humans display a natural interest in adventure, beauty, and high status. These interests have been selected by nature over a million years to increase survival and reproductive fitness. Since these traits are deeply imbedded in our collective psyche, cigarette advertisers are able to effectively combine these aspects of our nature with cultural signals in order to create a powerful advertising message.

DENISE E. BINION, USDA Forest Service, Forest Health Technology Enterprise Team,

Morgantown, WV 26505. **Preliminary report on the myxomycetes of the New York City Catskill watershed.**

Myxomycetes (plasmodial slime molds) are eukaryotic, phagotrophic bacteriovores usually 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.

The Catskill area of the New York City watershed (NYCWS), while possessing extremely diverse habitats, has received very little study in regard to myxomycete occurrence. The primary emphasis of this study focuses on patterns of species composition, species diversity and taxonomic diversity. Twenty-six different species of myxomycetes representing 13 genera were recorded from moist chambers prepared from tree bark, bryophytes, leaf litter and other plant refuse, and herbivore dung collected at eight study sites. Study sites visited include an old growth Hemlock forest, a high elevation dry ridge, a sphagnum bog and abandoned successional farmland and a clear cut.

KELLY FINK, Dept. of Bioscience, Salem International University, Salem, WV, 26426 and **MIWAKO DENDA, SIMON KELLY, MELISSA REASER, SUZANNE M.D. ROGERS**, Dept. of Bioscience, Salem International University, Salem, WV, 26426, Rogers@salemiu.edu. **Hydroponic and wetland growth of emergent wetland monocots.**

Our long-term goal is to develop *in situ* detoxification strategies by genetically transforming the common wetland monocots, such as *Juncus* and *Typha*, with metal tolerance and remediation abilities. To do so tissue culture protocols, transformation techniques, greenhouse and wetland growth requirements,

and methods for testing plant metal responses are needed. Accessing metal response by plants grown in soil is difficult due to the complex nature of soils. This problem can be avoided by growing plants hydroponically in nutrient solution. The objectives were to 1. determine needs for establishment of tissue culture regenerated plants in the greenhouse; 2. determine the response of such plants to hydroponic growth systems; and 3. evaluate the needs of cloned plants for successful establishment in wetlands. For greenhouse establishment it was necessary to grow plants in vitro to several cm in height, and once transferred to soil immediately cover the plants with plastic for at least 2 weeks, to provide high humidity. Plants could not be transferred directly from culture to hydroponic conditions. Older multi-shoot plants could be washed of soil and grown hydroponically with aeration, using various levels of Hoagland's solution. Initially some leaf browning occurred, which may have been due to root damage that inadvertently occurred when soil was removed. Wetland establishment was very successful in open areas of wetlands, but difficult in areas where there was high competition from preexisting plants.

Acknowledgments. We wish to thank Salem International University and the NASA WV Space Grant Consortium for their financial support, Robert C. Byrd High School for furnishing greenhouse, laboratory, and wetland planting space, and RCB ecology students and Salem International students for their participation in these studies.

REBECCA HECKERT, DUSTIN HAAS, and ERICA HARVEY, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554. **Collaborative, multi-institutional on-line polymer project.**

Two chemistry students at Fairmont State College participated in a four-week online study of polymers during the spring semester as part of an honors laboratory section of Chemical Principles II. The web-based project was designed and facilitated by faculty members in South Carolina, under the auspices of Project PCOL (Physical Chemistry On-Line), a National Science Foundation supported collaboration among physical chemistry faculty members from around the country. Project activities included use of web resource pages to learn about polymer structure, morphology and uses, laboratory experiments to explore the mechanical properties of polymers, and collaboration with groups from other schools to select appropriate polymers for new design applications. The Fairmont State College students collaborated with students from Wofford College, University of South Carolina at Spartanburg, and Rider University. Communication via an online discussion board allowed an exchange of data measured at each local site and subsequent discussion of results and ideas. Data and results from the project, sample exchanges from the discussion board, and student and faculty reactions to the project will be presented.

CHRISTOPHER HORSTKAMP, MICHAEL HARMAN, AMBER RICKETTS, and EDWARD SNYDER, Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443. **Computer applications to analysis of bryozoan fossils.**

Bryozoans comprise an abundant and diverse fossil component of Paleozoic age rocks in North America and around the world. Analyses of Mississippian and Permian age Bryozoa employing digital imaging techniques is a current focus of the paleontological research lab at Shepherd College. Direct input of the digital images to the computer is a critical component of these developing techniques.

Bryozoa are microscopic colonial marine invertebrates that are taxonomically complex,

requiring both exterior and three-dimensional interior sections for both quantification and description. Prior to this digital technology, a timely and extensive photographic process was required for species identification. Quantitative analysis requires numerous measurements of significant characteristic of bryzoan colonies, which was formerly undertaken by hand on the photographs produced. The cost and time of photography, extensive time spent producing measurements, and the inability to readily provide photographic data to other workers in the field has been a significant encumbrance to the application of this abundant fossil group to studies in paleoecology, biostratigraphy and paleobiogeography.

As a result of this study, computer generated catalogs of these bryzoa were generated and stored on compact disc. This information is therefore readily accessible to all workers in the field, and incorporates raw data gathered and conclusions resulting from statistical analysis.

ELIZABETH MAGNESS and ALBERT MAGRO, School of Science and Mathematics, Fairmont State College, Fairmont, WV 26554.
Lipoxygenase and apoptosis in breast cancer cells.

The objective of this study was to test the hypothesis that the blocking of cellular lipoxygenases in human breast cancer cells inhibits cell growth, induces apoptosis and modulates the transcriptional expression of genes associated with apoptosis. The human breast adenocarcinoma cell line, MCF-7, was used. The MCF-7 cells were treated in culture with the acetylenic broad spectrum lipoxygenase inhibitor 5,8,11,14 eicosatetraenoic acid. Cell growth was measured by use of the MTT assay. Apoptosis was measured by detecting the amount of soluble DNA-histone complexes in the cytosol. Apoptotic gene expression was measured by RT-PCR.

Inhibition of the MCF-7 cell's lipoxygenases by 5,8,11,14 eicosatetraenoic acid decreased cell growth and induced apoptosis. The steady state expression of the anti-apoptotic gene, BAG-1, was also decreased by inhibiting the cell's lipoxygenases. Inhibition of the MCF-7 cell's cyclooxygenases by indomethacin had little effect upon the growth and apoptotic state of MCF-7 cells.

RONALD L. MARTINO, Dept of Geology, Marshall University, Huntington, WV 25755, and **BASCOMBE M. BLAKE, JR.**, West Virginia Geological and Economic Survey, Box 879, Morgantown, WV 26507. ***Walchian conifers from the Middle Conemaugh Group (Late Pennsylvanian), Wayne County, West Virginia.***

The objectives of this study are to document and evaluate the significance of a well-preserved flora from Late Pennsylvanian strata of southern West Virginia. The assemblage is dominated by foliage of the form genus *Walchia* Sternberg, and also includes lycopod leaves (*Lepidophylloides*) and *Cordaites*.

The flora is preserved as compressions and impressions in an olive green, silty shale that occurs about 8.5 m above the top of the Ames Limestone. This places the stratigraphic level of the assemblage in the lowermost Casselman Formation with a Stephanian A/B age. The strata were temporarily exposed in a gas pipeline trench on the north side of Cedar Run 0.37 miles NE of Rt. 52.

The depositional environment may have been a flood basin margin, which bordered an interfluvial upland. This interpretation is based on facies characteristics and relationships of the Cedar Run exposure and nearby outcrops, and the ecologic tolerances of the floral constituents. The lycopod leaves were probably derived from *Sigillaria*, since this was the only arborescent lycopod to survive the extinctions associated with the Westphalian/Stephanian boundary.

Sigillaria is thought to have preferred swamp margins. *Cordaites* could grow on either dry or wet substrates. They are also thought to have flourished along swamp margins, and were tolerant of episodes of drought and high sedimentation rates. *Walchia* required well-drained soils. Upland interfluvial areas would have developed during episodes of river downcutting and would be expected to be above the level of river flooding. Upland runoff may have enabled mixing of upland coniferous vegetation with poorly drained, flood basin lycopod vegetation. In order for a well-preserved, *Walchia*-dominated floral assemblage to develop, minimal transport and rapid burial would be likely. The necessary depositional conditions may have been associated with a heavy storm with upland runoff, followed by flood stage river discharge along the margins of the flood basin.

The Cedar Run assemblage represents one of only a very few documented occurrences of *Walchia* in the Appalachian Basin. Two slightly older occurrences have been reported, one of which was from a road cut in Charleston, WV. These older *Walchia* occurrences and the one reported here occupy an approximately 50 m stratigraphic interval within the Conemaugh Group that coincides with the earliest occurrence of widespread, red bed, paleo-vertisols. Possible implications could indicate a transition from poorly drained, lowland soils to better drained, upland habitats as suggested by previous workers. The regional extent and increasing amounts of pedogenic carbonate in the paleo-vertisols also points to a long-term transition from wetter to drier climates. Recent workers have suggested that Late Pennsylvanian, Milankovitch-driven, climate cycles occurred with alternating wet and dry phases. Well-drained upland soils and drier climates may have occurred during glacioeustatic lowstands of sea level. The drier phases may have enabled dry woodlands and

extant conifers to expand as wetland floras receded.

ROSA-LEE MILLER and **JOHN C. SENCINDIVER**, Division of Plant and Soil Science, West Virginia University, Morgantown, WV 26505; **RONALD H. FORTNEY**, Department of Civil and Environmental Engineering, West Virginia University, Morgantown, WV 26505; **DAWN BLACK** and **MARIBETH OVERKING**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; **DENNIS A. BURNS**, Dept. of Bioscience, Salem International University, Salem, WV 26426; **WILLIAM N. GRAFTON**, Division of Forestry, West Virginia University, Morgantown, WV 26506; **ROBERT B. COXE**, Western Pennsylvania Conservancy, 209 Fourth Avenue, Pittsburgh, PA 15222; **MARTIN SCHNITTLER** and **STEVEN L. STEPHENSON**, Dept. of Biology, Fairmont State College, Fairmont, WV 26554; and **HAROLD S. ADAMS**, Division of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422.
Soil properties along major highways of West Virginia.

The properties of soils developing on areas affected by highway construction, particularly cut and fill areas, are often drastically different than the properties of the surrounding undisturbed soils. Soils on "cut" areas will be thinner than native soils, resulting in a reduced volume of soil from which plants may absorb water and nutrients. Soils on "fill" areas may be compacted so that plant root growth is restricted. The formerly existing soil profile and underlying geologic material may be mixed, leading to acidic soils and loss of structure. Knowledge of these potential problems will assist in planning alternative methods for soil and rock handling. As part of a study to characterize roadside habitats and vegetation, composite soil samples (0-10 cm depth) were collected on 85 randomly selected sites adjacent to four-lane highways throughout the state. All soils were

analyzed for cation exchange capacity, pH, organic matter content, nitrogen release, soluble sulfur, extractable phosphorus, exchangeable cations, base saturation and extractable metals. While little is known about the treatment of these soils prior to sampling, preliminary analyses of the data suggest that in most cases, nutrient status is adequate, and there is no indication of toxic levels of elements. Therefore, if vegetation establishment and growth are inadequate on these soils, the problem may be related to soil physical properties or some other external factor rather than soil chemical properties.

AMY B. SPURGEON and JAMES T. ANDERSON, Wildlife and Fisheries Resources Program, West Virginia University Division of Forestry, PO Box 6125 Morgantown, WV 26506-6125. **Assessment of herpetofaunal distribution and abundance: a comparison between upland and riparian habitats.**

Historically, herpetofaunal species have received little attention in regards to conservation planning because they are inconspicuous components of the ecosystem. However, increased documentation of herpetofaunal population declines has resulted in increased awareness of the importance these species play in the environment. Human activities are a major cause of species eradication, often a result of habitat destruction, fragmentation, and pollution. Therefore, it is important to document the species that inhabit an area in order to determine the extent to which disturbances influence those individuals. The present study is being conducted on the Camp Dawson Army Training Site in Preston County, West Virginia. The site is used for military training and maneuvering exercises, some of which result in damage to the surrounding habitat. Surveys to compare species composition, relative abundance, and distribution of herpetofauna inhabiting upland

and riparian areas, as well as evaluating the influence that habitat edges have on species movement, diversity, and relative abundance are being conducted. Pitfall arrays with 7.5-m drift fences and double-ended funnel traps were operated for a total of 23,630 trap nights from 5 July 2000 to 27 October 2000 and produced a total of 488 individuals of 27 different species (11 salamander, seven snake, five frog, two toad, and two turtle). Redback salamander (*Plethodon cinereus*) and American toad (*Bufo americanus*) were the most abundant species recorded. Preliminary results suggest that herpetofauna are most abundant in forested, upland sites. Results will be used to provide management recommendations for maintaining herpetofaunal assemblages throughout the base.

STEPHANIE YOHO, AMY STEVENSKI, JESSE SIMON and ERICA HARVEY, Dept. of Chemistry, Fairmont State College, Fairmont, WV 26554. **Learning through teaching: Design and implementation of chemistry laboratory experiences for homeschoolers.**

Three Fairmont State College students pursuing majors in education enrolled in the Chemical Principles II honors laboratory course with the objective of developing a series of laboratory sessions to be offered to local homeschoolers. Approximately fifteen homeschool students, ranging in age from ten to fifteen, along with several parents, attended the sessions held in the chemistry laboratory at Fairmont State College. The honors students devised and tested the procedures and divided the homeschool students into small groups. Each honors student was in charge of a group and facilitated the students and parents in the performance of the procedures. In the first session the students helped the homeschoolers explore the most efficient salt solution for preventing roads from freezing during winter weather. During the second session the students assisted the homeschoolers in

synthesizing esters (fragrance compounds) and
formulating their chemical structures.

