a mechanistic approach. The biogeochemistry module uses operator splitting to solve the coupled reaction and transport equations for solutes, gases, and soil components. Among the key questions we are examining is the appropriate level of complexity, e.g., which nitrogen species, terminal electron acceptors, and bacterial populations, to incorporate into the rate laws for microbial redox processes. The model is employed to investigate the nitrate levels in groundwater entering streams from different flowpath end-members and the dependence of these levels on temporal variables such as flow rate and season.

At the watershed scale, we are employing a data-intensive, inverse approach to estimate nitrogen sources and sinks using 20-year long water quality data records from Illinois. Using a simple mechanistic model of nitrogen sinks within the NHD stream network and a dynamic nitrogen balance for the soil system, we are able to accurately model the observations and generate estimates of denitrification in the streams. These estimates, of course, depend on the rate laws for streambed denitrification and assumptions about denitrification in shallow groundwater that are employed. Parameter collinearity makes it difficult to separately define the absolute magnitudes of the nitrate inputs from mineralization of soil organic matter and sinks due to denitrification.

By combining insights from the two models, we aim to 1) elucidate the spatial location of the predominant denitrification sink at the watershed scale, 2) quantify nitrogen sinks and sources at the watershed scale, and 3) provide insights into improved methods of modeling this significant biogeochemical process.

B12C-11 1625h

Interactions Among Grassland Plant Species, Microbial Communities, and Soil Processes

Valerie Eviner[1] (EvinerV@ecostudies.org)

Mark Waldrop[2] (mwaldrop@umich.edu)

Egbert Schwartz[3] (eschwart@du.edu)

Jennifer Pett-Ridge[4] (jeffiner@nature.berkeley.edu)

Mary Firestone[4] (510-6423677; mkfstone@nature.berkeley.edu)

[1]Institute of Ecosystem Studies, PO Box AB, Millbrook, NY 12545, United States

[2]University of Michigan, G540 Dana Building, Ann Arbor, MI 48109, United States

[3]University of Denver, Department of Biological Sciences, Denver, CO 80208, United States

[4]University of California, 147 Hilgard Hall, Berkeley, CA 94720, United States

Plant-microbial interactions are thought to be an important determinant of ecosystem processes, yet we do not know whether impacts of plant species on soil microbial community composition translate to impacts on function. We established field plots in a California annual grassland of five plant monocultures for two years to determine the effects of different plant species on the composition of the bulk soil microbial community and selected soil processes. Plant species were associated with distinct ecosystem process rates such as net nitrogen mineralization, nitrification, decomposition and soil respiration. Bacterial community substrate utilization profiles differed among different plant species and were related to labile soil C. DNA-based fingerprints of bacterial, ammonia oxidizer, and fungal communities did not generally differ in soils planted to different species; however, these microbial community profiles did strongly correlate to rates of decomposition. Terminal Restriction Fragment Length Polymorphism (TRFLP) analysis of soil microbial communities showed that the lupine community was distinct from the other four plant-associated communities. Phospholipid fatty acid (PLFA) patterns also failed to distinguish differences in the overall microbial communities associated with the five different moncultures. Interestingly, PLFA biomarker 16:1w5, indicative of AM fungi, differed among plant species treatments. This PLFA biomarker and bacterial TRFLP patterns were related to decomposition rates of a common litter. In summary, large functional differences were found between field plots with different plant species and the composition of the microbial communities was closely related to some of the functions assessed, independent of plant species. Only small plant-induced changes in microbial community composition were detected, yet apparently these changes had significant impact on function. Our analyses were not specifically targeted to microsites with high activity (such as rhizosphere soil) and our DNA and PLFA-based analyses included a potentially huge dormant community of soil microorganisms. While our analyses could detect little impact of plant species on overall microbial community profiles, a smaller active-fraction of the soil microbial community may have been more significantly affected.

B12C-12 1640h

Multiple Pore Region Model of Uranium(VI) Reductive Immobilization in Structured Subsurface Media

Eric E Roden[1] (205-348-0556; eroden@bsc.as.ua.edu)

Timothy D Scheibe[2] (509-372-6065; tim.scheibe@pnl.gov)

[1]The University of Alabama, Department of Biological Sciences A122 Bevill Bldg 7th Ave, Tuscaloosa, AL 35487, United States

[2]Pacific Northwest National Laboratory, Hydrology Group P.O. Box 999 MSIN K9-36, Richland, WA 99352, United States

A numerical simulation model of bacterial U(VI) reduction in fractured subsurface sediments was developed and used to test the potential feasibility of biomineralization at the fracture/matrix interface as a mechanism for immobilization of uranium in structured subsurface media. The simulations depict flow of anaerobic groundwater, with and without acetate as an electron donor for stimulation of U(VI) reduction by dissimilatory metal-reducing bacteria (DMRB), within mobile macropores along a 1-dimensional flow path. As the groundwater moves along the flow path, U(VI) trapped in the immobile mesopore and micropore domains (the sediment matrix) becomes desorbed and transferred to the mobile macropores (fractures) via a first-order exchange mechanism. By allowing bacterial U(VI) reduction to occur in the mesopore domain (assumed to account for 12 % of total sediment pore volume) according to experimentally-determined biomass-dependent kinetic parameters and an assumed DMRB abundance of 107 cells per cm3 bulk sediment, the concentration of U(VI) in the macropore domain was reduced ca. 10-fold compared that predicted in the absence of mesopore DMRB activity after a 6-month simulation period. Our results suggest that input of soluble electron donors over a period of years could lead to a major redistribution of subsurface uranium contamination in fractured subsurface sediments, converting potentially mobile sorbed U(VI) to an insoluble reduced phase (i.e. uraninite, UO2(s)) in the mesopore domain that is be expected to be permanently immobile under sustained anaerobic conditions.

B21A MCC: Hall C Tuesday 0830h

Geophysical Disturbances, Climate, and Ecosystem Patterns I Posters

(joint with H, OS, GC)

Presiding: **L Alexander,** Harvard University**; J Florsheim,** University of California, Davis

B21A-0700 0830h POSTER

Streambed Mobility and Dispersal of Aquatic Insect Larvae: Results from a Laboratory Study.

Stephen T Kenworthy (410-455-8017; stk@umbc.edu)

Baltimore Ecosystem Study, 5200 Westland Bvld, Baltimore, MD 21227, United States

Three series of flume experiments were conducted to quantify relationships between entrainment of surface layer gravels and displacement of benthic insect larvae. One series (B) utilized a sediment mixture with a median size 6.9 mm, maximum size 45 mm, and 10% < 2mm. Two other series examined the effects of locally coarsening the bed surface (Bc) and increasing the < 2mm fraction to 20% (S). Aquatic insect larvae were collected in the field and placed in an upstream segment of the flume bed. Flow rate, flume slope, and sediment transport rate were varied systematically among experiments. Displaced larvae were collected in a net at the end of the flume. The distribution of larvae remaining in the bed was obtained by sorting larvae from the sediment in 25 channel segments.

Flow rate and mean boundary shear stress varied among runs by factors of 1.2 and 2.4 respectively. Proportional entrainment of >11mm surface grains ranged from <0.05 to >0.90. Displacement of insect larvae increased in a regular and consistent manner with increasing flow strength and surface sediment entrainment. Significant displacement occurred for some types of larvae (Ephemerellid mayflies) over a relatively low range of shear stress and bed surface entrainment. Other larvae (*Atherix* sp.) were displaced only at the highest levels of bed surface entrainment. Displacement was lower from coarsened bed surfaces in series Bc, and higher from sandier sediments in series S experiments. The differential effects of bed surface entrainment upon various types of larvae are consistent with anatomical and behavioral differences that influence exposure to near-bed flow and bedload transport. These results suggest that spatial patterns of sediment mobilization are important for understanding patterns of dispersal and disturbance of streambed communities.

B21A-0701 0830h POSTER

Earthworm Activity and the Potential for Enhanced Leaching of Inorganic Elements in Soils

Gerard Gruau[1] ("33-2-23-23-60-86"; gruau@univ-rennes1.fr)

Frederique Ablain[1] ("33-2-99-61-81-74"; frederique.ablain@univ-rennes1.fr)

Daniel Cluzeau[1] ("33-2-99-61-81-86"; daniel.cluzeau@univ-rennes1.fr)

[1]CAREN - CNRS UMR 6118/6553, Campus de Beaulieu, Rennes 35042, France

The potential influence of earthworms on the mobility of soil inorganic constituents was experimentally investigated. Six 20 cm long and 15 cm i.d. columns were packed with soil (loamy material, Paris basin, France). Three earthworm specimens - Lombricus terrestris - were introduced into 3 of the 6 columns (earthworm treatment or ET), the remaing 3 being used to study changes in water composition and solute fluxes without earthworms (control treatment or CT). The 6 columns were operated for 8 weeks and were subjected to 100 ml addition of distilled water at 1, 8, 15, 22, 29, 36, 43 and 50 days. Effluents were collected weekly, filtered and analysed for their Dissolved Organic Carbon (DOC) as well as Si, Na, K, Mg, Ca, Fe, Mn, Al, Sr, Ba, Cu, Zn, Cr, Cd, REE and U concentrations. Replicates yielded extremely consistent results, with standard deviations generally lower than 10%. Effluent volumes were greatest during ET simulations (28% difference on a cumulative basis), which can be attributed to the construction by Lombricus terrestris of permanent vertical burrows into the soil columns. Different temporal chemical trends were observed depending on whether earthworms were present or not. During ET simulations, a washout phenomenon occurred for DOC, Ca, Mg, Fe, Ba, Sr, Cu and U during the startup outflow period (week 2). This washout was followed by a period of apparent equilibrium with concentrations in ET effluents remaining roughly constant for all solutes except REE, Zn and to a lesser extent Mn. No such washout nor equilibrium period was observed during CT simulations. Instead, concentrations in Ca, Mg, Fe, Ba, Sr, Cr and Cu decreased from week 2 to week 8, while those in other solutes increased from week 2 to week 5, then declining untill week 8. For many elements (not all), final (equilibrium?) concentrations (8 weeks simulation) were highest in ET effluents (e.g. 17% higher for Ca and Na; 30% higher for Zn), despite the enhanced infiltration rate (and thus the likely shorter soil-water interaction time). Although preliminary, these results suggest that earthworm activities can potentialy increase the leaching of a wide variety of inorganic elements in soils. This increase could occur through the ability of earthworms to change the biogeochemical conditions in the soil along their burrows (so-called drilosphere).

B21A-0702 0830h POSTER

Ecogeomorphic Modeling of Biodiversity and Disturbance

Daniel B.G. Collins[1] (dcollins@mit.edu)

Rafael L. Bras[1] (rlbras@mit.edu)

Gregory E. Tucker[2] (greg.tucker@geography.oxford.ac.uk)

[1]Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge 02139, United States

[2]Oxford University, Mansfield Road, Oxford OX1 3TB, United Kingdom

Biodiversity is modulated by the local exogenous disturbance regime, and in turn is itself instrumental in determining regional physiography. Disturbances may take on many forms including fluvial erosion, whose nature depends upon physiography and climate. This leads to a complex feedback between the biotic and abiotic landscapes. Two issues are addressed here. One is the effect climate change has on biodiversity, as mediated by fluvial erosion. The second is the geomorphic response to changes in biodiversity. These themes are explored using a regional ecogeomorphic landscape evolution model. The results are relevant to the study of long term climate change as well as to the understanding of the impact of short term natural and man-made perturbations on the landscape.

B21A-0703 0830h POSTER

Biogeochemical Consequences of Wind and Salvage-Logging Disturbances in a Spruce- Fir Forest Ecosystem

Cristina M. Rumbaitis-del Rio[1] ((303)492-5130; rumbaiti@colorado.edu)

Carol A. Wessman[1] (wessman@colorado.edu)

[1]Cooperative Institute for Research in Environmental Sciences , University of Colorado Campus Box 216, Boulder, CO 80309-0216, United States

Compound disturbances have the potential to fundamentally alter an ecosystem structure and function. This study examines the effects of a natural disturbance and a compounded natural and anthropogenic disturbance on soil properties, biogeochemical cycles, and ecosystem reorganization in a windblown and salvage-logged ecosystem in northwestern Colorado. Areas of intact forest are used as a control to compare the disturbance effects. Results indicate that soils in the salvage-logged areas are significantly drier, warmer, denser, and contain less organic matter than soils in blowdown or control areas. Significant amounts of erosion occurred in the salvage-logged areas to produce these results. Furthermore, net nitrogen mineralization rates are negative in soils from salvage-logged areas, indicating that immobilization of ammonium and nitrate is taking place. By contrast, net nitrogen mineralization rates are significantly higher in blowdown areas than in control areas. Seedling density, herbaceous cover, and plant species diversity are greatest in blowdown areas, and least in salvaged-logged areas. The results of this four-year study indicate that the mitigation effects of salvage logging significantly alter ecosystem functions and retard the rate of recovery when compared to unlogged blowdown areas.

B21A-0704 0830h POSTER

The Consequences of a Two Water Source Ecosystem on the Surface Carbon and Water Exchange in a Semiarid Riparian Woodland

Russell L Scott[1] (520.670.6380; rscott@tucson.ars.ag.gov); Chris Watts[2] (watts@cideson.mx); David Goodrich[1] (dgoodrich@tucson.ars.ag.gov); Dean Martens[1] (dmartens@tucson.ars.ag.gov); Kevin Hultine[3] (khultine@ag.arizona.edu); Enrico Yepez Gonzalez[3] (yepezgl@ag.arizona.edu); Travis Huxman[3] (huxman@email.arizona.edu); Guanghui Lin[4] (glin@bio2.edu)

[1]United States Department of Agriculture (USDA) Agricultural Research Service, 2000 E Allen Road, Tucson, AZ 85719, United States

[2]Instituto del Medio Ambiente y Desarrollo Sustentable (IMADES), Esq. Reyes y Aguascalientes, Hermosillo, Son 83190, Mexico

[3]University of Arizona, Department of Renewable Natural Resources, Tucson, AZ 85721, United States

[4]Columbia University - Biosphere II, Oracle Hwy, Oracle, AZ 85623, United States

A multi-year, multidisciplinary study was conducted to improve our understanding of the carbon and water exchange from a dominant, riparian mesquite (Prosopis velutina) ecosystem. Accordingly, we have used a variety of measurements including above and below-canopy eddy covariance, sap flow, soil/plant respiration, stable isotopes, soil moisture, and water table height to monitor key ecosystem processes and forcing. Groundwater table fluctuations and tree functioning (phenology, carbon uptake, transpiration) were well correlated suggesting that the trees rely principally on this 11 m deep, stable water source. The functioning of the understory plants and soil microbes, however, were dependent on recent precipitation. This bifurcation of water sources between overstory and understory resulted in interesting and unusual ecosystem fluxes. The tree water use was nearly constant before and after the arrival of the summer monsoon whereas the understory functioning changed dramatically. The apparent increase in total ecosystem photosynthesis during the rainy season, however, did not lead to a rise in net ecosystem carbon exchange. Rather, the net uptake of carbon decreased due to the substantial increase in respiration, which was fueled by precipitation, warm nighttime temperatures and an abundant source of deposited tree litter.

B21A-0705 0830h POSTER

Spatial Patterns of Nitrogen Loss From Fire

Jeffrey A. Hicke[1] (650-325-1521; jhicke@globalecology.stanford.edu); Guido van der Werf[2] (guido@ltpmail.gsfc.nasa.gov); Florent Mouillot[1] (florent@globalecology.stanford.edu); James T. Randerson[3] (jimr@gps.caltech.edu); Christopher B. Field[1] (cfield@globalecology.stanford.edu); Gregory P. Asner[1] (gasner@globalecology.stanford.edu)

[1]Department of Global Ecology, Carnegie Institution of Washington, 260 Panama Street, Stanford, CA 94305, United States

[2]NASA Goddard Space Flight Center, Mail Stop 923.0, Greenbelt, MD 20771, United States

[3]California Institute of Technology, Mail Stop 100-23, Pasadena, CA 91125, United States

Globally, the loss of molecular nitrogen (N_2) resulting from fires has been estimated to be 10-50 Tg N/yr, or 5-50% of global biological nitrogen fixation (BNF). Here we discuss spatial patterns of pyrodenitrification based on biomass burned and the ratio of N_2 loss to CO_2 loss. CO_2 emissions due to fires were calculated with a variety of fire input sources together with the CASA carbon cycle model, and we utilized these results to identify regions where pyrodenitrification could be an important process in the nitrogen cycle. The frequent burning in tropical woodlands and savannas generated an N_2 loss of 15-40 kg N/ha/yr. Extratropical pyrodenitrification (north and south of 20 degrees) was much lower, 5-10 kg N/ha/yr, resulting from the longer fire return interval. Comparisons with maps of BNF revealed that pyrodenitrification was a substantial fraction of BNF (>60%) in tropical woodlands and savannas, and in many of these locations exceeded BNF.

B21A-0706 0830h POSTER

Trace Gas Emissions from Extensive Aquaculture Systems in the Red River Delta, Vietnam

J. Michael Beman[1] (1-650-724-1535; beman@stanford.edu)

Karen C. Seto[1,2] (kseto@stanford.edu)

[1]Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305-2115, United States

[2]Center for Environmental Science and Policy, Stanford University, Stanford, CA 94305, United States

The Red River Delta of Vietnam is an area undergoing rapid land use change. Aquaculture development is among the most significant of these transformations, with important economic, social and environmental effects. We explored the potential for managed mangrove and converted paddy aquaculture systems in the Delta to produce and/or consume greenhouse gasses. We measured dissolved concentrations of the radiatively-important trace gasses methane (CH4) and nitrous oxide (N2O), as well as associated parameters. All ponds were super-saturated with CH4, with concentrations ranging from 132-1203 nM, (mean 561 nM) in managed mangrove, and 28-521 nM (mean 110 nM) in converted paddy. Surprisingly, none of the ponds was measurably supersaturated with N2O. Methane fluxes were calculated for all ponds using five well-accepted models of gas flux based on wind speed. Mean flux values ranged from 1.04 to 17.09 mg CH4 m-2 d-1 for managed mangrove, falling somewhere between fluxes reported for natural systems and those receiving sewage inputs. Further measurements should be made in more intensive systems to better understand the potential for trace gas productionparticularly N2Oin aquaculture systems.

B21A-0707 0830h POSTER

Changes in Regional Nitric Oxide Emissions from Savanna Soils Associated with Woody Encroachment

Roberta E. Martin[1] (303-818-8475; robin.martin@colorado.edu)

Gregory P. Asner[2] (650-325-1521; gasner@globalecology.stanford.edu)

[1]University of Colorado, Dept. of Geological Sciences, Boulder, CO 80305, United States

[2]Carnegie Institute of Washington, Dept of Global Ecology Stanford University 260 Panama Street, Stanford, CA 94385, United States

Mesquite has been rapidly increasing over the past 100 years resulting in documented changes to the biophysical and biogeochemical structure of savanna ecosystems world-wide. Some of these changes include increases in plant and soil C and N stores and cycling rates as well as isotopic shifts in these pools (Archer et al. 2001, Boutton et al. 1998, Hibbard et al.2001). However, there is no information about the impacts of woody encroachment on soil N oxides emissions. The objective of this study is to determine that remotely sensed variables of vegetation, soil type, and climate alone can be used to estimate N oxide emissions. N oxide fluxes and related parameters were measured at nine study sites across a range of woody canopy cover on two soil types. Spatially, woody canopy cover was the best predictor of NO emissions while temporally temperature was the dominant control given adequate soil moisture. Through linking these biogeochemical relationships with spatially explicit data derived from remote sensing data it is possible to extend these plot-scale measurements to the landscape and regional scales. This method allows better determination of the spatial distribution of N oxide emissions and associated variability.

B21A-0708 0830h POSTER

Major Disturbance Events in Terrestrial Ecosystems Detected using Global Satellite Data Sets

Pang-Ning Tan[1] (ptan@cs.umn.edu); Christopher Potter[2] (cpotter@mail.arc.nasa.gov); Michael Steinbach[1] (steinbac@cs.umn.edu); Steven Klooster[3] (sklooster@mail.arc.nasa.gov); Vipin Kumar[1] (kumar@cs.umn.edu); Vanessa Brooks Genovese[3] (vbrooks@mail.arc.nasa.gov); Ranga Myneni[4] (rmyneni@bu.edu)

[1]University of Minnesota, Dept. Computer Science and Engineering, Minneapolis, MN 55455, United States

[2]NASA Ames Research Center, Ecosystem Science and Technology Branch, Moffett Field, CA 94035

[3]California State University Monterey Bay, Earth System Science and Policy, Seaside, CA 93955, United States

[4]Boston University, Department of Geography, Boston, MA 02215, United States

Ecosystem scientists have yet to develop a proven methodology to monitor and understand major disturbance events and their historical regimes at a global scale. This study was conducted to evaluate patterns in an 18-year record of global satellite observations of vegetation phenology from the Advanced Very High Resolution Radiometer (AVHRR) as a means to characterize major ecosystem disturbance events and regimes. The fraction absorbed of photosynthetically active radiation (FPAR) by vegetation canopies worldwide has been computed at a monthly time interval from 1982 to 1999 and gridded at a spatial resolution of 0.5 degree latitude/longitude. Potential disturbance events (greater than 0.5 Mha) were identified in the FPAR time series by locating anomalously low values (FPAR-LO) that lasted longer than 12 consecutive months at any 0.5 degree pixel. We find that nearly 400 Mha of the global land surface could be identified with at least one FPAR-LO event over the 18-year time series. The majority of these potential disturbance events occurred in tropical savanna and shrublands or in boreal forest ecosystem classes. Verification of potential disturbance events from our FPAR-LO analysis was carried out using documented records of the timing of large-scale wildfires at locations throughout the world. Disturbance regimes were further characterized by association analysis with historical climate anomalies. Assuming accuracy of the FPAR satellite record to characterize major ecosystem disturbance events, we estimate that nearly 9 Pg of carbon could have been lost from the terrestrial biosphere to the atmosphere as a result of large-scale ecosystem disturbance over this 18-year time series.

URL: http://www.ahpcrc.umn.edu/nasa-umn/

B21A-0709 0830h POSTER

Field Assessment of the Gap Analysis Program Vegetation Database in BVOC "Hotspots" in California

John F. Karlik[1] (jfkarlik@ucdavis.edu)

Eugene D. Albertson[1] (not available)

[1]University of California Cooperative Extension, 1031 S. Mt. Vernon, Bakersfield, CA 93307, United States

Emission inventories of biogenic volatile organic compounds (BVOC) require an accurate spatial description of plant species or plant communities. Because it is species-specific, the Gap Analysis Program (GAP) geographic information system database may be a valuable resource for developing a statewide BVOC emission inventory for California. However, it is important to conduct field validations of GAP to assess its

accuracy and overall utility for biogenic emissions modeling. Nine polygons were selected in BVOC "hotspots" (in terms of model output) by California Air Resources Board staff for assessment. These "hotspots" occurred in naturally vegetated areas dominated mostly by oaks, ranging from Ventura County in southern California to Mendocino County in northern California. Quantitative vegetation composition data gathered through field surveys were compared to the species listings in GAP database. The species listed in GAP for these polygons accounted from zero to 94% of the relative cover found. About one-third of the 44 species listed in GAP were found in high enough proportions in the field surveys to justify their placement, and another 39 species, including eight oak species, were found in sufficient abundance to be considered as additional co-dominants. In recent years, similar field surveys were conducted in San Diego County, the Central Valley and Sierra Nevada foothills, and 35 polygons have now been quantitatively assessed. Considering the range of accuracy found, the GAP database may be a useful source of species composition and dominance information for BVOC inventories for California, provided supplementary data for leaf mass density or leaf area index can be obtained from other sources.

B21A-0710 0830h POSTER

Detecting Patterns of Land Use Disturbance at a Watershed Scale: A Study of the Navarro River Watershed using Hyperspectral Data Analysis Techniques

Joshua H. Viers[1] ((530) 754-6051; jhviers@ucdavis.edu); Joan Florsheim[2] ((530) 752-0530; florsheim@geology.ucdavis.edu); Carlos M. Ramirez[1] ((530) 754-6051; cmiramirez@ucdavis.edu); James F. Quinn[1] ((530) 752-8027; jfquinn@ucdavis.edu); Michael L. Johnson[3] ((530) 752-8837; mbjohnson@ucdavis.edu); Benjamin Kozlowicz[1] ((530) 754-6051; benkoz@pacbell.net)

[1]Department of Environmental Science and Policy; University of California, Davis, One Shields Avenue, Davis, CA 95616, United States

[2]Department of Geology; University of California, Davis, One Shields Avenue, Davis, CA 95616, United States

[3]John Muir Institute of the Environment; University of California, Davis, One Shields Avenue, Davis, CA 95616, United States

Analysis of hyperspectral data is a particularly novel approach to investigation of the relation between anthropogenic and natural disturbances, geomorphic responses, and ecosystem patterns at the watershed scale. During July 2000, hyperspectral imagery was collected for the Navarro basin (820km2) using the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). This NASA sensor covers the spectral wavelength range from 400nm - 2500nm, with spectral sampling of 10nm in 224 contiguous channels, and spatial resolution of 5m. These data are being analyzed for a variety of applications; however, their use for detecting patterns of disturbance within the watershed is intriguing, especially for the identification and delineation of mass wasting sites that deliver sediment to salmon bearing streams.

Mass wasting sites were extracted from AVIRIS imagery using image processing techniques such as Minimum Noise Fraction and Tasseled Cap transformations, image segmentation and masking. These geospatial and spectral data were analyzed for the North Fork of the Navarro River, a sub-basin where spawning habitat for threatened coho salmon is effected by accelerated sediment delivery. Additionally, fieldwork verified the spatial position and dimensions of mass-wasting sites identified from aerial photography. A subset of 1066 identified sites was used for assessing feature extraction error from the AVIRIS imagery; the remaining sites were used for model verification. Augmenting these data within GIS, a multivariate analysis incorporated: proximity to salmon bearing streams; hillslope gradient; landslide position; and timber harvesting to identify patterns of disturbance. Preliminary results indicate that AVIRIS imagery can be segmented to identify exposed soil; furthermore, these identified areas are typically lower elevation, moderately steep hillslopes in constricted river valleys and correspond with mapped delivery sites.

Hyperspectral data provide a means for the detection of sediment sources over large areas; however, the geometric and atmospheric corrections required to effectively process these data can be onerous. The current work is part of an interdisciplinary study at UC Davis intended to assist land use managers in development of TMDL guidelines in coastal watersheds in northern California. Our research in the North Fork indicates that similar approaches can be used for both inventorying and monitoring of disturbance patterns at the watershed scale.

B21A-0711 0830h POSTER

Vegetation Disturbance on a Multi-year Scale in the Great Basin, U.S. as Identified by AVHRR

Bethany A Bradley[1] (4018633485; Bethany_Bradley@brown.edu)

John F Mustard[1] (4018631264; mustard@porter.geo.brown.edu)

[1]Brown University, Department of Geology Box 1846, Providence, RI 02906, United States

The effects of global environmental change on vegetation health and vigor are proposed to be manifested at the landscape scale. Recognizing affected ecosystems is challenging on such a broad scale, but remotely sensed data offer the opportunity to test for changes in vegetation. While this method has been applied to tropical and temperate systems, less effort has been directed toward arid and semi-arid regions (with the exception of the African Sahel). Here we present results from the Great Basin, US in which we use AVHRR 1-km, biweekly composite NDVI data acquired from 1989-1999 to characterize vegetation phenology and identify anomalous response patterns.

To begin, we created a 1-year average phenology for each pixel using the 11-year NDVI dataset. We then subtracted the annual average from the full time series to create a residual difference NDVI. We fit a line to the residual for each pixel to determine the slope and root mean square (RMS) difference. The slope records the change in vegetation (in NDVI/yr) outside of the average phenology. RMS shows the variability in the residual over the 11-year period. The average slope for the entire Great Basin (700,000 sq. km) is 0.60 +/- 0.23 NDVI/yr. We assume that this amount of increase is due to systematic errors from the AVHRR instrument and the change from NOAA-11 to NOAA-14 satellites in 1995 (e.g. Gutman, 1999). Against this systematic increase, we can then target regions whose slopes exceed one standard deviation of the mean.

Our initial analyses have focused on areas of anomalous NDVI increase. One particular area of interest is located in northwest Nevada between 39.5-41N, 117-119W. The increase is limited to the valley floors in an elevation range of 1200-1400 m and does not extend to mountaintops or high valley slopes. Valley floors are contiguous and cover an area of 2000 sq km. The average slope increase of these regions is 1.29 +/- 0.30 NDVI/yr, three standard deviations above the mean for the Great Basin as a whole. Attempts to correlate the anomalous NDVI increase to rainfall are inconclusive to date. The high rainfall from El Nino in 1998 undoubtedly affected vegetation abundance, however this event occurred throughout the Great Basin and cannot sufficiently explain local anomalies. The region displays a variety of increase patterns. Some areas show a continuous rise over the 11 years, others have one or two years of anomalous increase. In several instances the NDVI increase is much more prominent in summer months relative to the rest of the year.

These results indicate that multiple processes are likely affecting the semi-arid ecosystems of the Great Basin. As yet it is unclear whether these changes are caused by geophysical and/or climatological disturbances, by invasion of non-indigenous species or by some other environmental factors. Future work will scale down this investigation to anomalous increases within the spatial extent of a Landsat scene.

Gutman, G.G., J. Geophys. Res. (D6), 104, 1999

B21A-0712 0830h POSTER

Hailstreak Occurrence and Persistence Observed With AVHRR NDVI Image Time Series

Geoffrey M Henebry[1] (402-472-6158; ghenebry@calmit.unl.edu)

Ian C Ratcliffe[1] (iratclif@calmit.unl.edu)

[1]CALMIT, University of Nebraska, 113 Nebraska Hall, Lincoln, NE 68588-0517, United States

Hail is a major cause of crop loss and property damage in the United States. Hailstreaks are columns of hail that have swept the ground. The abrupt devegetation of the land surface by hailstreaks can have significant biogeophysical consequences. Changes in the surface energy balance and local wind fields can give rise to 'inland sea-breeze' phenomenon that may serve to trigger convection. We investigated the relationship between hail occurrences and the appearance and persistence of hailstreaks in composited image time series. Due to abrupt changes in vegetation density, hailstreaks can be identified in Normalized Difference Vegetation Index (NDVI) imagery. To enhance detection of hailstreaks, ΔNDVI images were generated from a standard set of biweekly maximum AVHRR NDVI composites for the conterminous US produced by the USGS EROS Data Center. These data have a nominal spatial resolution of 1 km. Overlaying the digitized point locations of the National Weather Service reports of hail onto the ΔNDVI imagery, hailstreaks were identified as dark areas coincident with or proximate to hail reports. From 1990-1999, 112 events of significant hailstreaks were observed. Hailstreaks appear mostly in the Great Plains states of Nebraska, Kansas, and the Dakotas, with significant clusters in Minnesota, Iowa, and Texas. The hailstreaks ranged in length from 9 to 367 km (median=66 km; mean=82 km) and in area from 21 to 8443 sq km (median=408 sq km; mean=707 sq km). A total of 79,227 sq km of vegetation were impacted by hailstreaks during the 1990s; however, this estimate is a lower bound due to the compositing process that selects for maximum NDVI. The seasonality of hailstreaks peaked in summer (69%), with 58% appearing in June or July. More hailstreaks appeared in the spring (26%) than in autumn (5%). Observed hailstreak persistence ranged from 9 to 95 d (median=34 d; mean=37 d; mode=28 d). Hailstreak persistence was a complex function of seasonal timing of the event, vegetation type and phenology, and event severity.

B21A-0713 0830h POSTER

Detection of Surface Structure and Heterogeneity using MISR/Terra observations

Jean-Luc Widlowski[1] (jean-luc.widlowski@jrc.it); Bernard PINTY[1] (bernard.pinty@jrc.it); Nadine GOBRON[1] (ngobron@libero.it); Michel M VERSTRAETE[1] (michel.verstraete@jrc.it); David J DINER[2] (djd@jord.jpl.nasa.gov); Anthony B Davis[3] (adavis@lanl.gov)

[1]Joint Research Centre, TP 440, via E. Fermi, Ispra, va 21020, Italy

[2]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, ca 91109, United States

[3]Los Alamos National Laboratory, (MS C-323), Bikini Atoll Road (Bld. 30),, Los Alamos, NM 87545, United States

The recent availability of quasi-simultaneous multispectral and multidirectional measurements from space, as provided by the Multiangle Imaging Spectro-Radiometer (MISR) on board the Terra platform, offers new and unique opportunities to document the anisotropy of land surfaces at critical solar wavelengths. This contribution outlines simple physical principles supporting the interpretation of the anisotropy of spectral radiances exiting terrestrial surfaces in terms of a signature of surface heterogeneity. The shape of the anisotropy function is represented with two model parameter values which may be mapped and interpreted in their own right. Beyond the information about the heterogeneity of the surface, the value of one of these parameters also permits identifying geophysical conditions where the surface heterogeneity becomes significant. Structure functions and singularity measures can be employed to describe the non-stationary and intermittent behaviour of geophysical fields. This approach is applied on synthetic height field measurements of a large variety of vegetation canopies. The joint analysis of the shape of the anisotropy function together with the height fields yields remarkable patterns of organization: It is possible for multiangular instruments, like MISR, to deliver information about the type of surface heterogeneity at the subpixel scale, that is in agreement with canopy structure characterizations obtained by other means.

B21A-0714 0830h POSTER

Assessing Natural Disaster Impacts and Recovery Using Multifrequency, Fully-Polarimetric Synthetic Aperture Radar (SAR) and Optical Remote Sensing Techniques

Jeffrey K. Weissel[1] (1-845-365-8533; jeffw@ldeo.columbia.edu)

Kristina R. Czuchlewski[1] (1-845-365-8462; krodrig@ldeo.columbia.edu)

Yunjin Kim[2] (Yunjin.Kim@jpl.nasa.gov)

[1]Lamont-Doherty Earth Observatory of Columbia University, 61 Rte. 9W/P.O. Box 1000, Palisades, NY 10964, United States

[2]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, United States

Many natural disasters involving landslides, volcanic eruptions, fires, or floods entail terrain resurfacing, followed by subsequent recovery. Modern satellite and airborne remote sensing technologies, which combine broad spatial coverage and high spatial resolution with time-sequential site revisit capability, can provide important information on the extent and duration of major landscape disturbance. In humid climate settings, these hazards temporarily remove or replace a natural vegetation cover and in doing so, modify the physical properties of the land surface. In optical remote sensing, removal of vegetation alters surface albedo in the visible – near infrared (V-NIR) waveband, particularly the high reflectance from vegetation in the NIR. For SAR remote sensing, removal of vegetation

cover causes a change in dominant microwave scattering mechanism for the areas affected. SAR has operational advantages over optical sensors for rapid disaster assessment because of its day/night acquisition capability, the ability to "see through" smoke, clouds and dust, and the side-looking viewing geometry, which is an advantage whenever data collection directly above the site would prove dangerous. We show how multifrequency, fully-polarimetric airborne SAR data can be "inverted" for parameters that reflect scattering mechanism signatures diagnostic of different surface cover types. We apply a uniform approach to map landslides resulting from the 1999 M_W 7.6 Chi-Chi earthquake in Taiwan, volcanic flows from the major 1996 eruption of Manam volcano in Papua New Guinea, and the extent of damage from the summer 2002 Rodeo – Chediski wildfire in Arizona. In addition, earlier work has shown that multifrequency SAR polarimetric backscatter is sensitive to total above-ground biomass. This attribute can be exploited to calculate vegetation loss during a disaster and for assessment of regrowth during the recovery phase.

B21A-0715 0830h POSTER

Cold-Water Coral Ecosystem Development in the NE Atlantic: Evidence for Strong Coupling with Pleistocene and Holocene Climate Change

Peter W. Readman[1] (+353-1-662 1333; pr@cp.dias.ie)

Brian M. O'Reilly[1] (+353-1-662 1333; bor@cp.dias.ie)

Patrick M. Shannon[2] (+353-1-716 2331; p.shannon@ucd.ie)

[1]Dublin Institute for Advanced Studies, 5 Merrion Square, Dublin 2, Ireland

[2]Department of Geology, University College Dublin, Dublin 4, Ireland

The NE Atlantic continental margins between Norway and North Africa contain widespread provinces of cold-water carbonate mounds comprising an aphotic ecosystem as diverse in faunal composition as warm water tropical reefs. In each province the mounds occur in clusters or as dispersed individuals within single populations of up to several hundred mounds, some of which can be up to 300 m high. The main framework constructors of these 'cold-water-reefs' are the ahermatypic corals species *Lophelia pertusa* and *Madrepora occulata*. One such population is present west of Ireland along the eastern margin of the Rockall Trough in water depths of 700 - 900 m. The circular to elliptical bioherms, comprising the population, are developed within the transition region between the glaciated and non-glaciated (Pleistocene) parts of the margin and strong NE flowing contour currents flowing at up to 1 m/s appear to streamline their shape. Deep towed sidescan images of the population were used to build a statistical distribution for the sizes of up to 140 imaged mounds. The main characteristics of the distribution can be accounted for with an ecosystem development model in which mound growth and substrate colonization rates are simply coupled to changes in bottom current regime. This development model allows an age structure for the population to be determined using biological growth rate estimates for the main framework species. It also indicates that the form of the population distribution is likely to be highly correlated with climatic change, slope instability and related change in global ocean circulation patterns during the late Pleistocene and Holocene.

B21A-0716 0830h POSTER

Impacts of Drought Stress on $C^{18}OO$ Ecosystem Fluxes in an Agricultural Field: Measurements and Modeling

William J Riley[1] (510 486-5036; wjriley@lbl.gov)

Margaret S Torn[1] (mstorn@lbl.gov)

Marc L Fischer[2] (mlfischer@lbl.gov)

Chris J Still[3] (still@sequoia.atmos.berkeley.edu)

Joe A Berry[4] (joeberry@catalase.stanford.edu)

[1]Department of Earth Sciences, Lawrence Berkeley National Laboratory, Bldg 90/1116, 1 Cyclotron Rd, Berkeley, CA 94720, United States

[2]Environmental Energy Technology Division, Lawrence Berkeley National Laboratory, Bldg 90/3148, 1 Cyclotron Rd, Berkeley, CA 94720, United States

[3]Department of Geography, University of California, Santa Barbara, Santa Barbara, CA 93106, United States

[4]Department of Plant Biology, Carnegie Institution of Washington, 260 Panama St., Stanford, CA 94305-1297, United States

Drought stress affects plant photosynthesis and transpiration, as well as soil respiration and evaporation. In a coupled plant and soil system, drought can strongly impact the exchange of ^{18}O in CO_2 between the ecosystem and atmosphere. In this study we present diurnally resolved measurements of $\delta^{18}O$ values in ecosystem water pools in a sorghum field in the ARMCART SGP region (Oklahoma, USA). Over a 4-day period we measured continuous ecosystem CO_2 and H_2O fluxes using eddy correlation; soil moisture and temperature; $\delta^{18}O$ value of soil water in 4 soil layers, leaves, and stems 4 times per day; and ^{18}O in H_2O at 2 heights above the plant canopy. Ecosystem CO_2 fluxes reflect the impact of midday water stress. Measured soil water $\delta^{18}O$ values showed strong diurnal patterns reflecting soil-surface evaporation during the day and recharge from deeper soil layers at night. Diurnal soil water $\delta^{18}O$ values in the top soil layers varied by up to $6^o/_{oo}$. The $\delta^{18}O$ values of stemwater also varied over the course of the day, but to a smaller extent. Leaf water $\delta^{18}O$ values increased by up to $10^o/_{oo}$ over the day. To interpret these data and to estimate $C^{18}OO$ ecosystem fluxes we applied a mechanistic model, called ISOLSM, that simulates $H_2{}^{18}O$ and $C^{18}OO$ ecosystem stocks and fluxes between ecosystems and the atmosphere. ISOLSM includes modules to compute canopy vapor, leaf water, and vertically resolved soil water $H_2{}^{18}O$ content; leaf photosynthetic and retro-diffusive fluxes of $C^{18}OO$; root and microbial production of CO_2; soil diffusive fluxes of CO_2 and $C^{18}OO$ and equilibration of CO_2 with ^{18}O in soil water; and abiotic soil exchanges of $C^{18}OO$. The model has been tested in a C_4 dominated tallgrass prairie site close to the field studied here. Drought stress strongly affected the variability of the ^{18}O content of near-surface soil water. The low soil moisture levels impacted the soil-surface $CO^{18}O$ fluxes via interactions with the soil-gas diffusion coefficient, microbial and root CO_2 production, and the heavy near-surface soil water. Drought stress also impacted stomatal conductance, which in turn affected transpiration, the canopy air space vapor and vapor ^{18}O content, and leaf $C^{18}OO$ exchange. Finally, we present a sensitivity analysis of the ecosystem $C^{18}OO$ exchange to the method used to quantify the impacts of plant water stress.

B21A-0717 0830h POSTER

Sediment Retention Within Coastal Plain Bottomland Forested Wetlands

Katie M. Ross[1,2] (kmr4z@virginia.edu)

Cliff R. Hupp[2] (crhupp@usgs.gov)

[1]University of Virginia, Department of Environmental Sciences, 291 McCormick Rd, PO Box 400123, Charlottesville, VA 22903-4123, United States

[2]US Geological Survey, 12201 Sunrise Valley Drive, Reston, VA 20192, United States

Coastal Plain forested wetlands are unique ecosystems where fluvial geomorphic processes control sediment retention and vegetation patterns, which are intimately connected to each other. Yet, these interdisciplinary associations are typically lacking in traditional ecologic or geomorphic research within these ecosystems. Floodplain sedimentation rates and patterns, suspended sediment concentrations, substrate characteristics, vegetation and fluvial geomorphology were measured in field studies in eight 1-ha sites along three tributaries of the Chesapeake Bay to determine the dominant physical processes controlling deposition, substrate, and vegetation patterns in forested wetlands. Annual deposition was measured at 104 locations with feldspar clay pads. Sedimentation rates across the floodplain sites are highly variable, ranging from 0.5 mm/yr to 26.6 mm/yr. Multiple regression analyses suggest that the spatial patterns in net-annual and long-term deposition and substrate properties (grain sizes, sand:clay, and sorting) are controlled by the frequency and duration of inundation events and the total number of inundated days per year, the manner that sediment is distributed through the floodplain (dominant flow paths and/or the presence of slough networks, for example), and the potential for deposition of suspended sediments. Similarly, floodplain community diversity is significantly related to fluvial geomorphic processes (annual net deposition rates, percent inundation per year, and inundation duration per event). The results of this study provide valuable information on the development and evolution of Coastal Plain floodplains in the context of vegetation diversity patterns that have significant implications for the restoration and conservation of these systems.

B21A-0718 0830h POSTER

Impacts of Rising Temperatures on Vegetation Species Distributions

Christopher M Van de Ven[1] (650-725-0045; vandeven@pangea.stanford.edu)

Stuart B. Weiss[2] (650-854-9732; stubweiss@netscape.net)

[1]Stanford University, Dept. of Geological and Environmental Sciences, Stanford, CA 94305-2115, United States

[2]Creekside Center for Earth Observations, 27 Bishop Lane, Menlo Park, CA 94025, United States

Climate change is a long-term ecosystem disturbance having drastic impacts on species patterns and distributions. Mountain ranges in particular provide extensive evidence of past shifts in species distributions driven by climate change, and promise to be sensitive to future climate change. Complex environmental gradients in the White Mountains in eastern California produce striking variation in vegetation composition over short distances, dominated by the effects of elevation on temperature and precipitation, but more locally modified by gradients in potential insolation, slope, topographic position, and diverse geologic substrates including carbonate, metaclastic, and granitic rocks. This study examines the effects of changing temperatures on species distributions and patterns in an arid mountain range.

Digital elevation models, geologic maps and 650 ground control points were used to map current species distributions over 6200 km2 (620,000 ha) of the central and southern White Mts. Species-environment relationships of 89 plant species were modeled using Canonical Correspondence Analysis (CCA). CCA quantitatively describes species "envelopes" in multidimensional environmental space that were projected across entire landscapes at a scale of 18-50 m using a GIS. CCA models were calibrated from 434 field plots, and evaluated in the 216 remaining plots using kappa statistics.

We then modeled potential distributions under a 3°C warming scenario by dropping all elevations 500 meters (i.e. 2500 m becomes 2000 m), keeping all other factors constant. Species ranges contracted substantially (ranging from 95% - 30% reduction in area) as they moved upslope. Species with broad elevational ranges had substantial overlap in current and new ranges; others with narrow ranges had little overlap. High alpine species contracted to small populations around the tallest peak (4340 m) and its north-facing slopes. Several alpine species were predicted to go extinct. Ranges of mid-elevations species tended to fragment, while ranges of many desert species merged across a major pass. Local geologic barriers were identified at several areas: bristlecone pine, for example, is predicted to have difficulty ascending the south side of the granitic Barcroft Pluton from its favored dolomitic sites just below. These predictions provide a detailed set of hypotheses on the structure of current species ranges and their ability to persist through rapid climate change.

B21A-0719 0830h POSTER

Climate Cahnge Effects on Vegetation Distribution, Carbon Stocks, and Fire Regimes in California

James M Lenihan (541-750-7432; lenihan@fsl.orst.edu)

USDA Forest Service, USFS Pacific Northwest Research Station, 3200 SW Jefferson Way, Corvallis, OR 97330, United States

We simulated the response of vegetation distribution, carbon, and fire under two constrasting scenarios of future climate change in California. The simulations were generated by MC1, a vegetation model that simulates vegetation succession at large spatial extents through time while estimating variability in the carbon budget and responses to episodic events such as drought and fire. The results for the historical climate compared favorably to independent estimates of vegetation distribution, carbon density, and the fire regime. However, validating the historical simulation was complicated by the lack of land use effects in the model. The results under the future climate scenarios showed ecosystem sensitivities and interactions likely to be features of the response of natural and semi-natural systems to a rise in temperature and changes in precipitation. The response to increases in temperature was characterized by shifts in the relative dominance of tree lifeforms, and by changes in the productivity of trees. The response to changes in precipitation was more complex, involving direct effects on vegetation productivity associated with changes in available soil moisture, but also changes in tree-grass competition that were mediated by fire. The persistence of a Mediterranean climate with dry summers was a key feature of the modeled response. The summer months were warmer and persistently dry under both scenarios, so differences in the modeled fire behavior and effects were primarily a response to differences in simulated fuels.

B21A-0720 0830h POSTER

How Has Urbanization Altered the Carbon Cycle in the United States?

Marc Lee Imhoff[1] (301-614-6628; mimhoff@LTPmail.gsfc.nasa.gov)

Lahouari Bounoua[2] (301-614-6631; bounoua@dounia.gsfc.nasa.gov)

Compton Tucker[1] (compton@ltpmail.gsfc.nasa.gov)

Ruth DeFries[2] (Ruth_Defries@umail.umd.edu)

Taylor Ricketts[3] (ricketts@leland.Stanford.EDU)

[1]Biospheric Sciences Branch, Code 923 NASA's Goddard Space Flight Center, Greenbelt, MD 20771, United States

[2]Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD 20742, United States

[3]Center for Conservation Biology, Stanford University, Stanford, CA 94305, United States

We use data from two satellites and a terrestrial carbon model to quantify the impact of urbanization on net primary productivity (NPP) and its consequences on carbon balance and food production. Our results show that urbanization is taking place on the most fertile lands and hence has a disproportionately large overall negative impact on NPP. Urban land transformation in the US has reduced the annual NPP by 0.04 Pg C or 1.6 percent of its pre-urban value. The reduction is enough to offset the 1.8 percent gain made by the conversion of land to agricultural use, a striking fact given that urbanization covers an area less than 3percent of the land surface in the US while agricultural lands approach 29 percent of the total land area. At local and regional scales, urbanization increases NPP in resource-limited regions, and through localized warming urban heat contributes to the extension of the growing season in cold regions. In terms of biologically available energy, the loss of NPP due to urbanization of agricultural lands alone is equal to the caloric requirement of 16.5 million people, or about 6 percent of the US population annually.

B21A-0721 0830h POSTER

Assessment of the Impact of Urban Sprawl on Net Primary Productivity

Cristina Milesi[1] (1-406-243-6219; milesi@ntsg.umt.edu)

Christopher D. Elvidge[2] (1-303-497-6121; chris.elvidge@noaa.gov)

Ramkrishna R. Nemani[1] (1-406-243-4632; nemani@ntsg.umt.edu)

Steven W Running[1] (1-406-243-6311; swr@ntsg.umt.edu)

[1]Numerical Terradynamic Simulation Group / School of Forestry, University of Montana, Science Complex 428, Missoula, MT 59812, United States

[2]NOAA / National Geophysical Data Center, 325 Broadway, Boulder, CO 80303, United States

While urban areas are generally thought to reduce the photosynthetic capacity of the land, little research has been devoted to quantifying the net effect of urbanization on net primary productivity (NPP). The southeastern United States has undergone one of the highest rates of landscape change and urban sprawl in the country, representing an ideal study area in which to develop a remote sensing based methodology for a regional assessment of the impact or urbanization on ecosystem productivity. We used a combination of MODIS and nighttime Defense Meteorological Satellite Program / Operational Linescan System (DMSP/OLS) data to estimate the extent of recent urban sprawl and its impact on regional NPP in the southeastern United States. The analysis based on the nighttime data indicated that in 1992/93 urban areas amount to 4.5 % of the total surface in the region. In the year 2000, the nighttime data revealed an increase in urban developed land by 1.9 %. Estimates derived from the MODIS data indicated that land cover changes due to urban development that took place during the analyzed period reduced annual NPP of the southeastern United States by 0.4 %. Results from this study indicated that the combination of MODIS products such as NPP with nighttime data could provide rapid assessment of urban land cover changes and their impact on ecosystem productivity.

B21B MCC: Hall C Tuesday 0830h

Coupled Behavior of Biotic Systems and Climate I Posters *(joint with GC)*

Presiding: **R Craig,** National Science Foundation**; B A Maurer,** Michigan State University**; E Hadly,** Stanford University

B21B-0722 0830h POSTER

Impact of land-use and climate change on vernal pools in the Central Valley ecoregion of California

Christopher R. Pyke (805-452-1837; pyke@geog.ucsb.edu)

Christopher R. Pyke, National Center for Ecological Analysis and Synthesis 735 State St., Santa Barbara, CA 93101-3351, United States

Ecological systems are sensitive to the spatial and temporal distribution of environmental variability. They respond to changes in variability with changes in population processes, species interactions, and, ultimately, species persistence. The distribution of environmental conditions available to species across a region is a function of interactions between ecological tolerances and the spatial and temporal distribution of climate and habitat. This study explored the impact of interactions between changes in the geographic distribution of habitat and climate for rain-fed ephemeral depressional wetlands (vernal pools) in the Central Valley of California. The study used simulation modeling to (1) evaluate hydrologic regimes under historic climates, (2) modify hydrologic regimes based on regional climate predictions, and (3) evaluate land-use and climate change interactions. A stochastic weather generator was used to create synthetic historical time series and downscale predicted changes in regional climate for cool and dry and warm and wet conditions. Modeling results suggest that vernal pool hydrologic regimes exhibit non-linear changes over geographic space and reflect more intense changes in ecologically-relevant conditions than might be suggested by the gradient in precipitation alone. Consideration of climate change impacts in the absence of land-use change (i.e., habitat loss) indicates that vernal pools could experience either a small reduction in annual hydroperiod (cool and dry condition) or, more likely, a significant increase in the annual duration of flooding (warm and wet conditions). However, these region-wide responses change significantly when potential land-use change and associated habitat loss are considered. A bias in the distribution of reserve lands toward drier areas in the Central Valley results in a net shift toward drier, shorter-lasting, and less predictable vernal pools even under wetter climatic conditions. This research demonstrates that interactions between land-use and climate change can result in significant differences in the magnitude and direction of impacts compared to those predicted for either variable alone.

B21B-0723 0830h POSTER

Interactive canopies with Nitrogen controls in the new NCAR land model

QING LIU[1] (qliu@eas.gatech.edu)

Robert E Dickinson (roberted@eas.gatech.edu)

[1]QING LIU, School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA 30318-0340, United States

The Community Land Model (CLM) is a component of the Community Climate System model (CCSM). Because the water, energy and momentum exchange between the terrestrial ecosystem and the atmosphere are closely related to the plant-atmosphere CO2 exchange and the vegetation physiological situations, it's necessary to include the physiological response of terrestrial vegetation to the climate variation. This poster shows the incorporation of an interactive canopy model in the new land model, CLM2, as derived from an earlier one in BATS. The nitrogen controls on evaportranspiration proposed by Dickinson et al. in 2001 are also included. The leaf stomatal resistance is switched to the scheme in BATS to be consistent with its physiological parameters. Newly introduced parameters are evaluated for the Plant Function Type composition in the CLM2. The simulated energy fluxes are compared with the simulation of the CLM2; and the simulated ecophysiological fluxes and state variables are listed and some of them are compared with values from other sources.

B21B-0724 0830h POSTER

Impact of Deforestation on Cloud Properties and Rainfall Over the Costa Rica-Nicaraguan region

Deepak K Ray[1] (256-961-7856; ray@nsstc.uah.edu)

Udaysankar S Nair[1] (256-961-7841; nair@nsstc.uah.edu)

Ronald M Welch[1] (256-961-7789; welch@nsstc.uah.edu)

Robert O Lawton[2] (256-824-6388; lawtonr@email.uah.edu)

[1]Department of Atmospheric Sciences, University of Alabama Huntsville, 320 Sparkman Drive, Huntsville, AL 35805

[2]Department of Biological Sciences, University of Alabama Huntsville, Wilson Hall, Huntsville, AL 35899

The Nicaraguan-Costa Rican region in Central America exhibits the typical pattern of complex deforestation now seen throughout the tropics. The region is a mixture of lowland, mostly converted to agriculture, and mountainous regions, where pristine forests still persist. At present the northern fertile plains of Costa Rica are mostly utilized for agriculture. However in the adjacent regions of southern Nicaragua lowland forests are relatively intact. The extensive agricultural areas of northern Costa Rica is a region of discontinuity in the proposed Mesoamerican Biological Corridor which would connect the montane forests in Costa Rica to the lowland forests in Nicaragua.

The present study is part of a larger study which investigates the effects of continuing lowland deforestation and associated regional climate change in Central America on the stability of the entire proposed Mesoamerican Biological Corridor. The present work focuses on the effects of land use on the formation of cloudiness, cloud properties and rainfall in the forested regions of southern Nicaragua and the deforested regions of northern Costa Rica.

Land surface and cloud properties are retrieved using the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite data and products. The land surface properties retrieved are land surface temperature, albedo, Normalized Difference Vegetation Index (NDVI), Available Soil Moisture fraction and surface energy fluxes. The cloud properties retrieved are cloud optical thickness and effective radii. In addition, the frequency of cumulus cloudiness on hourly basis are derived from the Geostationary Operational Environmental Satellite (GOES) and rainfall is studied using Tropical Rainfall Measuring Mission (TRMM) satellite products. The correlations between the surface properties, cloud properties, cumulus cloudiness and rainfall as a function of ecosystem and topography is examined. Previous modeling work has shown that in this region the lowlands and highlands are highly coupled. Preliminary results from numerical modeling studies illustrating the impacts of deforestation on the regional climate will also be presented.

B21B-0725 0830h POSTER

Impact of Land Use on Cloud Properties Over the Haiti/Dominican Republic

Ronald m Welch[1] (256-961-7789; welch@nsstc.uah.edu)

Udaysankar S Nair[1] (256-961-7841; nair@nsstc.uah.edu)

Deepak K Ray[1] (256-961-7856; ray@nsstc.uah.edu)

Ahira Sanchez[2] (787-553-5029; epsilon_27@hotmail.com)

Marli Perez[2] (marli_perez@hotmail.com)

[1]Department of Atmospheric Sciences, University of Albama Huntsville, 320 Sparkman Drive, Huntsville, AL 35805

[2]University of Peurto Rico, P.O. 382, Mayaguez, PR 00681

The focus of this study is the effect of land use characteristics and surface properties on the preferential formation of cloudiness, especially cumulus cloudiness over Haiti and Dominican Republic for the year 2001. A combination of satellite imagery and numerical modeling is used in this study.

Satellite data and products from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite are used to retrieve surface properties such as land surface temperature, albedo, and Normalized Difference Vegetation Index (NDVI). The satellite data is then used to retrieve available soil moisture fraction and surface energy fluxes using the Soil Vegetation Atmospheric Transfer (SVAT) model. Cloud properties such as cloud optical thickness and effective radii are also retrieved over this region. In addition, the frequency of cumulus cloudiness on hourly basis is derived from