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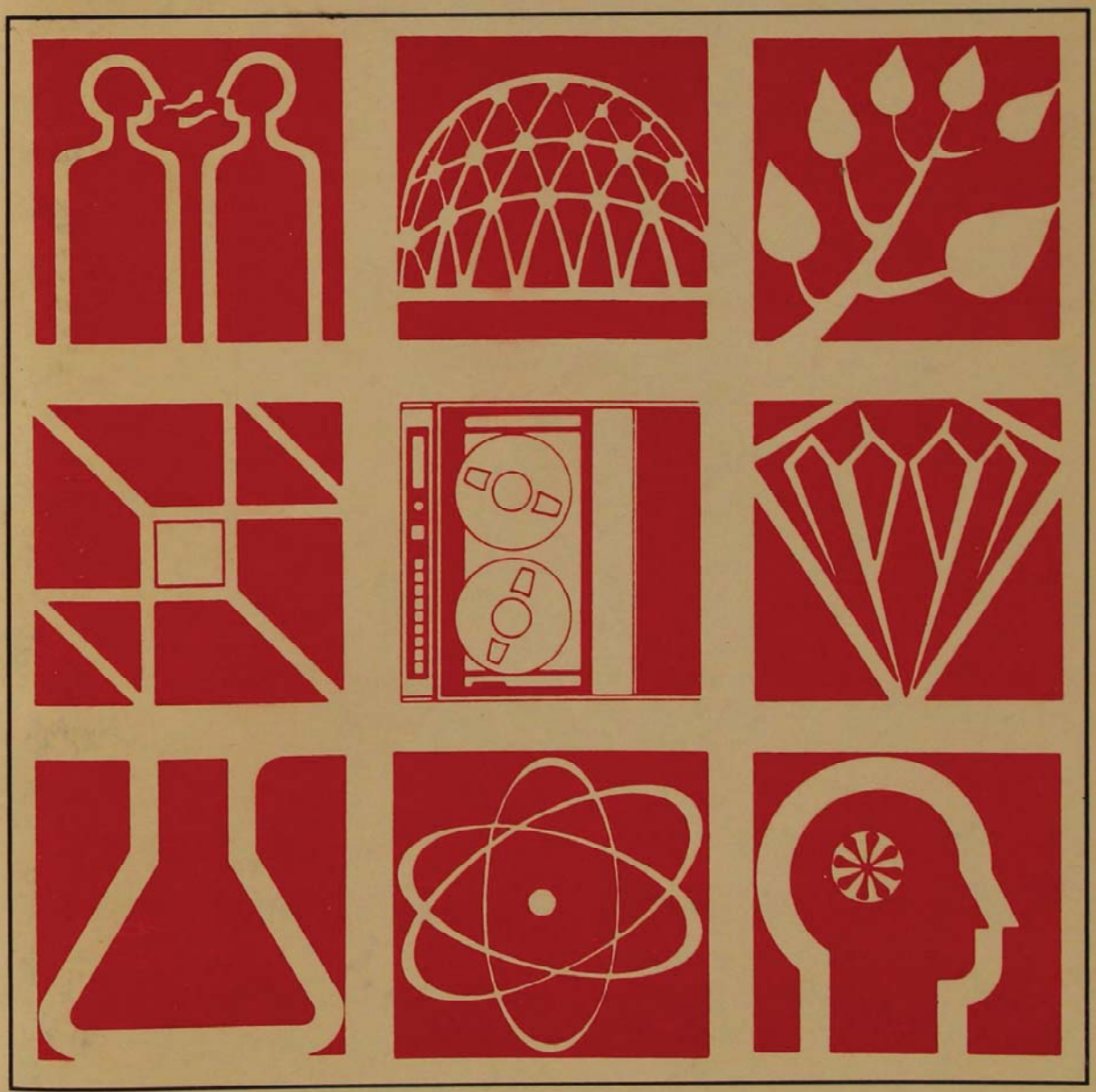

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BIOLOGY

PROCEEDINGS OF THE WEST VIRGINIA ACADEMY OF SCIENCE
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SEAN K. MEEGAN AND SUE A. PERRY. COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT, WEST VIRGINIA UNIVERSITY, PO BOX 6125, MORGANTOWN, WV, 26505-6125.
Periphyton Communities Dynamics in Headwater Streams of Contrasting pH.

We are assessing the influence of pH on periphyton communities in headwater streams of the Monongahela National Forest. These study streams differ in catchment geology, alkalinity, and mean baseflow pH (4.3, 6.2, and 7.7). Artificial tiles were placed in the streams to monitor differences in periphyton composition, chlorophyl a, and Ash Free Dry Weight (AFDW). Benthic chambers are also being used to estimate primary production. The alkaline stream had the highest species richness and eveness, whereas the acidic stream has the lowest. Chlorophyll a levels did not differ significantly between the alkaline and circumneutral streams, but were significantly lower at the acidic stream. No differences have yet been detected in AFDW estimates or production estimates. Low pH appears to effect the periphyton community by decreasing both species composition and biomass.

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THOMAS E. WEAKS, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Foliose and fruticose lichen communities of the New River Gorge National River.

Foliose and fruticose lichen communities were sampled from twenty-three study sites located between Fayetteville and Hinton, West Virginia. A total of 29 genera and 108 foliose and fruticose species were found to occur in the study area. The majority of species were corticolous, foliose forms. The number of species was highest for the genus Cladonia. Other genera represented by a high number of species were Parmelia and Parmotrema. Dominant species in the study area were Parmelia livida Tayl., Physcia millegrana Degel. and Pseudoparmelia caperata (L.) Hale. Species richness was found to be highest in areas where disturbance was intermediate on scales of intensity and frequency.

ALBERT M. MAGRO, Div. of Science, Mathematics and Health Careers, Fairmont State College, Fairmont, WV 26554. **An evolutionary basis for our sense of beauty of human form.**

Survey data were accumulated by having over 400 individuals report their perceptions of human physical characteristics. More than 100 comparative photographs and drawings were evaluated. The photographs and drawings compared anatomical shapes and proportions. The evaluators were instructed to select those shapes and proportions they considered most attractive. There was significant agreement among the evaluators as to what is considered attractive. When the resulting data were analyzed in the context of the paleoanthropic record for *Homo sapiens* and closely related hominids, the following hypotheses were formulated:

- **Aspects of our perceptions of physical beauty are innate.**
- **Physical characteristics of other species that are closely related to ours can be repulsive. This perception may assist in maintaining the separateness of our species and may be an avoidance of the risk of producing sterile offspring.**
- **Ancestral physical characteristics that are no longer expressed can be unattractive. This perception may be an avoidance of genetic regression.**
- **Evolutionary progenitive physical characteristics that are beginning to be expressed can be attractive. This perception may assist in maintaining a forward evolutionary direction.**

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HEATHER R. TRUITT, WILLIAM C. DALTON, and JOHN T. BURNS, Dept. of Biology, Bethany College, Bethany, West Virginia 26032. Temporal synergism of 5-HTP and L-DOPA in regulation of body weight in *Necturus maculosus.*

Temporal synergisms of circadian rhythms of neurotransmitter precursors may regulate the seasonal physiology of vertebrates (Albert H. Meier and John M. Wilson, Resetting Annual Cycles with Neurotransmitter-Affecting Drugs. In *The Endocrine System and the Environment*, ed. Follett, B. K., Ishii, S., and Chandola, A. pp. 149-156. Tokyo/Springer-Verlag, Berlin 1985). There were four experimental groupsof 7 or 8 salamanders each to receive neurotransmitter precursors of 5-hydroxytryptophan (5-HTP) and L-dihydroxy-phenylalanine (L-DOPA) in different

temporal relations and one control group of 8 salamanders that did not receive any injections. Beginning on January 14, the experimentals received daily injections of 0.1 mg/ .1 cc of 5-HTP at 0600 and daily L-DOPA injections of 0.1 mg/ .1 cc at either 0600, 1200, 1800, or 2400 for 10 days. Salamanders receiving neurotransmitter precursor injections had a loss ($P \leq .0001$, ANOVA) in body weight that differed with respect to the temporal relation of 5-HTP and L-DOPA injections. The 18-hour relation of neurotransmitter precursors was associated with the greatest loss in body weight ($.0005 < P \leq .005$, Student's t-test) as compared to the control group. This is evidence that temporal synergisms of neurotransmitters may regulate the body weight and the physiology of *Necturus maculosus*.

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MICHAEL DEMCHIK, Department of Biology, West Virginia University, Morgantown, West Virginia 26506 and DR. EDWIN MICHAEL, Department of Forestry, West Virginia University, Morgantown, West Virginia 26506. The Effect of Lunar Cycling on Collision Injuries in Raptors

Many studies have been done on the effect of lunar cycling and light intensity on the activity of small mammals; however, few studies have been done on the behavioral effects of light intensity on raptorial birds. Raptor injury reports from four raptor rehabilitation centers were used in this study. The reports were divided into diurnal (hawks, falcons and eagles) and nocturnal (owls) raptors. The lunar month was divided into four sections of equal length with each section having its midpoint on a different moon phase. ANOVA was used for analysis. Both new and full moon phases were found to have significantly higher occurrence of collision injuries ($P>0.003$) than the quarters. This was true for both diurnal and nocturnal raptors. Because diurnal raptors did not respond differently from nocturnal raptors, the cause of this difference is believed to be differences in small mammal behavior or geomagnetic differences that occur with change in moon phase.

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E. C. KELLER JR, and E. G. JESSEN, Department of Biology, West Virginia University, 26506 The Occurrence and Specific Associations of Spina Bifida with Environmental/Socio/Economic Attributes in the Counties of West Virginia.

Spina bifida is a congenital disease that belongs to a class of diseases known as neural tube defects. The causes of spina bifida are unknown, but generic, gender, and environmental factors are all thought to play significant roles

Correlation analysis were computed among the incidence of spina bifida and various environmental socio/economic, and other variables. In order to examine the incidence of spina bifida in relation to the environment, the relative incidence of spina bifida in West Virginia was examined by county.

This paper is concerned with two questions: 1) what, if any geographical, social, or environmental factors are related to the incidence of spina bifida and 2) are there "hot spots" of the occurrence of spina bifida in West Virginia?

The highest areas of occurrence of spina bifida are generally located in the northeastern (not including the eastern panhandle) and north-central part of West Virginia. This study also shows a higher incidence of spina bifida in counties having higher proportions of white residents, less affluent and less populated counties and less economically productive counties. Environmentally, the acidity and iron content of the natural waters of the state are strongly associated with the occurrence of spina bifida. Finally, geologically, the older formations (in the eastern non-panhandle portion of the state) are positively associated with the occurrence of spina bifida.

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GREG E. POPOVICH, Fairmont State College, Fairmont, West Virginia 26554. Human Pheromones: Phact or Phiction?

The debate rages on -- do humans possess the ability to secrete and detect chemical messengers like so many other species of the animal kingdom? In an attempt to provide a definitive answer, pheromonal research on human beings was exhaustingly

investigated. The information compiled represents findings from over two decades of study and includes even the most current research in the field. Various techniques of study, which have been employed by psychologists, physiologists, and biochemists, have provided insight into the anatomical structures that are most likely responsible for pheromonal release and detection-- parts of our bodies that we didn't know we had. Experts propose that human pheromones exist in both molecularly cumbersome ring forms and volatile short chain structures. These geometric differences allow for an intimate lock-and-key relationship with the controversial vomeronasal organ in the nose, which supposedly works independently of olfaction. These substances may be responsible for a host of behaviors via intrinsic hormonal actions as well as by manipulating our very own endocrine systems. Scientists and entrepreneurs alike theorize many uses for human pheromones, some of which are somewhat frightening since true pheromones would work beyond conscious control. After careful examination of data, one might conclude that, perhaps for millennia, man has been denying the existence of a primal sixth sense.

PROCEEDINGS OF THE WEST VIRGINIA ACADEMY OF SCIENCE
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TIMOTHY S. MCCLAIN, Dept. of Biology, Shepherd College, Shepherdstown, West Virginia 25401 and CLIFF STARLIPER, National Biological Survey, 1700 Leetown Road, Kearneysville, West Virginia 25430. Aeromonas Salmonicida Resistance to Antimicrobials in Salmonid Fishes.

The disease furunculosis causes significant disease and mortality in hatchery reared and wild fishes, primarily salmonids. The disease is characterized by swelling, lack of appetite, internal hemorrhaging and external lesions. Furunculosis is caused by the bacterium Aeromonas salmonicida which is a gram negative, oxidase positive, fermenter. An effective treatment for furunculosis is by use of Romet 30, which is a potentiated sulfa drug comprised of five parts sulfadimethoxine and one part ormetoprim. Treatment is 50 mg per Kg of fish per day for five days through feed incorporation. Romet was approved in 1984 for use in salmonids. In recent years certain hatchery managers have noticed reduced effectiveness of Romet in reducing disease and mortality. Edwardsiella ictaluri, an enteric, also treated by Romet has been shown to exhibit similar resistance. Work by (Starliper et al 1993) has shown this resistance to be plasma mediated. The present study involved a survey of twelve hatcheries across the north eastern United States to identify potentially resistant strains known to have furunculosis. About six hundred A. salmonicida strains were screened using the Kirby Bauer method against Romet. Varying degrees of resistance were found and the most resistant were selected. Thirty-eight geographic origins were selected and compared with four wild type strains. The reason for comparison was to determine the presence of other phenotypic markers in addition to Romet resistance. The forty-two isolates were screened with about forty antimicrobials and about sixty biochemical tests. The significant resistance markers found were Sulfamerrizine, Tetracycline, Oxytetracycline and Tribrissene. To a lesser extent resistance was found in the three antimicrobials Rifamtin,

Cefazolin and Chloramphenicol. Future work will involve transconjugate matings and agarose gel electrophoresis.

TRICIA SCOTT, KAREN WOLFE, and ALBERT M. MAGRO, Div. of Science, Mathematics and Health Careers, Fairmont State College, Fairmont, WV 26554. **Development of a rapid and sensitive assay for antigen specific immunoglobulins.**

An immunochemical assay to measure the titer of antibodies directed at specific antigens was developed and characterized. The assay is a novel combination of a number of proven and established procedures. The assay consists of the following:

Formalin treated *Staphylococcus aureus* was mixed with various dilutions of antisera. This formed a stable immunoglobuin *Staphylococcus aureus* complex that could be washed and pelleted by centrifugation. The *Staphylococcus aureus* antibody complex was then incubated with antigen that had been previously conjugated with biotin. The interaction of the antigen-biotin conjugate with specific antibodies on the cell surface formed a new complex that was washed and pelleted. The new complex was then incubated with an avidin-alkaline phosphatase conjugate and washed. The high affinity avidin-biotin binding resulted in a final complex containing an alkaline phosphatase concentration which was dependent upon the levels of specific antibody originally bound to the *Staphylococcus aureas*. Alkaline phosphatase enzymatic activity was determined by incubating the final complex with the substrate p-nitrophenyl phosphate. The concentration of the generated p-nitrophenol was determined colorimetrically. The assay proved to be a safe, rapid and sensitive measure of the titer of antisera directed against specific antigens.

PROCEEDINGS OF THE WEST VIRGINIA ACADEMY OF SCIENCE
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JEFFREY W. McCLURE and THOMAS E. WEAKS, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. New and rare lichens of West Virginia from the New River Gorge National River.

Three species of lichens are reported from West Virginia for the first time: Parmotrema austrosinense (Zahlbr.) Hale, Parmotrema mellissii (Dodge) Hale and Parmotrema tinctorum (Nyl.) Hale. For all three species, this represents a northern range extension. In

the case of P. tinctorum, this is a major range extension. Five rare species are reported from the New River Gorge: Parmotrema madagascariaceum (Hue) Hale, Platismatia glauca (L.) Culb & Culb. Hypotrachyna formosana (Zahlbr.) Hale, Hypotrachyna revoluta (Flk.) Hale, and Lobaria pulmonaria (L.) Hoffm.

BOTANY

JAMES RENTCH, School of Engineering and Science, West Virginia Graduate College, Institute, West Virginia 25112 and RONALD H. FORTNEY, School of Engineering and Science, West Virginia Graduate College, Institute, West Virginia 25112. The vegetation of West Virginia grass bald communities.

The vegetation of six West Virginia high elevation areas historically considered as grass balds were examined. All sites were in areas once dominated by a climax red spruce forest and are now surrounded by remnant spruce and northern hardwood forests. Sites ranged in elevation from 3,800 to 4,700 feet and had slopes from 0 to 15%. Five sites were west-southwest facing. One site, which differed in aspect (SE facing), had succeeded to partial canopy closure and was not sampled. Areas sampled ranged from 0.25 to 10 ha. Shrub herbaceous and ground layers were sampled using the point frequency intercept method. Three taxa were found at all five sampled sites; twenty-seven were found at only one site. Danthonia compressa Aust. was the dominant herb on three sites; Deschampsia flexuosa (L.) Trin. was dominant on one site. The relative frequency of graminoids exceeded 46% for four of the five sites. Shrub layers were dominated by ericads, particularly Vaccinium vacillans Torr. and V. angustifolium Ait. Combined frequency for ericads was greater than 62% for all sampled sites. Occurring at three sites was a ground layer of Polytrichum spp. and Lycopodium flabelliforme Blanchard. Individuals or clumps of Fagus grandifolia Ehrh. and stunted Crataegus punctata Jacq. were widely scattered over most sites. Diversity indices for each sampled site were generated. The site highest in species diversity was lowest in frequency for graminoids; species diversity negatively correlated with graminoid frequency ($r = -0.565$). Community similarity between the West Virginia sites and three southern Appalachian sites was also examined, and single axis polar ordination was performed based on percent dissimilarity. Historical profiles of the sites were compiled, and an hypothesis of bald origin and maintenance successfully.

TARA DUBEY, Dept. of Biology, Northern Illinois University, De Kalb, Illinois 60115. Effect of Diflubenzuron on B-glucosidase activity of Trichoderma reesei QM9414

The effect of Diflubenzuron on B-glucosidase activity of Trichoderma reesei was studied to get some idea of the possible influence of the pesticide on the cellulase enzyme complex of this fungus. B-glucosidase activity was measured using filtrates of fifteen day old cultures growing on the basal medium of Reese and Mandel, treated with different concentrations of Diflubenzuron, and incubated at 28°C. Absorbance was measured with a Bausch and Lomb spectrophotometer at 420 μm after incubating the reaction mixture at 50°C for one hour. Response of B-glucosidase was maximal in the control and was gradually suppressed with the addition of Diflubenzuron in concentrations of 10, 20, and 50 ppm. Response of this enzyme was different from those obtained for crystalline cellulase and CMCase, which showed increased activity when treated with these same three concentrations of Diflubenzuron. (Supported in part by funds provided by the USDA Forest Service.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, TARA DUBEY, Dept. of Biology, Northern Illinois University, De Kalb, Illinois 60115, GARY A. LAURSEN, Dept. of Biology and Wildlife, University of Alaska, Fairbanks, Alaska 99775, and GLENN P. JUDAY, Agricultural and Forestry Experiment Station, University of Alaska, Fairbanks, Alaska 99775. Aquatic fungi in streams of the Granite Cove Research Natural Area in southern Alaska.

Aquatic fungi in four small streams of the Granite Cove Research Natural Area, located near the western edge of the terminus of the Columbia Glacier in southern Alaska, were studied during the 1993 field season. Sampling methods used included (1) placing 12 different types of organic baits directly in the streams for a period of several days and (2) filtering conidia from samples of stream water. At least 23 species of lower fungi (15 chytridiaceous fungi, seven water molds, and one zygomycete) and 12 species of hyphomycetes were recorded from organic baits. At least 38 taxa, including 33 aquatic hyphomycetes and 5 dermatiaceous hyphomycetes, were identified from conidia filtered from samples of stream water. Numbers of conidia ranged from 127 to 1560 per 1000 ml of water, and the number of hyphomycete taxa found in a particular stream ranged from 20 to 27. Interestingly, the stream with the highest number of hyphomycete taxa present had the lowest number of lower fungi (only 5 taxa), whereas the highest number (12 taxa) was recorded from the stream with the fewest hyphomycetes. This suggests that in high-latitude streams the physio-chemical parameters most suitable for aquatic hyphomycetes may not favor the growth of many lower fungi. (Funded in part by a grant from the USDA Forest Service.)

ANURAG AGRAWAL, JENA R. HICKEY, DAVID F. HORNE, RICHARD C. SHINAMAN, and STEVEN L. STEPHENSON, University of Virginia Mountain Lake Biological Station, Pembroke, Virginia 24136. Vegetation-site relationships and successional dynamics of upland forest communities in the Mountain Lake area of southwestern Virginia

Studies of forest communities carried out as part of a vegetation mapping project at the University of Virginia Mountain Lake Biological Station in southwestern Virginia during the 1993 field season included analyses of (1) the successional dynamics and dendro-ecological (tree-ring) patterns of a former chestnut-dominated community on the NW-facing slope of Bald Knob, (2) environmentally-induced compositional differences in oak (Quercus spp.) communities at three different elevations and on two different aspects on Salt Pond Mountain, (3) successional dynamics of a scrub oak (Q. ilicifolia) community near the summit of Bald Knob, and (4) vegetation-site relationships of forest communities on the noses and hollows of a series of ridges on the N-facing slope of Big Mountain. Each of these studies was designed to provide data that could be incorporated into a high-resolution vegetation map being developed for Salt Pond Mountain. The general pattern of upland forest vegetation in the general study area is relatively well known. Northern red oak (Q. rubra) and chestnut oak (Q. prinus) are the usual dominants in most situations, with red maple (Acer rubrum), white oak (Q. alba), black oak (Q. velutina), and hickory (Carya spp.) also important. However, because of factors related to disturbance history, topography, and the underlying geology, major compositional differences in the tree stratum can exist within a rather limited area. The purpose of the four studies to be discussed in this presentation was to examine some of the ways in which these site factors influence the pattern of forest vegetation at particular localities on Salt Pond Mountain. (Supported by a Research Experiences for Undergraduates grant from the National Science Foundation.)

JOHN C. LANDOLT, Dept. of Biology, Shepherd College, Shepherdstown, West Virginia 25443, STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, DAVID F. HORNE, Dept. of Biology, Davidson College, Davidson, North Carolina 28036, and JAMES C. CAVENDER, Dept. of Environmental and Plant Biology, Ohio University, Athens, Ohio 45701. Recent collections of dictyostelid cellular slime molds from Central and South America.

Soil and litter samples collected from a cloud forest, a primary rain forest, and a secondary rain forest in Costa Rica were examined for dictyostelid cellular slime molds. The total number of forms isolated was 14, with greater species richness (7 forms each) and density (305 clones/g and 185 clones/g, respectively) recorded for the relatively undisturbed cloud forest and primary rain forest than for the secondary rain forest (6 forms and 28 clones/g). Interestingly, no single form occurred at all three sites, and a different form was the overwhelming dominant at each site. Soil and litter samples collected from six different forest study sites along the Amazon River in eastern and central Brazil also were examined for dictyostelids. At least 13 forms were recovered, including representatives of all three major genera. Dictyostelium purpureum and Polysphondylium pallidum were, by far, the most frequent and abundant forms isolated. Species richness ranged from 2 to 7 forms per study site, with dictyostelid densities ranging from 27 to 2043 clones/g.

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554. Distribution, ecology, and biogeographical relationships of New Zealand myxomycetes.

The data represented by a total of 687 field collections of myxomycetes were analyzed to obtain information on the patterns of occurrence, substrate relationships, and phenology of these organisms in two regions (northern [34-38° S latitude] and southern [38-47° S latitude]) of New Zealand. To assess biogeographical relationships, these same data were compared with similar data sets available for two study areas (located at 37° and 38° N latitude) in the mid-Appalachians of eastern North America, a study area in central Alaska (63-64° N latitude) in extreme northwestern North America, and study areas in northwestern (31° N latitude) and southern (12-13° N latitude) India. In general, the assemblages of myxomycetes present in New Zealand appear to be compositionally rather similar to those found in other regions of the world. Compared to most organisms, myxomycetes seem to show very little evidence of endemism. However, even though myxomycetes are among the most widely distributed of all terrestrial organisms, they do exhibit evidence of spatial distribution patterns that can be related to differences in climate and/or vegetation. These patterns are most evident when the differences that exist in the assemblages of species present in temperate and subtropical/tropical regions of the world are considered. (Supported by a grant from the National Geographic Society.)

HAROLD S. ADAMS, Dabney S. Lancaster Community College, Clifton Forge, Virginia 24422, STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, DAVID M. LAWRENCE, Dept. of Environmental Science, University of Virginia, Charlottesville, Virginia 22903, MARY BETH ADAMS, USDA Forest Service, Timber and Watershed Laboratory, Parsons, West Virginia 26287, and JOHN D. EISENBACK, Dept. of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. A gradient analysis of the red spruce/hardwood ecotone in the central Appalachians of Virginia and West Virginia

We are currently investigating patterns of species composition and distribution, ecologically important population processes, and microenvironmental gradients in

permanent transects (each consisting of a series of contiguous 10 x 10 m quadrats) established across the typically abrupt and narrow spruce/hardwood ecotone at five localities in the mountains of central West Virginia and western Virginia. Primary emphasis of our research is directed toward testing three basic hypotheses: (1) red spruce communities in the mid-Appalachians are decreasing in areal extent due to encroachment of surrounding hardwood communities, (2) stress-induced growth decline in red spruce is a factor in this decrease, and (3) the direction and rate of successional change can be predicted from models developed from quantitative data obtained from field studies of spruce/hardwood ecotones. Data obtained for a second growing season at two transect localities show that changes (based on percent dissimilarity in composition) in the tree stratum across the transect were greatest in the ecotone region (3.4% and 14.3%), with the least change at the conifer end (0.4% and 0.6%). The changes occurring among saplings and seedlings at the two localities differed to such an extent that no distinct trends were observed. Soil chemical factors for transects from which samples were collected displayed no consistent general trends, but varied from locality to locality. At all but one locality, concentrations of Al in the soil solution were generally high (up to 602 ppm). Plant parasitic nematode populations also varied from locality to locality, but Hemicycliophora sp. and Macropostonia sp. were generally abundant. Preliminary data obtained during the 1992 and 1993 field seasons suggest that mid-Appalachian red spruce communities presently exist at least in static equilibrium with respect to surrounding hardwoods and exhibit, at some localities, advance regeneration into the hardwood communities. (Supported in part by funds provided by the USDA Forest Service.)

RONALD H. FORTNEY, School of Engineering and Science, West Virginia Graduate College, Institute, West Virginia 25112, STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, and J. FRANK MCCORMICK, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37996. Changes in forest composition on the SW-facing slope of Beanfield Mountain in southwestern Virginia

A former oak-chestnut forest community on the SW-facing slope of Beanfield Mountain in the Mountain Lake area of southwestern Virginia previously sampled in 1939 and 1970 was resampled during the summer of 1993 to assess the successional changes that have taken place over the past half century. In 1939 an oak complex dominated by northern red oak (Quercus rubra L.) had replaced the chestnut-oak forest at elevations above 850 m. The 1970 study found that pignut hickory (Carya glabra [Miller] Sweet) had replaced chestnut as a codominant, with red maple (Acer rubrum L.) invading clearings. Therefore, the predominant forest was oak-hickory a half century following the chestnut blight. However, in 1993 hickories (pignut and mockernut, C. tomentosa [Poiret] Nuttall), with a combined importance value (IV) of 8.8 (maximum IV = 100), accounted for less of the canopy layer, and red maple had become a canopy codominant (IV = 17.1). Northern red oak and chestnut oak (Q. prinus L.) were the dominant oaks, with importance values of 18.2 and 14.6, respectively. Sweet birch (Betula lenta L.) also was a consistent component of the canopy (IV = 8.6), and striped maple (A. pensylvanicum L.) was an important understory species (IV = 11.9). Nearly seventy-five years following the blight, oaks have maintained their codominant status. Hickories, however, are less important than they were in 1970, while red maple and sweet birch are more important. As observed elsewhere in the central Appalachians, red maple is becoming an increasingly important component of the deciduous forests once dominated by chestnut. What was described as an oak-hickory forest in 1970 can now be characterized as an oak-maple forest. The importance of red maple is predicted to increase further, since potential recruitment was observed to be high throughout the study area.

HAROLD S. ADAMS, Div. of Science and Mathematics, Dabney S. Lancaster Community College, Clifton Forge, Virginia 24422 and STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554. An ecological study of high-elevation beech communities in western Virginia

Forest communities in which American beech (Fagus grandifolia Ehrh.) is a major component of the tree stratum occur at elevations up to 1830 m in the southern Appalachians. Such communities are well-documented for the Great Smoky Mountains, where they have been the subject of a number of studies. Beech communities appear to be relatively uncommon in the mid-Appalachians, and only rarely have examples of this forest community type been described for particular localities in western Virginia. In the present study, data on the composition and structure of the vegetation were obtained for forest communities with beech present as a dominant or codominant species at one study site on Mount Rogers in Smyth County and three study sites in the Mountain Lake area of Giles County. Soils data also were obtained for the three Mountain Lake study sites. The importance value (one half the sum of relative basal area and relative density) of beech in the tree stratum ranged from 23.4 to 43.8, whereas values for density (stems/ha) and basal area (m^2/ha) ranged from 280 to 990 and 16.3 to 27.3, respectively. Soil pH values for the three sites for which these data exist averaged 3.6. Interestingly, two ridgetop study sites were characterized by mean values of soil nitrogen 77 times higher than those recorded for a third study site located in a nearby shallow ravine.

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CHRISTOPHER T. RUHLAND and THOMAS A. DAY, Dept. of Biology, West Virginia University, Changes in ultraviolet-B radiation screening effectiveness with leaf age in *Rhododendron maximum*.

Leaves of evergreen plants such as rhododendron are exposed to large cumulative doses of ultraviolet-B radiation(UV-B; 300nm). The UV-B screening effectiveness of five leaf cohorts was assessed in shaded, naturally growing *Rhododendron maximum*. Epidermal transmittance and depth of UV-B penetration were measured with a fiber-optic microprobe. Epidermal transmittance (and depth of penetration) decreased with leaf age in 1 to 4 year old leaves, averaging 32 (62), 22(52), 16(45) and 13% (48μm) respectively. We assessed concentrations of UV-B absorbing compounds and anatomical characteristics to explain differences in screening effectiveness. Concentrations of UV-B-absorbing compounds increased with leaf age on both an area and dry weight basis. Epidermal thickness also increased with age due to cuticular thickening. Leaf surface reflectance of UV-B was about 4% and did not vary with leaf age. Current-year leaves were more effective at screening UV-B than 1 to 4 year-old leaves. Surprisingly, they had low flavonoid concentrations. In contrast to older leaves, effective UV-B screening by current-year leaves appears related to a thick epidermal layer, and in particular a greater epidermal cell height.

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JAGAN V. VALLURI, JASON BARNETT, JAMES MARCUM, and H. WAYNE ELMORE, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Protein synthesis in sandalwood callus cultures in response to drought and heat shock.

Environmental stresses such as drought and heat shock have been shown to elicit the production of specific protein in plants. A knowledge of the molecular responses such as gene expression during cellular adaptation would be helpful and might lead to the identification of the altered putative genes. Sandalwood callus was maintained on Murashige and Skooge medium supplemented with 1 mg/L 2,4-D and 1 mg/L benzyladenine. Rapidly growing sandal callus was exposed to low water potentials ranging from -0.4 MPa to -2.5 MPa and to elevated temperatures ranging from 32C to 42C. Protein changes induced by drought-and heat shock were assessed by SDS-polyacrylamide gel electrophoresis. After 48 h of exposure to stress, a 30% reduction in callus volume was observed. Moderate protein losses were apparent during the initial stress period of 2 to 48 h. Several low and high molecular weight proteins were enhanced during longer stress periods of 3 to 7 days. Although new proteins appeared to be synthesized only during stress, some were detectable at low levels in control tissue.

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KIMBERLEY W. CUNNINGHAM and THOMAS E. WEAKS, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Bryophytes of the New River Gorge National River.

Mosses and liverworts were sampled from twenty-three study sites located in the vicinity of the New River Gorge National River of West Virginia. A total of 114 species of mosses and 23 liverworts were collected. Much of the study area has been severely disturbed by coal mining, coke oven operations, timbering, and farming. Species richness of bryophytes was higher where disturbance had occurred than in relatively undisturbed areas. The majority of mosses present were epigaeic, heliphobous, pleurocarps. Dominant genera of mosses were observed to include the genera Brachythecium, Hypnum, and Thuidium. Only one species of Sphagnum (Sphagnum centrale C. Jens ex Arn & C. Jens.) was encountered. Most liverworts present were heliphobous, thallose forms. Dominant genera of this group of bryophytes were found to include Porella and Frullania.

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REBECCA A. HALL, MELINDA G. HOGAN and THOMAS E. WEAKS, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Periphyton of the tributaries of the New River Gorge National River.

Periphyton community structure was studied in thirteen tributaries of the New River. Six of these streams receive moderate to high levels of industrial and domestic organic pollutants. Industrial waste are primarily generated by white-water rafting operations. The other seven streams do not receive industrial waste and are generally free of domestic pollutants. Periphyton species diversity ranged from 0.58-0.93 in polluted streams and 0.08-0.64 in unpolluted streams. Species richness was low in both polluted and unpolluted streams when compared with other streams of West Virginia. The highest species richness (25) was found to occur in Wolf Creek, a stream moderately polluted with industrial waste. The highest cell density (2.9×10^{1} cm^{-2}) was recorded for the Left Fork of Fern Creek, a relatively polluted stream. The dominant algal types of polluted and unpolluted streams were in most cases blue-green algae and diatoms. Schozothrix calcicola (Ag) Gomont was the only dominant blue-green alga. However, in one stream, a small branch receiving run-off from a sewage treatment plant, the dominant species was Scenedesmus quadricauda (Turp.) Brebisson, a green alga. Periphyton indicator species suggest the presence of high levels of salt brine (principally NaCl), oil, and iron.

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CHARLES E. PUCKETT and DAN K. EVANS, Herbarium, Department of Biological Sciences, Marshall University, Huntington WV, 25755. The origin and status of the sterile hybrid *Carex deamii* Hermann (Cyperaceae).

Carex deamii Herm. is the putative hybrid of *Carex shortiana* Dew. and *Carex typhina* Michx. (Cyperaceae). The fact that *C. deamii* is a sterile hybrid is of little debate, due to the fact that neither viable pollen nor developed achenes have been found in any specimen. Because of *C. typhina's* close taxonomic relationship with *C. squarrosa* L., the exact paternal contributor from this group is a matter of debate. This study examined fourteen quantitative characters from 59 herbarium specimens representing the three suspected parental contributors and the hybrid from a wide geographic range. Characters were analyzed with principal component analysis, canonical discriminant analysis, analysis of variance, and Duncan's multiple range test. F values ranged from 1.02 to 211.99 and demonstrated a close morphological relation-

ship between *C. typhina* and *C. shortiana*, thus suggesting that the later is the maternal contributor to the hybrid. Statistical analysis showed an over-lapping relationship between *C. typhina* and *C. squarrosa*, making a statistical determination of species based on morphology very difficult. Thus, the paternal contributor of the cross is difficult, if not impossible to determine using morphology alone.

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SOPHIE LONG and THOMAS A. DAY, Dept. of Biology, West Virginia University, Morgantown, West Virginia 26506-6057. Penetration of ultraviolet-B radiation in the reproductive parts of *Hesperis matronalis* (dame's rocket).

Increased ultraviolet-B radiation (UV-B; 300 nm) resulting from depletion of stratospheric ozone may damage plant reproductive parts, thereby reducing plant fitness. To determine how far UV-B penetrates into the floral structure of *Hesperis matronalis* (dame's rocket), a fiber-optic microprobe was inserted into intact flowers perpendicular and parallel to the flower axis, and into individual sepals, petals, and ovaries. Compared to other floral parts, ovaries were very effective in screening UV-B. The epidermis of ovaries absorbed about 98% of incident UV-B, compared to about 37% and 15% in sepals and petals, respectively. Analysis of concentrations of UV-B absorbing compounds (flavonoids) in sepals, petals, and ovaries support these findings; ovaries have a much higher concentration of flavonoids relative to other floral parts. The intact floral structure appears to be very effective in screening UV-B before it reaches ovules in *Hesperis matronalis*. Pollen had lower concentrations of flavonoids than the female reproductive parts. Pollen may be the most UV-B susceptible reproductive part in *Hesperis matronalis*.

DAVID M. LAWRENCE, Dept. of Environmental Sciences, University of Virginia, Charlottesville, VA 22903, HAROLD S. ADAMS, Div. of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, VA 24422, STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, WV 26554, TAREK A. HIJAZ, Dept. of Environmental Sciences, University of Virginia, Charlottesville, VA 22903, CHARLES W. LAFON, Dept. of Geography, University of Tennessee, Knoxville, TN 37996, NEIL A. PEDERSON, School of Forestry, Auburn University, AL 36849, MARGOT C. WILKINSON, Dept. of Environmental Sciences, University of Virginia, Charlottesville, VA 22903, and P. JOY YOUNG, Savannah River Ecology Laboratory, University of Georgia, Aiken, SC 29803. A dendroecological comparison of three mid-Appalachian red spruce populations.

Red spruce (Picea rubens Sarg.) is the tree species most characteristic of the subalpine coniferous forests that occupy higher peaks and ridges of the Appalachian system from Maine to Tennessee and North Carolina. The distribution of spruce is restricted in the mountains of central and southwestern Virginia; indigenous populations exist at no more than about a dozen locations. The primary objective of the present study was to construct and then to compare tree-ring chronologies for three spruce populations (Little Spruce Bog, War Spur, and Mann's Bog) in the Mountain Lake area of southwestern Virginia. A secondary objective was to collect data on community composition, spruce age structure, and spruce growth characteristics at the three sites. The spruce populations at the three sites represent three distinctive age groupings, ranging from an average of 61 rings (breast height) at Mann's Bog to 195 rings at War Spur. Chronologies for the three sites for the period of 1940 to 1992 were generally similar. Correlation (response function analysis) of growth with climatic factors (monthly mean temperature and total precipitation for June of the prior year through August of the year of ring formation) was unique for each site, although weak overall with significant autocorrelation with growth in previous years. At Mann's Bog, where competitor density was greatest and trees were the youngest, no significant correlations of growth with climatic factors were detected. Temperature in July of the prior growing season and April of the current growing season and precipitation in September of the prior growing season were significantly correlated (all positively) with tree growth at Little Spruce Bog. Growth of the old-age trees (with the least competitor density) at War Spur was significantly correlated (positively) only with November temperature of the prior growing season. It is interesting that red spruce trees growing in such close proximity should respond so differently to these climatic factors. This would suggest that growth of these trees is affected more by specific local site factors than by regional climatic factors.

SUSAN MOYLE STUDLAR, Dept. of Biology, West Virginia University, Morgantown, West Virginia 26506 and SUZANNE McALISTER, Botany Depart. Oklahoma State University, Stillwater, Oklahoma 74078
Bryophyte Communities at Boehler Seeps, Oklahoma.

Boehler Seeps and Sandhills Preserve in southeastern Oklahoma includes wetland communities which are unusual for Oklahoma. Concern over the ecological impact of paving the road through the preserve led to this study. To provide baseline data for ecological monitoring, we prepared a preliminary bryophyte flora, and also did intensive vegetation analysis of bryophyte communities north and south of the road: in the acid hillside seep at the north end of Boehler Lake, and in the marsh at the south end of Hasell Lake. The two sites were sampled using stratified random sampling and ten continuous strip transects. The preliminary flora for the preserve is 63 species: 48 mosses and 15 hepatics. Eighteen species occurred on the ten transects (14 mosses and 4 hepatics). The dominant species (based on absolute cover) at the two sites are:

Aulacomnium palustre, Helodium paludosum, Pallavicinia lyellii, Sphagnum lescurii, and Polytrichum commune. These are all wetland species often found on acidic substrates. Distinctive zonations of species were evident through graphing the data, including ordination (DCA). These zones evidently reflected topographic gradients, and the availability of water and suitable subtrates. If disturbances (such as road improvement) alter the water levels and water chemistry of the wetlands, we expect these environmental changes will be indicated by changes in the zonations and species composition of bryophyte communities. (Supported in part by funds from the Oklahoma Nature Conservancy).

DENISE E. BINION, LORINDA K. FUNK, JOANN B. SPOONER, and STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554. An educational workshop on tropical forests in Costa Rica.

The Central American country of Costa Rica, with a total area of approximately 50,700 km^2, is about the size of West Virginia. Although relatively small, Costa Rica is geographically rather diverse and contains a wide range of tropical habitats and an extraordinary variety of plants, insects, birds, and other animals. In March 1994, as part of a course in tropical biology, a group of students from Fairmont State College spent a week in Costa Rica, where they had the opportunity to observe and study tropical forests on a first-hand basis. Among the places visited were the Monteverde Cloud Forest, the La Selva Biological Station, Braulio Carrillo National Park, and the Santa Elena Rain Forest Reserve. The purpose of this presentation is to describe and illustrate certain aspects of this unique educational experience. (Supported in part by funds provided by the Fairmont State College Foundation.)

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, YURI NOVOZHILOV, Komarov Botanical Institute, St. Petersburg, Russia, and GARY A. LAURSEN, Dept. of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 97755. A preliminary report of myxomycetes from boreal forest and Arctic tundra ecosystems of central Alaska and eastern Russia.

We are currently investigating the occurrence, distribution, and abundance of myxomycetes (plasmodial slime molds) in high-latitute boreal forest and Arctic tundra ecosystems of northwestern North America and northeastern Russia. The purpose of this preliminary report is to list those species of myxomycetes recorded to date from the Mainitz Lake region (63°35 N latitude, 176°45' E longitude) of the Chukotskaja Republic in eastern Russia and the Kantishna Hills region (65°35' N latitude, 150°43' W longitude) of Denali National Park and Preserve in central Alaska. The approximately 200 specimens upon which this report is based were collected during the 1984 field season (Russia) and during the period of 1991-93 (Alaska). Species recorded from both regions include Arcyria incarnata, Comatricha nigra, Didymium squamulosum, Enerthenema papillatum, Lycogala epidendrum, and Trichia decipiens. Interestingly, collections from the study site in eastern Russia, where the climate is transitional between continental and marine, include three snowbank species (Diderma niveum, Lamproderma arcyrioides, and Lepidoderma carestianum), but this special ecological group of myxomycetes is not represented among the collections from the study site in central Alaska, which is characterized by a continental climate. (Supported in part by a grant from the National Park Service.)

JOHN C. LANDOLT, Dept. of Biology, Shepherd College, Shepherdstown, West Virginia 25443, STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, GARY A. LAURSEN, Dept. of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, Alaska 99775, ROSEANN DENSMORE, National Park Service, Denali National Park and Preserve, Alaska 99755, and GLENN P. JUDAY, Agricultural and Forestry Experimental Station, University of Alaska Fairbanks, Fairbanks, Alaska 99775. Recent collections of Alaskan cellular slime molds: a review.

Recent collections of dictyostelid cellular slime molds (CSM) from Alaskan soils and litter have included representatives of at least seven different described species, two recognized varieties of one species, and several isolates which do not fit any current species descriptions. The rather cosmopolitan species, Dictyostelium mucoroides, is the most common and abundant CSM overall, with D. sphaerocephalum also common, especially in alpine tundra and in disturbed sites. Nomenclature used in this review follows Raper (1984); therefore, records of Dictyostelium mucoroides reported herein would represent D. brefeldianum as proposed by Hagiwara (1984), while D. sphaerocephalum (after Raper) would correspond to Hagiwara's concept of D. mucoroides. Riparian sites, dominated by willow (Salix) and alder (Alnus) shrubs and trees, typically have the greatest absolute densities of CSM and are characterized by the greatest species richness. Soils and litter from tree line zones, dwarf birch (Betula nana)-blueberry (Vaccinium uliginosum) communities and other sites, including some spruce-hemlock forests, with ground surfaces covered by thick moss and lichen mats, yield relatively low densities of CSM. (Supported by grants from the National Park Service and the USDA Forest Service.)

CHEMISTRY/BIO-CHEMISTRY

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B. DASSARMA, Dept. of Chemistry, West Virginia State College, Institute, West Virginia 25112. Preaching chemistry as a component of general education.

Beginning college chemistry is taught at two levels - one for science, and the other for non-science majors. Chemistry is, therefore, like a foreign language to the large majority of college students, who will become our future Presidents, Senators, Congressmen and lawmakers, administrators, businessmen, lawyers and leaders in many walks of life.

A course has been developed at West Virginia State College to introduce the basics of chemistry and chemical toxicology in a common sense language. The stuff around an individual constitutes his environment. Those stuff that can be stored for future use are called matter, a common name for chemicals. Study of chemicals is chemistry. The effects of a chemical depend on its nature, the susceptibility of an individual, and its route of entry, but mainly on the dose. All chemicals will become harmful at a large enough dose. It is only the nature of the dose-response curve that distinguishes different classes of chemicals we call food, medicine, cosmetics, poisons and carcinogens. There are no good or bad chemicals - it is the dose that makes the poison.

F.L. NESBITT, Dept of Natural Science, Coppin State College, Baltimore MD, P.S.MONKS (NAS/NRC Research Associate), M. J. SCANLON, Fairmont State College Fairmont WV, L.J. STIEF; Laboratory for extraterrestrial Physics, NASA Goddaard, Greenbelt, MD 20771 **Absolute rate constants for the reactions of $F(_2P)$ with C_2H_2 and C_2H_4 at T=298K**

Absolute rate constants for the reaction of C_2H_2 and C_2H_4 with $F(_2P)$ atoms have been measured by using discharge flow mass spectrometry at a temperature of 298.15 and 1 Torr nominal pressure. The results obtained were $k(F+C_2H_4) = 6.2 \pm 1.3 \times 10^{-12}$ which at low pressures is associated with the abstraction channel forming C_2H + HF and $k(F + C_2H_4) = (2.7 \pm 0.5) \times 10^{-10}$ (both units in cm^3 molecules^{-1} sec^{-1}) which is a measure of the

total rate. Product studies were also conducted. This study represents the first direct measurements of the rate constants for both $F+C_2H_2$ and $F+C_2H_4$ reactions. Comparison between the absolute rate constants and previous relative rate measurements are made, along with rates and products of other halogen atoms and CN with C_2H_2 and C_2H_4 .

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S. CRAIG STAMM[1], MANG XIANG[2], WEN-ZONG WHONG[1], and TONG-MAN ONG[1,2], [1]National Institute for Occupational Safety and Health and [2]West Virginia University, Morgantown, West Virginia 26505. Transformation and analysis of Balb/c 3T3 cells exposed to nitrosated extracts of coal dust and/or snuff.

Epidemiological investigations of the incidence of cancer in coal miners have revealed that there is a positive relationship between this occupation and the occurrence of gastric cancer. Previous research has suggested that coal dust, which can enter the stomach via direct ingestion or by lung clearance, can undergo nitrosation reactions which result in the formation of carcinogenic compounds. Dietary components and/or the use of smokeless tobaccos have been indicated as potential sources of the nitrites responsible for these chemical reactions. Snuff has been particularly indicated as a possible risk factor due to its content of tobacco specific nitrosamines, and the potential presence of aromatic amines as endogenous carcinogenic agents. In this study, the Balb/c 3T3 mammalian cell line was exposed to nitrosated extracts of coal dust and/or snuff in the in vitro transformation assay, and the resulting transformed cells (foci) were cloned for further examination. Both the soft agar assay and the focal reconstruction assay indicate that a high percentage of these transformants have a strong potential for the formation of tumors in mice in vivo. Also, extracted DNA from these transformed cells are being examined for the activation of proto-oncogenes via dot blot analysis. These findings will be important in helping to reveal the etiology of the observed increased incidence of gastric cancer in coal miners both in terms of the potential sources of carcinogenic compounds and in assessing possible oncogenic targets.

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BELINDA BARKER, TIM BARNETTE, DAVID MILLER and MARK CHATFIELD, Dept. of Biology, West Virginia State College, Institute, WV 25112.

Isolation and characterization of the gene for soybean glutathione reductase.

Glutathione reductase (GR) participates in a sequence of coupled redox reactions (ascorbate-glutathione pathway) which results in hydrogen peroxide scavenging. GR is by far the most studied and widely distributed of the enzymes of the ascorbate-glutathione cycle. GR is present in bacteria, protozoa, fungi, plants and animals.

We report the isolation and characterization of the GR gene from a soybean Charon 40 genomic library. Forty-seven putative positive clones were isolated from a primary screen of 6×10^5 clones using a 2.1 kb. [P-33] labeled probe synthesized by random priming a GR cDNA template(provided by X. Tang & M. A. Webb, Purdue University). Five of these genomic clones were purified and their inserts ranged from 12- 17 kb. A southern blot analysis of these clones with both 5'- and 3'- cDNA probes [ca. 300 bp. in length] yielded one clone that appeared to contain both ends of a full length GR cDNA. Restriction endonuclese mapping of this Charon 40 clone and subcloning into pBluescript are in progress.

Tang and Webb reported that GR appears to be a large multigene family in soybean. A similar southern blot analysis of soybean total DNA digested with Bam HI, EcoRI, Hind III, Pst I, and enzymes not used by Webb (Sal I, Sac I, Xho I, Xma I) suggest that there are probably two GR genes in soybean cultivar Hobbit.

The molecular genetics of GR in plants is an area of active research and may lead to advances in understanding how plants respond to oxidative stress.

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DAVID W. MILLER, REGGIE TRIPLETT and
MARK CHATFIELD, Department. of Biology,
West Virginia State College, Institute, WV 25112.

Isolation and characterization of the gene for soybean, cytosolic ascorbate peroxidase.

Acsorbate peroxidase (AP) was originally discovered in spinach chloroplasts where it is particularly abundant. A related form is also present in the cytosol. In soybean (Glycine max [L]. Merr.) root nodules AP initiates a sequence of coupled redox reactions (ascorbate-glutathione pathway) which results in the destruction of harmful hydrogen peroxide.

We report the isolation and characterization of the AP gene from a soybean Charon 40 genomic library. Fifty putative positive clones were isolated from a primary screen of 6×10^5 clones using a 1.1 kb. [P-33] labeled probe synthesized by random priming an AP cDNA template (Plant Physiol.103:661-62).Ten of these clones were purified and their inserts ranged from approx. 9-19 kb. After DNA blot analysis of these clones with both 5'- and 3'- cDNA probes, two clones were selected that appeared to contain both ends of the full length cDNA. A six kb. DNA fragment from one of these clones has been subcloned into pBluescript. Restriction endonuclease mapping, construction of nested deletions of this subclone with exonuclease III and double-stranded dideoxysequencing are in progress.

The DNA structures of AP genes have been determined for both pea (Mittler and Zilinskas, 1992) and Arabidopsis (Kubo et al., 1993). In both cases an intron is present in the 5'- untranslated region, an uncommon trait for a plant gene. It has been suggested by Mittler and Zilinskas that this unusually placed intron may result in increased gene expression. We are interested in defining the genetic regulation of the ascorbate glutathione pathway. Fine gene structure analysis and promoter mapping are steps toward that goal.

MELISSA SQUILLARO
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Supercritical Fluid Extraction in Environmental Analysis

Supercritical fluid extraction (SFE) is a rapid, selective and convenient method for extracting analytes from environmental samples which are not inherently ready for analysis by such methods as chromatography and spectroscopy. The use of supercritical fluids for the extraction of organic pollutants from environmental samples has received increasing attention because of the potential to dramatically reduce the time required for sample extraction as well as the eliminate the need for large volumes of liquid solvents. This presentation will focus on the different techniques of SFE, and their advantages over traditional extraction methods.

KETAN GANGAL
West Virginia University
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Chlorofluorocarbon Alternatives

Chlorofluorocarbons (CFCs) are now believed to be the major culprits in global warming and ozone depletion over the Antarctic continent. Because of this, various chemical methods have been developed of producing potential substitutes for some CFCs. The structures of these substitutes and their methods of synthesis will be discussed in this talk.

KEVIN SHEFCHEK
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The Affect of Oxygen in the Initiation of Polymerization Reactions

Oxygen initiation of polymerization is important in processes ranging from the synthesis of polyethylene to redox polymerization. In addition, oxygen may not initiate a polymerization reaction directly, but can initiate a polymerization in a sperate process. The importance of oxygen in the initiation of polymerization reactions will be discussed in this talk.

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JULIE SANDIFORD, NANCY STEWART, and VERNON REICHENBECHER, Dept. of Biochemistry and Molecular Biology, Marshall University, Huntington, West Virginia 25755. Development of Rabbit Antisera Directed Against Rat Manganese-Dependent Superoxide Dismutase.

Superoxide dismutase enzymes protect organisms from the toxic effects of highly reactive superoxide anion radicals by catalyzing the conversion of two superoxide anion radicals into hydrogen peroxide and molecular oxygen. It has been proposed that oxygen free radicals and superoxide dismutases may play a role in many pathological processes, including Down's Syndrome, Parkinson's Disease, Amyotrophic Lateral Sclerosis, and hypertension. These studies were designed to develop antisera preparations specifically directed against rat Manganese-Dependent Superoxide Dismutase (MnSOD) in order to provide reagents which could be used for the study of the tissue distribution of this enzyme in animal models of diseases. A synthetic peptide corresponding to the 16 carboxy terminal amino acids of rat MnSOD was synthesized using an Applied Biosystems Model 431A Peptide Synthesizer and Fmoc chemistry using Multiple Antigenic Peptide (MAP) resin. The peptide was cleaved from the resin, partially purified, and lyophilized for use in antibody production. Two male New Zealand White rabbits were injected with the synthetic peptide in Titermax adjuvant, following the drawing of a sample of preimmune serum. Six biweekly booster injections were administered. An Enzyme-Linked Immunosorbent Assay showed that the immune sera contained about 100-fold higher levels of antipeptide antibodies than were found in preimmune sera. Western blots of rat heart extracts probed with these antisera revealed a protein band with a molecular weight of 23,000 daltons, confirming that the antisera recognize MnSOD. We conclude that, since these antisera preparations specifically recognize rat MnSOD, they should be useful in future immunocytochemical studies of the tissue distribution of this enzyme in rat models of pathological conditions.

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Morgantown WV 26506-6045
Generation of Acyl Radicals from 2-napthylthioesters

The utilization of acyl radicals in the formation of Carbon-Carbon bonds is a recognized and well documented synthetic method. The photochemical generation of acyl radicals from thioesters is practical in terms of its versatility of reaction conditions and specific reference will be made to S-naphthyl thioesters for acyl radical generation. In addition, subsequent intramolecular addition reactions of the acyl radicals to alkenes, such

as ring closures and possible tandem cyclizations will be discussed.

*P.S. MONKS NAS/NRC Research Associate, *P.N. ROMANI, F.L. NESBITT, Dept of Natural Science, Coppin State College, Baltimore MD, M. J. SCANLON, Fairmont State College Fairmont WV, *L.J. STIEF; *Laboratory for extraterrestrial Physics, NASA Goddaard, Greenbelt, MD The Kinetics of the Formation of Nitrile Compounds in the Atmospheres of Titan and Neptune

The nitrile compounds HCN and C_2HCN (cyanoacetylene) were detected on Titan by Voyager 1. The ethylene-analog nitrile to acetylene C_2H_3CN remains undetected. More recently, ground-based observers have detected HCN on Neptune and placed an upper limit on C_2HCN. Kinetic aspects of the formation of acrylonitrile have been studied in a discharge-flow mass spectrometric system at T=298K. The fractional yield for the formation of acrylonitrile from the fast gas phase reaction $CN + C_2H_4 \longrightarrow C_2H_3CN + H$ has been determined to be (0.2 ± 0.1). The other possible gas phase reaction leading to the formation of acrylonitrile, $HCN + C_2H_3 \longrightarrow C_2H_3CN + H$ has been determined to be slow under planetary conditions at k(T=298K) = 2-7 X 10^{-14} cm^3 $molecule^{-1}$ sec^{-1}, but remains in important chemical sink for HCN.

ECOLOGY

PROCEEDINGS OF THE WEST VIRGINIA ACADEMY OF SCIENCE
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LEE MULLINS and DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Density dependent cannibalism in naiadal dragonflies involved in fish exclusion experiments and the impact of fish predation in their abundance and species composition.

The hypothesis that two species of dragonflies, Erythemis simplicicollis and Pachydiplax longipennis, differ in vulnerability to predation from bluegill (Lepomis macrochirus) was tested. Predators and prey were collected from Tom's Pond and Green Bottom Swamp, both areas are contained within the Green Bottom Wildlife Management Area, Cabell County, West Virginia. E. simplicicollis and P. longipennis coexist together to be the most abundant naiadal dragonflies in the Green Bottom Wildlife Management Area. In laboratory experiments with bluegill as predators, E. simplicicollis naiads were more vulnerable to predation than P. longipennis. Combining the data from five trials, 11 out of 25 E. simplicicollis survived compared to the 19 P. longipennis that survived. This proved to be significant ($p=0.021$) at the 0.05 confidence level. In trials involving only one species of dragonfly at a time, there was a 40 percent survival for both species. In fishless trials involving intraspecific competition, it was illustrated that dragonflies exhibit cannibalism. The mechanism of competition seems to be predation by larger naiads on smaller naiads. No evidence of either exploitation or interference competition was found in the interspecific competition trials (100% survival), due to the naiads being of the same size class or instar.

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LEE MULLINS and DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Flight periods of dragonflies inhabiting the Green Bottom Wildlife Management Area, Cabell County, West Virginia, with special reference to territoriality.

The flight periods of nine species of dragonflies provided the background information on the behavioral ecology of dragonflies inhabiting Green Bottom Swamp in the Green Bottom Wildlife Management Area, Cabell County, West Virginia. The flight periods were recorded for all the species occupying this habitat during the summer of 1993. Territoriality has now been documented in a variety of both dragonflies (Anisoptera) and damselflies (Zygoptera). Each day during the breeding season males go to the water to compete for access to females which visit the water to copulate and oviposit. Oviposition peaked in early afternoon with the females preferring a shallow cove in the farm pond and the shallow, highly vegetative area of the main swamp. Daily mating success of males was estimated based on the time, place, and duration of territorial behavior. Estimated daily success correlated significantly with wing condition and body length.

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ERICH EMERY and DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Seasonal variation in the benthic macroinvertebrate populations in the Green Bottom Wildlife Management Area, West Virginia, in relationship the water quality and vegetation types.

The Green Bottom Wildlife Management Area is located along the Ohio River approximately 26 km northeast of Huntington, West Virginia. The area contains a valuable wetland of approximately 57 hectares. A baseline study of the benthic macroinvertebrates became important when personnel at the U. S. Army Corps of Engineers, Huntington District, proposed a habitat and modification to add marshland by building dykes. The limited ichthyofauna (central mudminnow, bowfin, grass pickerel, sunfishes) depend heavily on the benthic macroinvertebrates as a food source. Any major changes in the food chain could alter the food habits of fishes. Eight stations were established in the wetland representing various vegetation and substrate types and water depths. Seasonal collections (January, April, July, October) were made at each station. Triplicate samples were taken with an Eckman dredge (9" x 9"). The following physical and chemical parameters were recorded at each station: dissolved oxygen (mg/L), phosphates and nitrates (mg/L), conductivity (umho/cm), turbidity (JTU), depth (cm) and temperature (C). The percentage composition, number of taxa, functional feeding groups, mean number of individuals, and Shannon-Weaver index of diversity were calculated for stations and seasons. Using a SAS program, seasonal differences among stations were analyzed with ANOVA followed by Newman-Keul pairwise comparison procedure.

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KEVIN YOKUM, BRENT JOHNSON, CLIF TIPTON and DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Leaf shredding experiments between naiadal Peltoperla arcuata and Tallaperla maria (Plecoptera: Peltoperlidae).

Naiads of Peltoperla arcuata Needham and Tallaperla maria (Needham and Smith) were collected from a first-order tributary of the Elk Lick Run drainage basin in the Fernow Experimental Forest, Tucker County, West Virginia. The experimental forest is in the Allegheny Mountains of the unglaciated Allegheny Plateau. Its elevation ranges from 1750 to 3650 feet (533 to 1112 m). In the laboratory, naiads were placed in containers with aerated stream water at 15 C and several species of autumn-shed leaves (e.g. American beech, black birch, black cherry, dogwood, red oak, red maple,

rhododendron, sugar maple, sassafras, sycamore, hickory, yellow popular). Additionally, naiads were exposed to different leaf combinations to determine preferential consumption. After two weeks, the naiads were weighed and ashed in a muffle furnace at 550 C. Leaves were dried in an oven and weighed. Tannin and lignin content of the water was determined after the experiment. A repeat experiment was conducted using the 5 most preferred leaf species of the original 12. The ranking of leaves according to consumption by Peltoperla and Tallaperla naiads will be discussed along with the tannin and lignin analysis. Finally, the results will be compared to the laboratory leaf shredding of naiadal Peltoperla tarteri Stark and Kondratieff and Tallaperla cornelia (Needham and Smith).

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CLIF TIPTON and DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Preliminary observations on the reproductive activities of the grass pickerel, Esox americanus vermiculatus LeSueur, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.

The grass pickerel is mentioned on the Vertebrate Species of Concern List in West Virginia. The reason for the West Virginia status is that lentic, vegetated areas required for spawning of grass pickerel are limited within the state and are constantly being reduced by agricultural, residential, and industrial developments. The distribution of the grass pickerel in West Virginia is restricted to four counties along the Ohio River in the southwestern region. Green Bottom Swamp, a naturally occurring wetland of approximately 53 hectares, provides habitat for the grass pickerel. A proposed habitat alteration to add marshland by building dykes has prompted this study. Information from this study will establish a baseline for reproduction activities of the grass pickerel prior to habitat perturbation. Pickerel were collected seasonally by seines, pillow traps, and electroshocking. Attempts were made to determine the duration of the reproductive season by: (1) calculating the seasonal gonosomatic index (GSI); (2) observing spawning in the field and laboratory, and (3) noting the appearance of young-of-the-year individuals. Field observations will be made in the new wetland to determine any reproductive activities during the first year.

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TIM HAYES and DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Food habits of a disjunct population of the central mudminnow, *Umbra limi* (Kirtland), in the Green Bottom Wildlife Management Area, West Virginia, in relation to seasonal changes and age classes.

Seasonal and age group variations in the food habits of the central mudminnow were studied at the Green Bottom Wildlife Management Area, West Virginia. Monthly collections were made in the heavily vegetated, littoral areas of the wetland between August 1989 and December 1992. Point values were assigned to each stomach and were used to calculate percent frequency of occurrence and percent total volume. Twenty-three types of food items were found in the diet. Percent total volume calculations showed that amphipods were a major food course in all seasons except summer. Ostracods and odonates played an important role in the fall and winter diets. Duckweed (Wolffia spp.) was utilized in high amounts in the summer and fall when it is abundant in the area. Most items showed a steady frequency of occurrence throughout the year although duckweed, copepods and caldocerans occur less frequently in the diet when they were not as abundant in the water. Diet overlap indices showed a high correlation between similar seasons and a low correlation between dissimilar seasons. Age class comparisons of percent total volume showed that in the younger age classes of mudminnows (0, I) ostracods and amphipods played an important role in the diet. In the Age Classes II and III, duckweed and odonates were the major food items taken. Most food items showed a steady percent frequency of occurrence throughout the age classes. Similarity indices showed that the closer in age fish are the more similar their diets. Mudminnows are omnivorous and highly opportunistic in their feeding habits.

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BRENT JOHNSON and DONALD C. TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755. Low pH tolerance, under static bioassay conditions, of the nymphs of the mayfly *Callibaetis fluctuans* from a newly mitigated wetland in the Green Bottom Wildlife Management Area, West Virginia.

Although nymphal mayflies are generally considered pollution intolerant and found predominately in areas of good water quality, *Callibaetis fluctuans* seems to be an exception. This species apparently thrives in the harsh environment of Green Bottom Swamp

where dissolved O_2 is low and the environmental parameters are constantly changing. *C. fluctuans* nymphs were experimentally tested under static bioassay conditions to determine their tolerance to low pH. Nymphs were exposed to four pH values (1.5, 3.0, 5.0, and 7.0) in the laboratory investigation. The 96-hour TLm (median tolerance limit) test was used as the measure of acute toxicity to low pH. The straight-line graphical method was employed to determine the pH value at which 50 percent of the nymphs survived after 96 hours. Tests were duplicated and the mean was plotted as the final TLm value. Results will be compared with other pH tolerance studies of nymphal mayflies.

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DEANNA HURST, MARC ABRAMS, AND THOMAS DEMEO
School of Forest Resources, Penn State University
USDA Forest Service, Monongahela National Forest
Classification and gradient analysis of the Monongahela National Forest

Study of the relationship between the environment and the distribution of vegetation is necessary in assessing impacts of man-caused disturbance. Vegetation-site relationships were examined using 260 forest stands sampled in the Monongahela National Forest, West Virginia. Four dominance types based on overstory composition were recognized using cluster analysis techniques: Quercus alba, Quercus rubra, Acer saccharum, and Picea rubens. Compositional gradients of the types, with respect to environmental variation, were investigated by indirect gradient analysis and were strongly correlated to elevation and slope. At one end of the gradient was the Quercus alba group, occurring on well-drained, low-elevation ridges, and at the other end was the Picea rubens group, located on poorly-drained, high elevation plateaus. Quercus rubra and Acer saccharum groups, in the middle of the continuum, are both located on steep sideslopes. A plausible explantion for group differentiation is a soil moisture gradient, determined by slope, elevation and latitude.

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DONALD TARTER, Department of Biological Sciences, Marshall University, Huntington, West Virginia and DIANE NELSON, Department of Biological Sciences, East Tennessee State University, Johnson City, Tennessee. Preliminary list of tardigrades (Phylum: Tardigrada) from mosses and liverworts in the Monongahela National Forest.

The Monongahela National Forest (MNF) stretches over 830,000 acres of the Allegheny Mountain Range. Mosses and liverworts were collected on the ground, rocks, and trees from the following areas between 1988-1993: Seneca Rocks (2400'), a 1,000-foot quartzite formation, (2) Dolly Sods (4000'), a tundralike region that forms the eastern section of the Allegheny Plateau, (3) Spruce Mountain (2800'-4800'), a region of windblown red spruce and rock outcrops, and (4) Cranberry Glades (3400'), a land covered with a bog, bog forest and shrubs. Twenty-four species of tardigrades, including one new species, representing ten genera (Diphascon, Hypechiniscus, Hypsibius, Isohypsibius, Itaquascon, Macrobiotus, Milnesium, Minibiotus, Pseudechiniscus, Ramazzottius), were identified from the MNF. The most common species were Hypsibius convergens (Urbanowicz), Macrobiotus hufelandi Schultz, M. richtersi Murray, Milnesium tardigradum Doyere, Minibiotus intermedius (Plate), and Ramazzottius oberhaeuseri (Doyere). Five species (Hypechiniscus gladiator, Pseudechiniscus suillus, Macrobiotus occidentalis, Hypsibius maculatus, Diphascon scotium) were found only at the low altitude of 2800 feet. Hypsibius oberhaeuseri and D. prorsirostre were collected only at the highest altitude of 4800 feet.

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MARY BETH ADAMS, JIM KOCHENDERFER, TED ANGRADI AND PAM EDWARDS, Northeastern Forest Experiment Station, Timber and Watershed Laboratory, Parsons, WV 26287. Effects of Elevated Acidic Inputs on Litter Decomposition.

It has been demonstrated that severe direct effects of acidic deposition are not likely. However, indirect effects, through impacts on nutrient cycling are not as clearly understood, nor as thoroughly researched. To investigate the effects of elevated atmospheric inputs on nutrient cycling in forests of the central Appalachians, a whole-watershed acidification project was begun in 1989 on the Fernow Experimental Forest near Parsons, West Virginia. Ammonium sulfate fertilizer has been applied, at twice the ambient rates of nitrogen (N) and sulfur (S) deposition, in 3 applications per year since 1989. Because forest litter and soil can be considered among the most

important sinks of atmospheric nutrient inputs, a study was implemented to examine the effects of elevated N and S inputs on litter decomposition. Freshly fallen litter from four species (black cherry, red maple, black birch, and yellow poplar) was placed in plastic mesh bags and placed on 4 plots on two watersheds. One of the watersheds was the treatment watershed, receiving the ammonium sulfate applications, and the other was a control watershed with a forest of similar age and composition. Litter bags were collected every two months for the first year to determine changes in mass and nutrient content. Sampling will continue on an annual basis for 2 additional years. As expected, the four species differed in their decomposition rates, with yellow poplar and red maple showing the slowest decay rates. The effects of treatment on decomposition and the interaction of treatment and species will also be discussed.

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FISHER, MARK A. and GILLIAM, FRANK S., Dept. of Biol. Sci., Marshall Univ., Huntington, WV 25755.

Changes in soil physical and chemical characteristics during wetland creation.

Availability of most nutrients is sensitive to the oxidation-reduction (redox) status of the soil. Thus, soil nutrient changes are potentially substantial under the permanently inundated conditions of wetland formation and creation. The objective of this study was to examine changes in the nutrient availability in soils of a created wetland after 8 months of inundation in the Green Bottom Mitigation Site, Cabell County, West Virginia. Three plots along two transects were established in the mitigation area, formerly a riverbottom old-field site. Two plots each transect were located below the intended water level (inundated plots) and one plot each transect was located above this level (control plots). Two additional plots were established in each of two existing wetland areas-- one ~4 yr-old wetland created from beaver activity and the adjacent, original Green Bottom Swamp. Soils from each plot were sampled prior to the inundation period to depths of 0-10 cm and 10-20 cm. *In situ* redox potential, soil texture, available N, and extractable macro- and micronutrients were determined. All plots were re-sampled 8 months following inundation and the same were made. Redox potentials suggest that the inundation soils of the mitigation site rapidly attained reducing conditions of natural wetlands. There were decreases in sand-sized particles (coupled with increases in clay particles), apparently the result of breakdown of larger particles under reducing conditions. Availability (extractability) of macro- and micronutrients was closely linked to redox potential. Ca became less soluble and Fe became more soluble under the reducing conditions of inundated soils. Available N (extractable NO_3^- and NH_4^+) had a more complex response to changing redox potential. Forms of available N were somewhat equally balanced between NO_3^- and NH_4^+ in the old-field soils. The anaerobic conditions of the inundated soils, however, prevented net nitrification, thus there was little N in the form of NO_3^- in these soils (>98% in the form of NH_4^+). Much higher pools of available N in the inundated soils indicate lower plant uptake of N these conditions. Results after this 1-yr study suggest that soils of the created wetland are rapidly approaching conditions of natural wetland soils.

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CASSIE JO FOSTER, Department of Biology Wheeling Jesuit College, Wheeling, WV 26003. The effects of rock size on macroinvertebrate community composition of Wheeling Creek

The effects of rock size on macroinvertebrate community composition were studied passively by comparing Wheeling Creek macroinvertebrates with substrate characteristics. Substrate size and texture were measured using video image analysis. This gray-scale analysis was applied to photographs of sediments collected during benthic sampling. Image analysis is a new method which should prove to be more accurate and less tedious than the traditional methods used to determine substrate size.

Image analysis was used to measure the area and circumference of the rocks; the diameter was found mathematically from the measured area. The means of the rock sizes which were measured with image analysis were compared to those which were estimated in the field. The relative circumference and area were used to develop an index of substrate heterogeneity.

An active study was conducted by placing sixteen baskets of artificial substrata in one Wheeling Creek riffle. The baskets were filled with rocks of four size classes, one size class per basket. Four baskets of each size class were allowed to colonize, collected, and analyzed for differences in benthic community associations with substrate size classes.

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WALTER J. CYBULSKI III, Department of Biology, Wheeling Jesuit College, Wheeling, WV 26003 The relationship between stream order and leaf litter decomposition in the Wheeling Creek watershed

The decomposition of white oak leaf litter was examined in first, fourth, and sixth order stream reaches in the Wheeling Creek watershed, to determine if differential processing occurred in and among the varied reaches according the River Continuum Concept of Vannote (1980). The three study sites were located in the northwestern part of West Virginia in Ohio County outside

the city of Wheeling. White oak processing was examined using 5 gram allotments of autumnal shed leaves placed in 4 mm mesh size nylon leaf bags. One bag per month was collected for a period of sixth months. The percent dry weight remaining and the decay coefficients (-k) were determined for each bag in each order as a measure of the rate of processing. Leaf bags in the first order streams had the highest processing rate, with a decay coefficient of 0.00441 and a 24.9% dry weight loss. Leaf bags in the fourth order stream had a decay coefficient of 0.00402 and a 22.7% leaf dry weight loss. The sixth order stream leaf bags lost 20.7% of their dry weight and had a decay coefficient of 0.00363. Leaf shredding macroinvertebrates appeared to utilize leaves in first and fourth order reaches. However, macroinvertebrate community composition varied between streams. Amphipods of the family Gammaridae, the caddisfly Pycnopsyche sp., and the cranefly Tipula abdominalis were the dominant shredders in the first order stream. In the fourth order stream Pycnopsyche was the most significant shredder. Variations in abiotic factors among orders did not appear to markedly affect processing rates. During the first three months of the study there were no significant differences between the individual rates of leaf processing in the three stream orders.

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KEITH A. NIGGEMYER
DEPT. of BIOLOGY
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Primary production and decomposition rates of the macrophyte Justicia americana in Wheeling Creek watershed

Primary production of the aquatic macrophyte Justicia americana was measured during the 1993 growing season at ten study sites in the Wheeling Creek watershed located within Ohio and Marshall counties. The harvest method with a 0.25m2 sampling hoop was utilized for the collection of above ground plant biomass. A total of 150 samples containing 6,268 plants were harvested. Mean stem lengths for the months of June, July, and August were 31.12cm., 48.70cm., and 55.73cm. Average dry weight biomass for the months of June, July, and August were 24.23g., 56.62g., and 69.10g. respectively. Differences in monthly biomass were determined to be 32.39g. between June and July, 12.48g. between July and August, and 44.87g. maximum biomass between August and June. Productivity for the June-July growth period was 1.08g/d., and .416g/d for the July-August growth period. These data combined with photo-interpretation

of the aerial extent of plant beds provides a measure of energy contribution to the Wheeling Creek stream ecosystem.

Decomposition rates for bed versus non-bed regions of Justicia americana were studied at four study sites. Forty 4mm-mesh nylon bags with 25 gram allotments were placed in streams and collected at weekly intervals for determination of decomposition rates. Physical parameters such as water flow rates and temperatures were also recorded. Decomposition bags were analyzed for leaf-shredding macroinvertebrates for each of the study sites.

An investigation is being conducted into the possible causes for the absence of growth of Justicia americana in two of the three tributaries of the watershed, as opposed to lush growth in the remaining tributary and mainstream. Transplant experiments were conducted during the 1993 growing season. Stem length, rhizome length, flower number, and surviving stalk number were recorded bi-weekly during the transplant experiment. Stem lengths of transplants were compared to stem lengths of established plant beds. Comparative soil nutrient analysis of the tributaries and mainstream plant beds is being conducted.

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Ben M. Stout III and Kenneth E. Rastall
Department of Biology, Wheeling Jesuit College, Wheeling, WV 26003

Wheeling Creek water quality assessment: monitoring protocol for Ohio River watershed studies

Wheeling Creek is a 6th-order tributary of the Ohio River. Surface water is well-buffered with an average Ph (log mean H+ concentration) of 8.3 and alkalinity of 176 ppm at 110 sites. The 77,400 ha watershed typifies regional streams with agricultural/urban/industrial land use patterns. The objectives of this research are to establish baseline water quality information, identify water quality threats with an eye toward protection and restoration, develop a water quality training model for students at secondary school and college levels, and promote basic research into the structure and function of biological communities in an Ohio River tributary. Chemical, physical, and biological water quality monitoring was conducted at 98 sites during May and June 1993. Additional studies were conducted to provide ecosystem functional measures, particularly production and decomposition. In 1994 these sites will be georeferenced to the nearest 2m using a differential global positioning system, and the data will be compiled into a geographic information system (GIS). The GIS will enable exploratory spatial data analysis and the

opportunity to test the tenets of the river continuum concept. In preliminary analysis we find measures of benthic insect densities and quality (richness, diversity, EPT index) to be sensitive to geomorphological attributes such as distance from the Ohio River. More detailed geostatistical analysis will be possible by overlaying digital line graph, digital elevation models, and land-use patterns on measures of biotic community structure and function.

STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, GARY A. LAURSEN, Dept. of Biology and Wildlife, University of Alaska, Fairbanks, Alaska 99775, JOHN C. LANDOLT, Dept. of Biology, Shepherd College, Shepherdstown, West Virginia 25443, GLENN P. JUDAY, Agricultural and Forestry Experiment Station, University of Alaska, Fairbanks, Alaska 99775, and ERNEST C. BERNARD, Dept. of Entomology and Plant Pathology, University of Tennessee, Knoxville, Tennessee 37901. The Columbia Glacier ecosystem in southern Alaska.

The Columbia Glacier, one of the largest and most impressive of Alaska's tidewater glaciers, covers an area of 1,370 km^2. In 1984, the Columbia Glacier began to undergo a drastic retreat that has continued since that time. As of 1992, the ice front was receding several hundred meters per year. This drastic retreat is occurring in a forested region and thus offers the unique opportunity to observe and study forest succession and development in a setting similar to conditions at the end of the last ice age. During July of 1993, baseline ecological data were collected from several study sites in the Granite Cove Research Natural Area, located near the western edge of the terminus of the glacier. Study sites investigated included (1) an old-growth mountain hemlock-Sitka spruce forest on the cove wall, (2) a number of successional herb and shrub communities on recently exposed areas adjacent to the terminus of the glacier, and (3) several blanket bogs/muskegs on low-elevationand geomorphologically stable surfaces within the cove. The purpose of this presentation is first to describe these study sites and then to discuss some of our data. (Supported in part by a grant from the USDA Forest Service.)

DAVID M. LAWRENCE, Dept. of Environmental Sciences, University of Virginia, Charlottesville, Virginia 22903, STEVEN L. STEPHENSON, Dept. of Biology, Fairmont State College, Fairmont, West Virginia 26554, and HAROLD S. ADAMS, Div. of Arts and Sciences, Dabney S. Lancaster Community College, Clifton Forge, Virginia 24422. Biogeographic patterns in upland forest community composition in the mid-Appalachians of Virginia and West Virginia

Biogeographic patterns in upland forest community composition in the mid-Appalachians were examined using quantitative data on the composition of the overstory (stems $\geq$10 cm DBH) from 216 stands. Sampled stands occupied a wide range of site conditions and included representatives of all of the major forest types present in the region. Preliminary results obtained using TWINSPAN and DECORANA indicate that there are two major forest types: those with a significant component of red spruce and other species typically associated with spruce, and those without a significant spruce component. Red spruce stands can be further differentiated on the basis of codominant species such as balsam fir, Fraser fir, and eastern hemlock. Forest types without a significant spruce component include pitch pine/black oak, scarlet oak, mixed oak, chestnut oak, chestnut oak/black oak, chestnut oak/red maple, red oak/white oak, chestnut oak/red oak, red oak, red oak/red maple, red oak/white oak/black birch, sugar maple/hickory, sugar maple, and hemlock/yellow poplar. The influences of a variety of environmental factors account for the differences that exist in forest community composition, with those factors related to elevation, topographic position, underlying geological substrate, and disturbance history the most important.

DON NASH, Dept. of Biology, Marshall University, Huntington, West Virginia 25755 and ROSE-MARIE MUZIKA, USDA Forest Service, Morgantown, West Virginia 26505. Physiographic control of overstory species in Ridge and Valley and Allegheny upland forests.

As a means of understanding vegetation differences with province and topographic variables, forest vegetation was examined on two mountains in the Monongahela and George Washington National Forests. Transects covering an elevation gradient of 460 m and 370 m were used on Allegheny Mt. (ridge and valley) and Gauley Mt. (Allegheny upland), respectively. Twenty-eight overstory species were identified at Allegheny Mt., compared with 22 at Gauley Mt. Ten of these occurred exclusively at Allegheny, while five were unique to Gauley. In terms of basal area, *Quercus rubra* (red oak) and *Acer saccharum* (sugar maple) dominated at Allegheny Mt., with similar elevational distributions. On Gauley Mt., *Prunus serotina* (black cherry) and *Acer saccharum* dominated. *Prunus serotina* occurred more frequently on lower elevations, and *A. saccharum* exhibited a bimodal elevational distribution. Stem density of *Fagus grandifolia* (beech) was high on Allegheny Mt., particularly on the west-facing slopes, second only to *A. saccharum.* At the higher elevations on Gauley Mt., *Picea rubens* (red spruce) and *Betula allegheniensis* (yellow birch) occurred commonly. Basal area was consistently greater at Allegheny Mt. than at the corresponding elevations at Gauley Mt. Much of this variation is likely due to disturbance history as well as the climatic and edaphic differences between provinces.

MICHAEL K. NOWLIN and JEFFREY E. BAILEY, West Virginia Div. of Env. Protection, Water Resources Section, Biology Program, St.Albans 25177.

Status of the macroinvertebrate community in the Greenbrier River, Summers County, West Virginia.

The purpose of this study was to examine the status of the aquatic macroinvertebrate community sampled from 1978 through 1987 in the Greenbrier River near Hilldale, Summers County, West Virginia. Hester-Dendy multiplate samplers were deployed in triplicate at a fixed sampling station in late spring (May - June) of each year. A period of 6 to 8 weeks was allowed for macroinvertebrates to colonize the samplers. Upon retrieval the macroinvertebrate samples were transported to the West Virginia Division of Environmental Protections' Biology Laboratory for processing. Recovery rate of samplers was one hundred percent for all years with the exception of 1978 and 1979, in which case only 2 of the 3 samplers deployed were recovered. A total of 83 genera, found in 35 families and representing 16 orders, were identified. Yearly mean abundance of macroinvertebrates remained relatively stable (between 50 & 125 individuals) throughout the study period, except during 1978 and 1984 when mean abundance was notably higher. Taxa richness, Shannon-Weiner Diversity Index, Brillouin's Diversity Index, %EPT contribution, and %Chironomidae contribution each exhibited a possible cyclic pattern. EPT Index remained relatively constant, with exception of 1986, when a notable decrease was observed. The observed decrease may have been in response to heavy flooding during the fall of 1985. Hilsenhoff's Biotic Index (modified) generally decreased over the course of the study, possibly indicating an improvement in water quality.

TED ANGRADI, JIM KOCHENDERFER, BETH ADAMS, AND PAM EDWARDS, Northeastern Forest Experiment Station, Timber and Watershed Laboratory, Parsons, WV 26287. A paired watershed approach to monitoring the effects of timber sale activities on aquatic resources.

We initiated this study in response to a request by the Monongahela National Forest to assist them in developing methods for monitoring effects of forest management activities on soil and water resources of headwater streams. The objectives of this study are to monitor the impacts of a typical National Forest Timber Sale on aquatic, soil, and water resources, and to develop, evaluate and refine methods for monitoring biological (aquatic macrobenthos) and physical (sediment, water chemistry) factors related to aquatic resource values.

This study is being conducted on two adjacent, confluent watersheds in the Indian Run drainage of the Little Black Fork of the Shavers Fork River in West Virginia. The study employs the Before-After-Controlled-Impact-Pairs (BACIP) sampling design in which the paired "impact" (logged) and control watersheds are sampled contemporaneously and repeatedly before, during, and after the timber sale. Impacts will be determined by comparing the mean difference between the watersheds (Log(impact) - Log(control)) in the period before and the period after treatment for each biological and physical variable. The treatment watershed is 244 acres of which 67 acres are scheduled to be clearcut using best management practices beginning in spring 1995. The control watershed is 131 acres. Replicate macroinvertebrate samples are collected at multiple stations along each stream in spring and fall. Quantitative and semiquantitative samples are collected to allow comparison of intensive versus more rapid methods (e.g., EPA Rapid Bioassessment Protocols). Sediment cores and Whitlock-Vibert box samples are taken in riffles to compare fine particle content of stream gravel. Streamflow is gaged just above the confluence of the watersheds using rectangular concrete control sections equipped with FW-1 water level recorders. Stormflow is sampled using automated pumping samplers housed in heated shelters. Turbidity and sediment concentration are determined for both base and stormflows. Water chemistry variables are determine for weekly grab samples. On-site soil disturbance will be quantified for the logged areas. Data collection began in summer of 1993. Macroinvertebrate data have not been summarized. Preliminary sediment and water chemistry data indicate pre-impact differences between the watersheds for several variables. These differences are most likely due to differences between the watersheds in geology and past land-use history.

GENERAL

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MELISSA A. KUHL, Dept. of Mathematics,
Marshall University, Huntington, WV 25755.
Approximating Functions By Non-polynomial Methods Using Mathematica.

In several branches of science and engineering, periodic functions occur naturally, and a need develops to estimate these periodic functions from measured data. There are several methods to approximate functions; two of which are under study here. The two methods chosen for examination are Padé and Fourier approximations. Periodic functions such as f(x) = sin[x] require the use of Padé approximation which improves the quality of approximation by using quotients of polynomials instead of polynomials, themselves. Polynomial approximation of sin[x] fails because the polynomial eventually pulls away from the Sine curve, going into global scale. In using Fourier approximation, functions defined on [-Pi,Pi] are estimated by building them from Sine and Cosine waves in the same manner that music can be built from basic harmonics. Approximations are made more accurate by using additional waves. Examining families of functions with these two methods allows a comparison to find which method's approximations are more accurate over defined intervals using the Mathematica software on the NeXT computer for its computational speed and graphing capability. The different methods of approximation are suitable, or sometimes simplier, dependent upon the function's characteristics. For example, whether a function is odd, when f(-x) = -f(x), or even, when f(x) = -f(x), which in the case of Fourier approximation makes it simplier, and in the case of Padé approximation determines the type of function used.

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DRS. MICHAEL J. AND VIRGINIA C. DEMCHIK
Jefferson High School, Rt. 1 Box 83
Shenandoah Jct., WV 25442

Developing Research Into The Components Of The Nucleus Of An Atom

During the summer of 1993, both authors were employed as teacher research associates at CEBAF, The Continuous Electron Beam Accelerator Facility in Newport News, Virginia in a Department of Energy program. The program called SITE was The Summer Institute For Teacher Enhancement. CEBAF is a developing facility where scientists and engineers encounter problems and as the do, they use the processes of science to overcome them and proceed toward completion of the project. In October, 1993, the facility was 92 % built and is expected to be in full operation during the summer of 1994.

As teacher research associates, we worked in teams with an individual mentor. Each author worked with a different mentor. Both completed research which carried some significance into the project. The first was the the thermodynamic measurements made in the linac. A device was built by the mentor to measure the heat content of the linac when the accelerator was in full operation. The device and methodologies used produced baseline data which was useful in laying groundwork for measurements in the hall.

The second involved the use of standing waves and then passage through an aluminum oxide ceramic. As the passage took place various other standing waves were generated and would interfer with the operation in the cryomodule. The elimination of the unnecessary standing waves was acomplished through the development of an aluminum nitride glassy carbon composite which absorbed all waves except the standing waves that are needed to carry the electron beams to the fulfillment of their task.

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DR. MICHAEL J. DEMCHIK
Jefferson High School, Rt. 1 Box 83
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Constructivism In Chemistry: A Global Issues Approach

Constructivism is a technical term for a classroom that is concept oriented, student centered, non-textbook oriented, lab based, discovery oriented, and related to the real world. Chemistry II, as taught at Jefferson High School is such a course. Chemistry II emphasizes the following concepts at a greater depth than that found in a Chemistry I course. The following topics are utilized in this course: solution chemistry, equilibrium, oxidation-reduction, acid, bases and salts, transition element chemistry, nuclear chemistry, and selected topics in chemistry such as polymers.

Issues such as The Acid Rain Project, Acid Mine Drainage Studies, the Opequon Watershed Project, Nuclear Energy and Hazardous Wastes, Air, Land, and Water Pollution, and Interactions of Food Resources and Human Health and Disease are utilized in a real world context. Special emphases are made with special individual student projects such as "The Effects Of Acid Rain On Wheat" and "The Effects Of Acid Rain On Germinating Peas" and small group projects such as "Liquid Crystals". Forensic Science is a special unit that finishes up the school year.

The overall program is a seventy percent laboratory based program. Evaluation or testing frequenty is of the situational test, rather than a factual test. The students in the 1992-93 school year were in a similar program as the one currently described. Their growth occurred from the 83rd to the 95th percentile on the CTBS, Comprehensive Tests of Basic Skills, From 4T, subsection science. The overall program shows good attitudinal aspects and an indepth interest in real world chemistry.

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ALAN D. SMITH and ALLEN R. LIAS, Department of Quantitative and Natural Sciences, Robert Morris College, 600 Fifth Avenue, Pittsburgh, PA 15219-3099. Curriculum trends in applied mathematics education.

An increased interest in this country in recent years has focused on the need for applied educational experience for our students. Areas of continued support include, but are not limited to, applied biology and the natural sciences, applied communications, and applied mathematics. Robert Morris College (RMC), a focused post-secondary educational institution of about 6,000 students is in the midst of curriculum development to support and/or diversify its academic offering in the business disciplines. Applied mathematics education is one of those areas that the Quantitative and Natural Sciences Department at the College is proposing to develop, but from a nontraditional viewpoint.

This nontraditional viewpoint or applied academic curriculum is founded in the belief that basic academic knowledge should be blended with daily or workplace applications in order to communicate to students the importance of mastery of subject matter. Especially, applied mathematics education emphasizes the need of mathematics in understanding and using algebra and geometry in problem solving in probability and statistics, computer applications, quality control, geometric relationships, budget balancing, and consumer decision-making, to list a few. Since it is assumed that part of our national goal in education is to increase levels of involvement and achievement of high school students in mathematics and science, as well as increase the number and quality of technicians for work in an ever-increasing technical environment, applied mathematics development has obvious benefits over the traditional mathematics education.

World-class undergraduate and graduate education in the mathematical sciences is essential for continuous growth of this nationa in scientific progress and economic competitiveness. Unfortunately, due to corporate downsizing, sluggish economy, political changes overseas, increased numbers of graduates in mathematical sciences, and other reasons, unemployment and underemployment rates among new graduates in the mathematical sciences have been increasing while the number and percentage of new Ph.D.'s in this field going into business and industry have been decreasing. This certainly is not the trend that is desired if we are to accomplish the national education goals for our country to reach by the year 2000. The fourth goal, which states that American students will be first in the world in mathematics and science achievement is especially in danger.

However, as CORD (Center for Occupational Education) guidelines suggest, applied courses must adhere to the following: (1) be doable by students in the middle 50 percent of high school populations; (2) focus on problem solving; (3) be practical and relevant; (4) emphasize associate hands-on-learning; and, (5) retain integrity of course content. Obviously, if these guidelines are adopted, traditional mathematics education curricula must also be revised. We are suggesting a more balanced approach in educating, training, and certifying mathematics instructors at the secondary level. Also, perhaps state certification agencies should re-evaluate current standards on teaching credentials, or at the very least, consider applied mathematics education as a certifiable

ALAN D. SMITH, Department of Quantitative and Natural Sciences, Robert Morris College, Pittsburgh, PA 15219-3099.
Needs assessment and program design of health services management.

The recent trends in reevaluating the nature of costs associated with our nation's health care system have focused national attention on the management of the health care system.

Robert Morris College, an independent coeducational institution offering the B.S.B.A., M.B.A. and selective associate degrees mainly in the business disciplines, has offered a bachelor's degree and certificate program in Health Services Management since Fall Semester, 1991. A needs analysis was conducted by a consultant and presented in this paper. From this needs assessment and related input from administrative sources, a new program offering was developed to deal with the need for management training in the health care industry.

The needs assessment survey had been sent primarily to executives from health service organizations mainly in the Pittsburgh SMSA. The findings were as follows: 1. The majority of responding employers (78 per cent) perceived a need for a bachelor's degree program in Health Services Management. 2. Sixty-five per cent indicated value in offering a Certificate Program in Health Services Management; with 56 per cent willing to provide tuition reimbursement. 3. Few employers, 31 per cent, are familiar with similar bachelor's or certificate programs. 4. At least 84 per cent of the respondents rated all core courses important to very important. 5. At least 90 per cent of all respondents rated all specialty courses important to very important. 6. Potential areas of employment include office management, 66 percent; accounting, 54 per cent; and marketing, 48 per cent. 7. Seventy-two percent indicated a willingness to provide a six-month internship; yet only 31 per cent were willing to compensate the student. 8. Respondents were generally somewhat familiar, 70 per cent, with Robert Morris College and agreed that the College provides quality education, 71 per cent; yet few are familiar with specific programs. 9. Hospitals perceived the least need for a bachelor's degree program in Health Services Management, 51 per cent; and were least likely to see value in a certificate program, 58 per cent.

In addition, a relatively detailed analysis of the type of organization (ambulatory surgery center, HMO/PO, medical sales, etc.) and important parameters unique to the health field is included in the survey.

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SUSAN K. JOY, Department of Education Administration, and DAN K. EVANS, Department of Biological Sciences, Marshall University, Huntington, West Virginia. Conflict in the Development of a Wildlife Management Area in Cabell County, West Virginia.

As human populations continue to encroach upon natural areas and the concern for endangered and nongame species continues, the public has taken a more aggressive role when management of public lands is being considered. The development of the Green Bottom Wildlife Management Area is an example of such public involvement. To offset impacts of constructing the Gallipolis Locks and Dam replacement project, the Corps of Engineers purchased an 836-acre tract in Cabell County as a mitigation site. When the area was leased to the West Virginia Division of Natural Resources in 1988, a seven-month controversy ensued, involving local history buffs, archaeologists, hunters, environmentalists, and others. Issues included restoration of an historic house constructed at the site in 1835. The structure was of particular interest due to its association with Albert Jenkins, a member of Congress in 1857 and a Confederate General during the Civil War. There was also concern about protection of numerous archaeological finds that had been recorded from the area. The conservation of an extensive wetland that had served as a research area for university researchers since the early 1970s was also a point of consideration. The controversy received extensive coverage in area newspapers, and a public hearing held in February 1990 centered around use of the area as nongame versus game interests. Concerns subsided with approval and implementation of a management plan intended to provide opportunities for hunters, while protecting and enhancing existing resources at the site.

WES GLADWELL, Dept. of Physics, Glenville State College, Glenville, West Virginia 26351. Determining the speed of light.

This experiment was conducted to determine the speed of light. This experiment has been conducted before by scientists who tried various methods, ranging from using expensive, high-tech equipment to inexpensive, homemade methods. Some of the methods were nonetheless unsuccessful, while others proved to be accurate and useful.

In 1564, Galileo seemed to be the first to measure the velocity of light by using lamps with shutters. This experiment called for two people--one to stand on one side of a hill and the other on the opposite side of the hill. One person would then open and shut the lamp's shutter, and the other person would make record of the time the light appeared and disappeared. The principal behind this method was sound, although the method itself was not an accurate one. Galileo indirectly had the first measurement of velocity of light by the application of the telescope and the discovery of Jupiter's satellites. From this, Roemer, in 1644, deduced that the extreme time lag corresponding to the minimum and maximum distances between the earth and Jupiter represented the time taken by light to travel across the diameter of the earth's orbit. He obtained a value for the velocity of about 214,000 km/sec, the error being largely due to the uncertainty in the diameter of the earth's orbit.

In 1726, Bradley studied the star of Draconis and found that its position appeared to changed due to parallax, which is due to the observer's motion. From measurements and observations, Bradley deduced that the angle and the ratio of the velocity of light to the velocity of the earth's motion in its orbit was therefore 10,210 to one, giving a value for c of 301,000 km/sec. Bradley's calculations for timing light proved to be within reason.

In 1849, Fizeau introduced a principal that holds much importance in the field of measurement. He observed a parameter, which was in this case the intensity of light returned after a series of trips, which reached an optimum value when the time of repetition agreed with the time of travel. The measurement of time was replaced by the measurement of the rate of repetition or frequency. Fizeau's calculations gave a value of 313,000 km/sec for c.

Foucault, another scientist who made the second successful study of the speed of light in 1862, reflected light from a rotating mirror through a lens to the concave mirror. The value obtained from this study was 298,000 km/sec with an estimated uncertainty of 500 km/sec.

These are only a few examples of experiments with optical measurements. Other methods were explored in the 1900s. During the 1900s, light was timed through a vacuum at approximately 186 miles/sec (or 300,000 km/sec) by Michelson.

The purpose for my experiment was to find a way of timing light. This was done by using the Doppler Effect (*The **Doppler Effect** is the apparent change in wavelength of radiation emitted by a moving body. This effect is noticeable when the source of light is moving toward or away from an observer.)* By using the Doppler Effect, and Roemer's method of timing Jupiter's satellite Io, I will determine the speed of light.

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MELISSA JO KASHEY and JOHN H. HULL, Dept. of Psychology, Bethany College, Bethany, West Virginia 26032. The "bear" facts: Trends in gender-role stereotyping across 30 years of Berenstain Bears books.

Seventy-four of the "Berenstain Bears" children's books published between 1962 and 1992 were surveyed. Counts were made for all books of total number of appearances of female and male family members, and total appearances of nonfamily males and females. Additionally, all identifiable occupations and activities were tallied by gender of book character engaged in the occupation or activity, then rated by independent judges as to how masculine or feminine they were. Overall, pictures of female characters - family and nonfamily - appeared significantly less often than did pictures of male characters. Male characters were portrayed in occupations and activities rated significantly more masculine than those in which female characters were portrayed. Finally, although there was a significant trend toward inclusion of a higher proportion of female characters across the 30 years of books, gender-role stereotyping of activities and occupations did not change significantly across the 30 years.

GEOLOGY

E. RAY GARTON and KELLEY DEEM, EnviroCheck, PO Box 200, Barrackville, WV 26559. Results of Sub-Slab Passive Radon Venting at the National Aero Space Education Center and Fairmont State College.

During pre-construction testing, soil gas Radon levels were found in excess of 800 pCi/l in the foundation area of the Education & Health Careers building at Fairmont State College. This suggested that elevated indoor radon levels were possible in the new building since indoor radon levels of over 9 pCi/l had been found in other buildings on campus. Working with the contractor and the school administration, EnviroCheck designed a sub-slab soil gas venting system, to be installed during the construction phase of the building. The system consisted of a network of perforated, 4 inch, PVC pipes laid in gravel filled trenches throughout the foundation slab area. The pipes were interconnected and vent stacks run up through the building and out the roof. A vapor barrier was laid over the entire slab area of the building before the slab was poured. Once the building was under roof an E-PERM ion chamber Radon detector was placed in each of four vent stacks approximately 10 feet below roof level. The results of the vent stack tests made in late October, 1992, ranged from 20.2 pCi/l to 40.7 pCi/l. We believe that Radon vents by thermal convection currents when the ground temperature is warmer than the outside air (winter). When the ground tem-

made in late October, 1992, ranged from 20.2 pCi/l to 40.7 pCi/l. We believe that Radon vents by thermal convection currents when the ground temperature is warmer than the outside air (winter). When the ground temperature is colder than the outside air (summer), Radon may not vent naturally. During times of equal ground and air temperature Radon flow will be in equilibrium. Barometric pressure should also have an effect on the Radon flow. Based on the initial results at FSC a similar system was installed at the Robert C. Byrd, National Aero Space Education Center. Alpha Track Radon Detectors (ATRD) iwere nstalled in both buildings in all frequently used rooms that have ground contact. In addition ATRD's were placed in all roof vent stacks. All ATRD's were exposed for at least 90 days during December, 1993 through March, 1994, then submitted for laboratory analysis. The results of the ATRD testing show the average indoor Radon concentrations for the test period and the effectiveness of the passive vent system.

FREDERICK GRADY, 1201 South Scott Street, Apt. 123, Arlington, VA 22204 and E. RAY GARTON, Mammoth Geophysical, Inc. PO Box 200, Barrackville, WV 26559.
The Pleistocene Peccaries *Platygonus vetus* and *Platygonus compressus* from West Virginia Caves.

Two species of the extinct Pleistocene peccary genus *Platygonus* are known from West Virginia cave sites. *Platygonus vetus* is a large middle Pleistocene species and is best represented in West Virginia by a complete skull and other bones from Renick Quarry Cave in Greenbrier County and a large number of bones and teeth from Hamilton Cave in Pendleton County. The Hamilton remains of *Platygonus vetus* consist mostly of teeth and foot bones suggestive of remains from carnivore meals and some of the bones show carnivore tooth marks: An isolated canine crown of *Platygonus vetus* was found in Eliza Davis Cave in Pendleton County and a foot element of this species has been tentatively identified from Bowden Cave in Randolph County. The late Pleistocene *Platygonus compresses* is a smaller species than *Platygonus vetus* and is know from caves in Greenbrier, Monroe, Pendleton, and Pocahontas Counties. This species is best represented in West Virginia from Patton Cave in Monroe County where more than 20 individuals were found in one spot including several virtually complete skulls. Teeth and bones of *Platygonus compressus* have also been found in Buckeye Creek Cave and Bransford Cave in Greenbrier County, Hamilton and New Trout Caves in Pendleton County, and Poor Farm Cave in Pocahontas County. Specimens from two sites in Patton Cave were Carbon 14 dated at 13,350 and 22,620 years before present.

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EBERHARD WERNER, P. O. Box 795, Morgantown, WV 26507

Pseudokarst features of the Coopers Rock State Forest

The term *pseudokarst* is applied to features of the landscape which mimic those developed on true karst, or solutional, landscapes, but which are created by processes other than solution. Features such as caves, sinkholes, and sinking and re-appearing streams are often found in landscapes which are not underlain by normal karst rocks such as limestone or gypsum. In the Coopers Rock State Forest, the principal surface rock type is a relatively pure, somewhat friable, sandstone that is readily eroded by water moving over and through it. The surface of the rock exposed to the atmosphere tends to be case-hardened by repeated wetting and drying, and resists erosion; but where the rock is protected from drying out, weathering progresses. As a result, sand particles are removed from fracture walls and between rocks by water moving below the land surface, enlarging many of these fractures and other openings, which in turn allows for even more water flow and sand transport. Conduits are developed, and loose material roofing these conduits may collapse into the voids to develop some of the sinkholes seen in parts of the Forest. Other closed depressions appear to be artificially created, perhaps as prospect pits dug for iron early in the last century; some of these are now capturing surface flows and developing subterranean drainage conduits. Although some caves may develop by this process, most caves in the Forest are near the edge of the Cheat River gorge in the rock cities developed there, and are formed by movement of large blocks of rock downslope on thin shaly beds that become slippery when wet. Adjacent blocks move slightly different distances or tilt or rotate different amounts, thereby opening space between them which may be roofed over by slabs of rock or soil and root mats, thereby creating caves.

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EBERHARD WERNER, P. O. Box 795, Morgantown, WV 26507. **Geological and geographical information on West Virginia gathered before 1875 – the legacy for I. C. White**

When I. C. White began his geological work in West Virginia, he was not stepping into a total vacuum, some work had been done to survey the geology and geography of the area. However, the work done was relatively little or late compared to the surrounding areas. New Virginia, as the western part of Virginia that was to become West Virginia was known, underwent the typical progression of exploration, exploitation, and settlement that normally leads to systematic scientific investigation. However, because

the natural resources which later became sought after, such as timber, coal, and oil and gas, were not considered to be worth the effort that it would take to transport them to market until the latter half of the nineteenth century, the area was largely bypassed by development; the valuable resources were those which had a large value relative to their bulk, which is not true for most found in West Virginia. Travel to the west, where the good farm land was located, was much easier by bypassing the area of the state than by going through it. Most early settlement occurred along the northern border, partly around iron furnaces established near the road to Pittsburgh and Wheeling and sources of iron ore, limestone, and trees for charcoal, and in the valleys of the New, Greenbrier, Potomac, and Ohio rivers where floodplains and limestone valleys provided good farmland. Most of the earliest geological knowledge came from travellers, missionaries, and land evaluators who incidentally recorded geological "curiosities" in the journals they kept of their travels through the area. Those who were settled here knew the country better, but their concerns were with farming and hunting in order to survive, and they rarely kept records or communicated with those outside the area. Only after the area was well settled was there a systematic study initiated by the Virginia Geological Survey, and even that was rather cursory in the future West Virginia because of transportation problems and a perception of relatively little value in the land.

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RONALD L. MARTINO, MARK A. MCCULLOUGH, and TERRY L. HAMRICK, Department of Geology, Marshall University, Huntington, WV 25755. Stratigraphy, Paleontology, and Depositional Environments of the Lower Conemaugh Group in the Wayne and Prichard 7.5' Quadrangles, Wayne County, WV

Outcrops of the Lower Conemaugh Group (Glenshaw Formation) at 13 localities were evaluated in terms of their component facies as distinguished by lithology, sedimentary and biogenic structures, fossils, paleocurrents and facies geometry. Paleoenvironmental interpretations include shallow marine, deltaic, alluvial and paludal depositional settings. Three marine units are present within a 21 m stratigraphic interval which are correlated with the Lower Brush Creek, Upper Brush Creek, and Cambridge(?) marine zones described by Merrill (1986) along the Big Sandy River. Marine invertebrate genera represent articulate and inarticulate brachiopods, fenestellid bryozoans, crinoids, bivalves, bellerophontid gastropods, and fusulinids.

Previous stratigraphic studies in this part of Wayne County are very limited. The results of this project 1) extend the known geographic distribution of marine units in the southern Dunkard basin, 2) demarcate the southern limb of the Parkersburg-Huntington syncline through the Wayne-Prichard area with a deep significantly greater than that shown in the Wayne County Report (Krebs and Teets, 1913), and 3) indicate that transgressive-regressive packages of strata recognized further north have considerable lateral continuity, supporting an allocylic rather than autocyclic origin. The recognition of 3 closely spaced marine units in the area calls into question previous identification of units as Brush Creek or Ames Limestones at some locations described in the County report. Since geologic mapping and identification of coal zones is based largely on correct identification and correlation of marine units, this study should have important consequences for past and future stratigraphic work and mapping in Wayne County.

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PATRICIA LAZIER, BUFFY SUBORA & CHRISTINE TAYLOR, Dept. of Physical Science, Shepherd College, Shepherdstown, West Virginia 25443. Intraspecific Variation and Taxonomic Analysis of Three Species of Acanthocladid Bryozoa.

The Mississippian Warsaw formation (Valmeyeran [Osage-Meramecian] in age) from central Illinois has one of the most abundant assemblages of acanthocladid Bryozoa in the world. Taxonomic approaches to the acanthocladids have met with limited success, primarily due to solely exterior analysis of the colonies or 2-dimensional interior analysis based on sections through the colony. For this reason, the acanthocladids have commonly been ignored in taxonomic and paleoecologic works. Snyder (1991) proposed a revised taxonomy, based on a combined descriptive and quantitative exterior and interior analysis, applying a three-dimensional reconstructive approach. Such an approach has proven successful in meshwork fenestrates, but has not been strictly applied to the pinnate fenestrates.

Ptylopora conferta Ulrich 1890, Ptylopora cylindraceae Ulrich 1890, and Acanthosepta n. gen. varsoviensis n. sp. were analyzed applying this revised approach. The species were clearly separated on the basis of exterior and interior analyses, and 3-dimensional reconstructions of autozooecial chambers. Photomicrographs and illustrations are both employed to allow consistent genus and species assignments as well as recognition of species by other workers.

Intraspecific variation between the three species has been undertaken both quantitatively and descriptively to determine genotypic and phenotypic implications of variations observed in shared characters.

ZOOLOGY

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JEFFREY V. NICHOLS and PETRA BOHALL WOOD, WEST VIRGINIA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT, WEST VIRGINIA UNIVERSITY, P.O. BOX 6125, MORGANTOWN, WV 26506-6125. Effect of two-age management and clearcutting on songbird density and reproductive success.

We examined density and reproductive success of passerine species on un-cut forest stands and on stands harvested 10-14 years ago on the Monongahela National Forest of West Virginia. Stands were harvested using 2 silvicultural treatments: clearcutting and 2-age management (a type of deferred removal). In 2-age management, 2 distinct age classes are maintained at 1/2 rotation apart. Throughout the first rotation stands resemble an even-aged stand with approximately 10-30 overstory trees/acre left un-cut. Each of the 2-age and clearcut stands were replicated 6 times. No-harvest stands had 7 replicates. The study involved a total of 19 stands. Surveys in periphery areas placed adjacent to treatments allowed us to determine if density or nesting success of birds in un-cut areas were affected by directly adjacent cutting practices. All stands and periphery areas were censused 5 times with the variable-circular plot technique from May-July 1993. Thorough nest searches of all stands and periphery areas yielded complete nest histories on 95 nests representing 23 species. We present preliminary first year data on bird density and nest success from a 2-year study.

E. RAY GARTON, Mammoth Geophysical, Inc. PO Box 200, Barrackville, WV 26559, FREDERICK GRADY, 1201 South Scott Street, Apt. 123, Arlington, VA 22204 and STEVEN D. CAREY, Department of Life Sciences, University of Mobile, P.O. B ox 13220, Mobile, AL 36613. The Vertebrate Fauna of West Virginia Caves, Final Report.

The Vertebrate Fauna of West Virginia Caves was published in September, 1993, as Bulletin 11 of the West Virginia Speleological Survey. As of the publication date, 57 species of vertebrate animals representing 39 genera have been recorded from West Virginia caves. Vertebrate fauna are reported in only 229 (7%) of 3100+ known caves. Vertebrate cave fauna are found in 17 of the state's 55 counties. The taxa represented include 5 species of fish, 23 species of amphibians, 3 species of reptiles, 6 species of birds, and 20 species of mammals. It is the intent of the authors to report new records on a yearly basis through the WV Academy of Science and other Speleological related publications.

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CONLEY MARCUM, JR. and THOMAS K. PAULEY, Department of Biological Sciences, Marshall University, Huntington, WV 25755. Larval Characteristics of Four Salamander Species in the Fernow Experimental Forest, Tucker County, West Virginia.

Larvae of four salamander species, Eurycea bislineata, Desmognathus monticola, D. ochrophaeus, and Gyrinophilus p. porphyriticus, were studied in the Fernow Experimental Forest to determine distinguishing morphological markings and the length of larval periods. Each species has several pairs of dorsal spots between the fore and hind legs. The spots of D. ochrophaeus larvae are much smaller than those of D. monticola and are often lost soon after hatching. Desmognathus ochrophaeus larvae also have the characteristic head marking and dorso-lateral stripe of the adult and may have a larval period as short as two weeks, while D. monticola larval period is approximately 9-10 months. Eurycea bislineata larvae also have pairs of spots on the dorsum between the fore and hind legs, however, the spots are more numerous and the larvae are much lighter in color than the desmognathine species. Eurycea bislineata larvae are more stream-lined and slender compared to D. monticola and D. ochrophaeus larvae. The head of E. bislineata larvae is somewhat pointed and the tail is sharply keeled, while the desmognathine larvae have more rounded heads and less sharply keeled tails. The larval period for Eurycea bislineata is three to four years. Gyrinophilus p. porphyriticus larvae are up to three times larger in snout-vent-length (SVL) than E. bislineata larvae which are approximately 1/3 greater in svl than the two desmognathine species. Gyrinophilus p. porphyriticus larvae are often pinkish in color and have no spots on the dorsum, but have mottling on the body and a squared head. The characteristic line from the nares to the eye found in adults is usually present. The tail is very sharply keeled, but is often broken off in older larvae.

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ANTHONY B. BORDA, JR. and THOMAS K. PAULEY, Department of Biological Sciences, Marshall University, Huntington, West Virginia 25755.
Utilization of wood duck nest boxes at the Green Bottom Wildlife Management Area, West Virginia.

Utilization of wood duck (Aix sponsa, L.) nest boxes was evaluated at the Green Bottom Wildlife Management Area, a 1,110-acre mid-Ohio Valley floodplain. Primary focus was directed upon nest box utilization by the wood duck but use by other species of birds, mammals and insects was observed and recorded. Utilization of the nest boxes by the wood duck was analyzed with respect to plant community type, orientation and proximity to other wood duck nest boxes. Forty-three wood duck nest boxes were observed and inspected and wood ducks nested in 24 of the nest boxes in 1993. A total of 361 eggs were counted. Clutch size ranged from 0 to 38 with the mean clutch size being 15. Nests with a clutch size of greater than 15 eggs suggests that the nest may have been a dump nest, the term given to a nest where eggs were deposited by two or more females. Eleven of the 24 nest boxes utilized by wood ducks contained clutches of more than 15 eggs. Eleven other species of birds, mammals and insects were observed and recorded utilizing some of the wood duck nest boxes in 1993 prior to, during and subsequent to the wood duck nesting season which began in March and extended into June. The fact that nearly 50% of the 24 nest boxes utilized by wood ducks for nesting may have been dump nests suggests a high number of young females in the breeding population or too many nest boxes were initially placed in the area or poor placement of some of the nest boxes in proximity to placement of other wood duck nest boxes or some combination of all or some of these factors.

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STEVEN D. KOENIG, SUE A. PERRY, WILLIAM B. PERRY, COOPERATIVE FISH & WILDLIFE RESEARCH UNIT, WEST VIRGINIA UNIVERSITY, PO BOX 6125, MORGANTOWN WV 26506-6125. Respiratory response of larval fathead minnows (Pimaphales promelas) and swordtails (Xiphophorus helleri) to an episodic change in pH.

We investigated the respiratory response of larval fathead minnows and swordtails to episodic change in pH. Fish were placed in a buffered pH solution (pH 5 to 8) of reconstituted soft water at 25°C. After two hours initial exposure, their rate of oxygen consumption was measured for two hours exposure in a Gilson Differential Respirometer. On a dry weight basis, the mean respiratory rate of fathead minnows on day-of-hatch was twice that of swordtails on day-of-birth. There was no significant difference in the mean respiratory rate (per mg dry weight) between one-day-old and 30-day-old swordtails. The effect of pH on respiration was significant. The magnitude of the respiratory response varied between the two species and with age in swordtails.

RITA F. VILLELLA, C.D. SNYDER, AND D. LEMARIÉ, NATIONAL BIOLOGICAL SURVEY, LEETOWN CENTER, 1700 LEETOWN ROAD, KEARNEYSVILLE, WV 25430. INFLUENCE OF HABITAT ATTRIBUTES AT DIFFERENT SPATIAL SCALES ON FISH ASSEMBLAGE STRUCTURE IN THE OPEQUON CREEK DRAINAGE, WEST VIRGINIA.

Spatial dynamics of riverine species are determined by relationships among numerous instream, riparian, and watershed processes. However, linkages among these elements and their relative and cumulative effects on stream communities are poorly understood. A five year watershed study was designed to address these relationships on Opequon Creek, a fourth order tributary of the Potomac River. Opequon Creek is a multiple land use watershed composed of 42 sub-basins representing predominantly forested, agriculture, and urban landscapes. Substantial increases in urban development in the watershed has stimulated considerable concern among local and regional resource management agencies. The objectives of the study are 1) to identify fish population and community metrics sensitive to large-scale watershed attributes such as land use, and 2) to relate physical attributes at different spatial scales to fish assemblage structure in small, headwater streams in the watershed. A nested sampling design is being used in each of the sub-basins having permanent streams. By selecting sub-basins within a single watershed for analysis, similarities in climate, vegetation, soils, and lithology should reduce natural variability in surface water chemistry thus isolating human-induced changes on the landscape. Measurements at each landscape level are being compiled into a GIS database and maps of instream habitat, riparian zone and basin attributes will be constructed and queried. A suite of multivariate techniques will be used initially to relate biological and physical data, identify redundant variables, and generate hypotheses for further testing. Results of the study should provide resource managers with additional information to be used in the conservation of natural resources in this region. Ultimately, similar studies in other watersheds could be conducted to determine the extent to which observed patterns could be generalized.

JANET L. CLAYTON, West Virginia Division Natural Resources, PO Box 67, Elkins, WV 26241. Freshwater bivalves in Elk River, West Virginia with emphasis on federally endangered species.

During 1991 and 1992 an extensive survey of the unionid bivalve population in the Elk River was conducted. The purpose of the survey was to determine the status of two federal candidate species, Pleurobema clava and Epioblasma rangiana, and the federally endangered Lampsilis abrupta. Twenty-one stations were surveyed in the Elk River below Sutton Dam, and three stations were surveyed above Sutton Lake. Methods used were water scopes, snorkeling, scuba, and bank/midden searches. The Elk River maintains a very diverse and abundant bivalve population throughout most of its entire length below Sutton Dam (24 species). A limited bivalve population exists above Sutton Lake (6 species). Live individuals of P. clava were found at six of the 21 stations surveyed below the dam, and it appears that there is a reproducing population. This survey did not reveal any E. rangiana, however, since this survey was completed two live individuals of E. rangiana were located at one site in the lower reaches of the river. This survey and recent surveys conducted by other individuals have found limited numbers of L. abrupta inhabiting the lower reaches of the Elk River although no evidence of reproduction has been seen.

CRAIG W. STIHLER, West Virginia Division Natural Resources, PO Box 67, Elkins, WV 26241. New records for the land snail, Triodopsis platysayoides, a West Virginia endemic.

Triodopsis platysayoides was described by Stanley Brooks in 1933 from a specimen collected at Cooper's Rock, Monongalia County. When this species was listed as federally threatened in 1978, it was still known only from the vicinity of Cooper's Rock. Surveys by WV Division of Natural Resources and U.S. Fish and Wildlife Service employees increased the number of localities for this species to 7 before the publication of the T. platysayoides recovery plan in 1983. All seven sites were in areas of sandstone outcrops and boulders within the Cheat River Gorge near Cooper's Rock. WVDNR biologists then identified areas of potential habitat by observing the gorge from a helicopter under "leaf off" conditions. In subsequent years, 36 sites were visited by WVDNR personnel and student assistants from West Virginia University, Morgantown. These surveys located 10 additional locations for this snail. These 17 sites are located in a 3.4 km X 5.4 km region of Monongalia and Preston counties south of U.S. Route 68. One additional site was discovered approximately 10.3 km southeast of the nearest known location. This site is unusual in that it is associated with a limestone cave. All known sites for this species are found in the Cheat River Gorge or in the steep valleys of its tributaries; no site is more than 1.88 km from the Cheat River. Sites range from 396 m to 622 m in elevation. Dr.

Thomas Pauley and graduate students from Marshall University, Huntington, WV, looked for T. platysayoides while conducting surveys for green salamanders (Aneides aeneus) in sandstone outcroppings in Cooper's Rock State Forest north of U.S. Route 68; no specimens of T. platysayoides were found.

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Thomas K. Pauley, Department of Biological Sciences, Marshall University, Huntington, WV 25755 and James Kochenderfer, Fernow Experimental Forest, Parsons, WV 26257. Utilization of Artificial Ponds by Amphibians in Recent Clearcuts.

During the spring and summer of 1993, 22 newly constructed ponds on skidroads in two clearcut units were studied to determine use by amphibians. The ponds had a mean size of 9.9 m^2 and a mean depth of 20.6 cm. Of the 22 ponds, 4 anuran species were found to breed in 11 of the ponds, while 7 of the ponds were utilized by more than one species. Anuran species included Bufo a. americanus, Rana sylvatica, Pseudacris brachyphona, and Hyla chrysoscelis. In addition, two species of urodelan larvae were found to inhabit two of the ponds. Eleven of the original 22 ponds dried up before September 1. Water chemistry and water depth were measured, but no differences were detected between colonized and noncolonized ponds.

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SAMANTHA L. DEGASPERIS and JOHN T. BURNS
Dept. of Biology, Bethany College, Bethany,WV 26032. The Effect of Dexamethasone on the Pigeon Cropsac Response to Prolactin.

The cropsac response was studied in 13- week old pigeons *Columba livia* that received pretreatments of dexamethasone or saline injections. The pigeons were housed in indoor wire coops (3 birds per coop) and were

placed on a 12L:12D photoperiod (500 Lux) (0600 to 1800 lights on). The pigeons were divided into 3 groups of 6 birds each that received the dexamethasone (.025 mg in .125 cc of .85 % saline given repeatedly to each bird at 0600, 1200, 1800, and 2400 on December 5), 3 groups of 6 birds each that received just saline (.125 cc of .85% saline given repeatedly to each bird at 0600, 1200, 1800, and 2400 on December 5), and a group of 3 birds that received no injections during the experiment. Injections of ovine prolactin (.2 mg/day, 1 mg = 32 I.U., in .25 cc of .85% saline) were given daily (at 0600 or 1200 or 1800) for 4 days beginning December 8, to groups of pigeons that had received dexamethosone pretreatment as well as those that had received only saline. When the pigeons were killed (24 hrs after their last prolactin injection), it was found that the body weight of the dexamethosone pretreated pigeons (477.59 $\pm$ 14.06 g, mean $\pm$ S. E.) was less ($P \leq .005$, Student's t test) than the saline pretreated pigeons (549.83 $\pm$ 13.29 g) and the cropsac weight of the dexamethosone pretreated pigeons (3.15 $\pm$ .15 g) was less ($.025 < P \leq .05$) than the saline pretreated pigeons (3.62 $\pm$ .16 g). The group of 3 uninjected pigeons had a body weight of 511.67 $\pm$ 56.38 g and a cropsac weight of 2.03 $\pm$ .08 g. No statistically different responses (ANOVA) were found with regard to time of day of the prolactin injections. It is concluded that dexamethasone pretreated does reduce the cropsac response to prolactin in the pigeon.