Body Composition and Migration Potential of Army Cutworm Moths Taken from Alpine Aggregation Sites in Glacier Park [TWS]

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Grizzly bears (*Ursus arctos horribilis*) consume army cutworm moths (*Euxoa auxiliaris*) from late June through mid-September on alpine talus slopes in Glacier National Park, Montana. To better understand the nutritional importance of army cutworm moths to grizzly bears in Glacier National Park, we determined temporal abundance patterns, body mass, total moisture, total nitrogen, total lipid, and gross energy of moths collected from alpine moth aggregation study sites throughout the summer. Army cutworm moths arrived in the alpine of Glacier National Park in early July in 1994 and in late June in 1995. We did not capture any army cutworm moths after 10 August in 1994 or after 30 July in 1995. Army cutworm moths showed a marked increase in body mass, total moisture, total lipid, and gross energy, and a decrease in total nitrogen over the course of the summer. We calculated that an army cutworm moth flying in late summer through still air, presumably at a speed that minimizes cost of transport, could fly 140 km using body lipid reserves alone.

Environmental Sciences and Engineering

Preliminary Study of the Beaverhead River and the Effects of the Dillon Community: Biology [MAS]

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Aquatic macroinvertebrate diversity and abundance are often used as a barometer of the health of riparian ecosystems. Aquatic macroinvertebrate counts, in conjunction with chemical analyses of specific stream reaches, may be useful harbingers of stream degradation. Sixty-two students from the 100 level biology class at WMC-UM participated in the field collection and in the laboratory identification of aquatic macroinvertebrates (to Order) sampled from four stations along the Beaverhead River in southwestern Montana. Stations were approximately 20 feet in length and located within the low water marks in areas with riffles and cobbles. Students collected 3 replicate samples of macroinvertebrates, with a surber stream bottom sampler, within each of the four river stations in January and again in February of 1997. Histograms were plotted to allow comparison of the distribution of invertebrate Orders within and across each of the four river sites. Two species

richness indices, the number of species in a defined sampling unit (S) and Margalef's index (Dmg) and one proportional species abundance index, Simpson's (D) were calculated for each of the four river sites for both January and February. S and Dmg show relatively little change across all four river sites while D indicates a loss of diversity and a shift in species dominance/ evenness characteristics at our most downstream site (below a sewage treatment plant). At this site, aquatic nematodes (Nematoda) are 6 times more abundant than any other aquatic invertebrate Order.

PRELIMINARY STUDY OF THE BEAVERHEAD RIVER AND THE EFFECTS OF THE DILLON COMMUNITY: CHEMISTRY MAS

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Students in two Freshman-level college chemistry classes studied water quality of the Beaverhead River, which flows through Dillon, Montana, as a lab component of their classes. This activity had several goals -- to involve beginning-level chemistry students in real scientific research, to offer the community planning boards information that would otherwise not be available, and to provide data for a longer term monitoring of Beaverhead River water quality. Many of the students at this college are studying to become public school teachers, so an additional goal was to provide a model for student research in science classes. Four collections sites were chosen: two upstream from Dillon, one just within the town, and one just downstream of town. Chemical analyses were done using a HACH portable water chemistry lab, with EPA-approved equipment and test procedures. Analyses performed at the water-collection sites included temperature, pH, dissolved oxygen, conductivity, and total dissolved solids. Samples were transported back to the lab and immediately analyzed for ammonium, nitrate, sulphate, and phosphate ions and alkalinity. One group tested the reliability of the results using chemical standards. Our analyses show that the river water is well within drinking-water standards for the analytes studied. It has healthy dissolved oxygen and pH levels and is well buffered. The results of this project provide a "clean" base level for planned continued monitoring of the river.

CHEMICAL CHARACTERIZATION OF CLARK CANYON RESERVOIR, MONTANA MAS

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A preliminary study of the water chemistry of Clark Canyon Reservoir, Montana, was begun. Clark Canyon is located 20 miles south of Dillon, and is filled by Red Rock River and Horse Prairie Creek, and is the source of the Beaverhead River. Clark

Canyon is a rich and popular fishery. Samples were taken at the deepest part of the lake (near the dam) depths of: surface, 5 m, 10 m, 15 m, 20 m, and bottom (approx. 25 m). During the winter, holes were drilled in the ice and a water sampler used. Temperature, pH, dissolved oxygen were measured on site, and the samples were immediately transported back to the lab for analysis. All analyses were done within 48 hours of sampling. Analysis was done with a HACH DR/2000 Spectrophotometer following EPA protocols. Results obtained for several analyses are reported here. The concentrations reported are ranges and averages of samples taken on four different dates. Calibration standards were run to check for accuracy, and all reported results have errors of less than 10%. Sampling dates: 1/5/97, 1/31/97, 2/23/97, 4/17/97. All concentrations are in mg/L except pH and where otherwise noted. Temperature: range 1-6°C, average 4°C. Dissolved oxygen: range 4.7-4.8, average 9.3. Nitrate: range 0.44-1.63, average 0.77. Nitrite: range 0.013-0.030, average 0.020. Sulfate: range 66-88, average 76. Phosphate: range 0.33-2.86, average 0.89. Iron: range 0-0.71, average 0.14. Fluoride: range 0.10-0.69, average 0.40. Chloride: range 6.6-16.5, average 9.8. Ammonia: range O.12-0.37, average O.22. Calcium hardness: range 112-185, average 151. pH: range 7.56-8.64, average 8.10.

The Atmospheric Missing Link - Where Has All of the CO^2 Gone? [MAS]

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Being able to accurately estimate the global carbon budget is critical to the estimation of future environmental conditions. Comparing known CO^2 sources and sinks, modelers have recorded an annual net imbalance of approximately 2.2 gigatons of carbon. It was hypothesized that the oceans were sequestering the "missing" carbon, but testing has resulted in the rejection of that hypothesized. It is assumed that the potential sink must be large and have global distribution to account for such a massive quantity of carbon. After the oceans, the next largest potential sink appears to be the soil. This research analyzed soil samples from a Kansas State University experimental site that had been established for the purpose of examining the effects of elevated CO^2 levels on soil carbon content. Treatments examined were ambient and two-times ambient CO^2 levels. Particulate Organic Matter (POM) was isolated from whole soil samples using a dispersing agent and mild mechanical disruption of aggregate structure. The POM was then treated with a series of density extractions to isolate distinct phases of the degradation continuum. Dry weight examination revealed increasing POM recovered with exposure to elevated CO^2. SEM revealed that the density extraction procedure successfully isolated distinct POM fractions. Carbon analysis revealed that soil carbon levels increased significantly under enhanced CO^2 conditions - Rough calculations indicate the deposition of an additional 0.2 kg C/g whole soil per m^2 to a depth of 5 cm.

The Integration of the Sciences at Western Montana College, Dillon, Montana [MAS]

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Western Montana College is a small (1200 students) liberal-arts college located in southwestern Montana. Starting in the fall semester of 1996, the science departments joined forces to form an interdisciplinary department of environmental sciences. This move was motivated by a desire to create an undergraduate program that involves meaningful integration of the sciences. As a result, we eliminated the traditional departments (e.g., biology, chemistry, geology, and physics), and formed a single department focused on field-based, environment-specific education. In order to obtain sufficient background in a particular science discipline, each student will choose a track in biology, chemistry, or geology. However, to provide integration, students will also take several field courses that require them to work as part of an interdisciplinary research team. In addition, each student will do a senior project or professional internship that incorporates several science disciplines. This approach has been tested through several projects incorporating more than five classes. Studies have been started on the effects of past mining in the Birch Creek drainage in the Pioneer Mountain Range, and the effects of the Dillon community on the Beaverhead River. We have also had one student in an internship with the USFS in a study of riparian zones. Another student completed a semester of research at Argonne National Lab in Chicago, IL. That work was in an environmental sciences lab studying the soil as a possible carbon sink for global emissions.

Forensic Sciences

Adventures in Baby-sitting: How Not to Treat Your Ward!!! [MAS]

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Perhaps one of the saddest and most tragic cases in recent times occurred during the evening hours of September 9, 1995 in Kalispell, MT. Two and a half year old Joshua Scott Norman died as the result of intentional poisoning at the hands of his teenage (15 years old) baby sitter. Early efforts at denial of any wrong doing on the part of the baby sitter were quickly dispatched through the combined efforts of the State Crime Lab's Medical Examiner, Toxicology Section, and Chemistry Section. The lab was able to show that young Joshua Norman had succumbed to lethal levels of codeine and phenol (one of the active ingredients found in Pine-Sol). The lab's