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The Lost City Hydrothermal Field (LCHF) is a novel peridotite-hosted vent environment discovered in Dec. 2000 at 30 N near the Mid-Atlantic Ridge. This field contains multiple large (up to 60 m), carbonate chimneys venting high pH (9-10), moderate temperature (45-75 C) fluids. The LCHF is unusual in that it is located on 1.5 my-old oceanic crust, 15 km from the nearest spreading axis. Hydrothermal flow in this system is believed to be driven by exothermic serpentinization reactions involving iron-bearing minerals in the underlying seafloor. The conditions created by such reactions, which include significant quantities of dissolved methane and hydrogen, create habitats for microbial communities specifically adapted to this unusual vent environment. Ultramafic, reducing hydrothermal environments like the LCHF may be analogous to geologic settings present on the early Earth, which have been suggested to be important for the emergence of life. Additionally, the existence of hydrothermal environments far away from an active spreading center expands the range of potential life-supporting environments elsewhere in the solar system.

To study the abundance and diversity of microbial communities inhabiting the environments that characterize the LCHF, carbonate chimney samples were analyzed by microscopic and molecular methods. Cell densities of between  $10^5$  and  $10^7$  cells/g were observed within various samples collected from the chimneys. Interestingly, 4-11% of the microbial population in direct contact with vent fluids fluoresced with Flavin-420, a key coenzyme involved in methanogenesis. Enrichment culturing from chimney material under aerobic and anaerobic conditions yielded microorganisms in the thermophilic and mesophilic temperature regimes in media designed for methanogenesis, methane-oxidation, and heterotrophy. PCR analysis of chimney material indicated the presence of both Archaea and Eubacteria in the carbonate samples. SSU rDNA clone libraries constructed from the Eubacterial DNA show that diverse microbial communities, including autotrophic microorganisms and animal symbionts, are contained within the vent structures. In concert, these results indicate that abundant and varied microbial communities inhabit different regions of the chimney structure and may be specifically adapted to the reducing, volatile-rich fluids percolating through the chimneys.

In addition to expanding the range of known deep-sea ecosystems, the microbial ecology of carbonate structures associated with hydrothermal venting at the LCHF may provide key insights into the microbiology of subsurface environments near this site. Studying the microbial communities within these systems will enable us to better understand geo-microbial processes associated with serpentine environments and perhaps allow us to expand our search for life elsewhere in the universe.

**B71B-0743 0830h POSTER**

**Preserving the Record of Life in the Solar System**

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We have yet to discover, much less characterize, all of the environments on Earth that support life. Not surprisingly, our ability to make general statements about the distribution and characteristics of life is limited, and inferences about life's origins—even on this planet—are circumscribed. The potential that there exist extraterrestrial habitats in which life may be found drives certain aspects of space exploration, and the identification of extraterrestrial environments in which Earth organisms could survive is one strategy in establishing the existence of life on other worlds. Hence, deficiencies in our knowledge about life environments here limit our concepts of where to look for life outside of the Earth. But other factors also may limit our ability to learn general lessons about life as we identify and explore life environments here and elsewhere. In particular, each separate living environment can be viewed as containing unique data about the capabilities, distribution, and origin of life—data that may be lost or destroyed by the introduction of biological contamination

from other sites. This paper will address issues associated with avoiding such cross-contamination in solar system exploration, and while exploring restricted sites on Earth. While identifying specific sites of concern on other worlds, it will illustrate the role of experiments in synthetic environments in informing the precautions that must be taken to preserve the secrets of life that exploration seeks to uncover.

**B71C MCC: 132 Sunday 0830h**  
**Water, Energy, and Carbon Exchange in Forest Systems I (joint with A, H, GC)**

**Presiding: B Law, Oregon State University; P Thornton, National Center for Atmospheric Research; D Baldocchi, University of California, Berkeley**

**B71C-01 0830h INVITED**

**Ecological Controls on Land-Atmosphere Exchange**

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We have been using long-term eddy covariance to investigate the patterns of energy and CO<sub>2</sub> exchange between the atmosphere and a freshwater marsh in California, and also between the atmosphere and a series of boreal forest stands in Manitoba, Canada. Most researchers believe that ecological phenomenon, such as plant herbivore interactions and interspecific differences in plant life-history strategy, are relatively unimportant in determining the interannual and landscape patterns of Land-Atmosphere exchange. However, we have found that interactions between plants and herbivores exert a large control on the interannual patterns of energy and CO<sub>2</sub> exchange in the freshwater marsh, and that interspecific differences in plant strategy are critical for understanding the landscape scale patterns of energy and CO<sub>2</sub> exchange in the boreal forest. Despite a relatively constant climate and flooding regime at the California marsh, annual Carbon balance varied by 6 tC ha<sup>-1</sup> or more from year to year. These deviations were caused in part by variation in herbivory by rodents and insects. Likewise, peak CO<sub>2</sub> uptake by boreal forest stands recovering from fire differed less than expected, with a 4-year-old stand assimilating CO<sub>2</sub> at rates comparable to that by middle aged stands, and faster than that by old stands. These patterns reflect differences in the life history strategies of the dominant plants, with the youngest stands dominated by fast growing ruderals, the middle aged stands dominated by fast growing competitive species, and the old stands dominated by slow growing stress tolerant species.

**B71C-02 0845h**

**Seasonal Variations in Carbon, Water and Energy Fluxes in an Oak/Grass Savanna and in Photosynthetic Capacity of Oak Leaf in California**

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We present the results of measurements on flux and ecophysiology from two co-existing Ameriflux sites, a grazed annual grassland site and an oak/grass savanna site, located at the foothill of Sierra Nevada in California. The two sites are about 2 km apart, and have a Mediterranean climate with wet, cold winter and dry, hot summer. The predominant tree species is blue oak (*Quercus douglasii*) and grasses are C<sub>3</sub> species. The main objective of the study is to investigate the roles of high temperature, soil moisture and plant functional type on the carbon, water vapor and energy exchanges between

ecosystems and atmosphere. Continuous measurements of carbon and water vapor fluxes over and under the oak/grass savanna ecosystem started in April 2001 and over the annual grassland ecosystem in October 2000. Meteorological and soil parameters (air temperature, radiation, VPD, precipitation, soil moisture etc.) were also measured. Grass leaf area index (LAI), predawn water potential and gas exchange (A/Ci curve) of oak leaf were measured at 1-2 weeks intervals.

The annual grass germinates in late Oct after receiving a substantial rainfall and senesces in early May due to the soil drought development. Flux results show that daytime carbon uptake and latent heat flux (LE) at the grassland and understorey of the savanna followed closely grass LAI, which in turn was controlled by soil moisture content. Nighttime ecosystem respiration was found to track closely to the daytime photosynthetic rate, indicating the importance of photosynthetic assimilates allocation for respiration. During the dry summer, when the grass was dead, virtually all the available energy was partitioned into sensible heat (H). Small positive values of F<sub>CO2</sub> were observed. We also observed large pulse ecosystem respiration after rain events during non-growing season. In our ecosystems with very low NEP, such rain events might be one of major environment forcings that cause larger inter-annual variability in NEE.

There are large differences in energy balance and partitioning over the two co-existing ecosystems. Net radiation balance (R<sub>n</sub>) over the grazed grassland peaked (around 600 W m<sup>-2</sup>) as early, at the end of April, just before the grass senescence. While for the oak-grass savanna, R<sub>n</sub> peaked (around 700 W m<sup>-2</sup>) more or less around summer solstice. More than one-third of the total energy exchange was attributed to the understorey throughout the season.

Oak tree leaf out occurred in late March, and it senesced in mid-Oct. From gas exchange measurements, it was found that maximum carboxylation rate (V<sub>cmax</sub>) shows a strong seasonality. Peak V<sub>cmax</sub> of over 120 μmol m<sup>-2</sup>s<sup>-1</sup> was reached shortly after the leaf full expansion in the early summer, but lasted less than a month. Then there was a progressively decrease followed by a senescence reductions in V<sub>cmax</sub> during the middle and late summer. In contrast, Ball-Berry slope and marginal water cost of carbon gain are relatively constant over the whole season, even under severe drought when the predawn water potential of leaves dropped to -6.8 MPa. The constancy of the marginal water cost suggests that stomata still operate optimally under drought condition. It is clear from results that the seasonality of these photosynthetic parameters must be taken into account for long-term modeling carbon exchange between terrestrial ecosystems and atmosphere to accurately simulate GPP.

**B71C-03 0900h**

**Large Carbon Uptake by an Unmanaged 250 year-old Deciduous Forest in Central Germany**

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Unmanaged forests at a late stage of successional development are considered to be insignificant as carbon sinks, since in theory, assimilation is thought to be balanced by respiration. However, little experimental evidence for this hypothesis exists so far for forests at the ecosystem scale. Therefore, we performed continuous eddy covariance measurements of carbon dioxide over an unmanaged beech forest in the Hainich National Park in Central Germany as part of the EU project CARBOEUROFLUX. This forest shows typical characteristics of an advanced forest with large dead wood pools, a diverse stand structure and a wide tree age class distribution, up to 250 years.

Large carbon uptake rates up to 40 μmol m<sup>-2</sup> s<sup>-1</sup> were measured in summer while typical nighttime carbon losses were at around 4 μmol m<sup>-2</sup> s<sup>-1</sup>. Consequently, this forest was a large carbon sink over two years, with 528 g C m<sup>-2</sup> yr<sup>-1</sup> in 2000 and 496 g C m<sup>-2</sup> yr<sup>-1</sup> in 2001. Daytime summer fluxes were strongly controlled by photosynthetic photon flux density (R<sup>2</sup> = 0.8 - 0.9), with minor effects of the ratio of diffuse to total downward radiation or the vapor pressure deficit. Nighttime CO<sub>2</sub> fluxes were mainly controlled by soil temperature (R<sup>2</sup> = 0.7) and soil moisture. In addition, high nighttime CO<sub>2</sub> fluxes (4 - 6 μmol m<sup>-2</sup> s<sup>-1</sup>) were found directly before and during bud break in spring as well as just after leaf fall of both years (2000 and 2001), reflecting stand physiology corresponding to phenological changes, independent of soil temperature.

To increase confidence in these unexpected high carbon sinks, the usual quality checks such as stationarity tests and u<sub>s</sub> correction were performed. In addition, measurements of wind profiles at 5 heights within

the canopy revealed a decoupling of above and below canopy air flow under conditions of low  $u_*$  ( $u_* < 0.3 \text{ m s}^{-1}$ ), probably indicating down slope drainage. With this new independent method, we derived a  $u_*$  threshold value for appropriately excluding nighttime eddy covariance data. We estimated errors due to nighttime gap filling at about  $\pm 10\%$  of the annual carbon sink.

In conclusion, unmanaged forests at a comparatively late stage of successional development can still act as significant carbon sinks with large implications for forest management practice and negotiations about biological sinks within the Kyoto protocol.

#### B71C-04 0915h

##### Disturbance Effects on the Seasonal Dynamics of Carbon Uptake in Boreal Forest Ecosystems

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Fire has been identified as a major factor that alters the timing and magnitude and net ecosystem production in boreal forest ecosystems. Here we present eddy covariance measurements from three sites in a fire chronosequence in interior Alaska. Specifically, from February to September of 2002, we measured carbon dioxide, water, and sensible heat fluxes from a 3-year old stand with mixed grasses and shrubs (*Festuca altaica*, *Salix spp.*, *Betula glandulosa*), a 15-year burn with large aspen stands (*Populus tremuloides*) and an ~80-year burn black spruce forest (*Picea mariana*). We find that while the 3-year burn was a small persistent source throughout the growing season, both the ~80-year and 15-year burn sites were net sinks. The ~80-year black spruce forest had an earlier onset of photosynthesis than the 15-year aspen stand. The 15-year aspen stand showed a large respiration pulse in the spring (late May) before leaf out occurred. Despite the larger spring respiration pulse and later onset of photosynthesis the 15-year aspen stand had the largest midsummer uptake rates and resulted in the largest net seasonal uptake of the three sites.

#### B71C-05 0930h

##### Effects of Climate Variability on Estimates of Annual NEP for a Coniferous West Coast Forest During an El Niño/La Niña Cycle

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Effects of Climate Variability on Estimates of Annual NEP for a Coniferous West Coast Forest During an El Niño/La Niña Cycle

The annual net ecosystem productivity (NEP) of a 53-year-old Douglas-fir stand on the Canadian west coast varied considerably during the years 1998 to 2001, which included the El Niño/La Niña cycle of 1998/1999. The four years of eddy correlation (EC) CO<sub>2</sub> flux data analyzed here offer a unique opportunity to study how a typical forest ecosystem in the Pacific Northwest reacts to interannual climate variability. This is true even though annual NEP values calculated from EC data are subject to large biases. These come from the choice of methods of gap filling, energy balance correction, and the criteria for exclusion of low turbulent fluxes and lead to uncertainties in the annual NEP of about 300 g C m<sup>-2</sup>. Yet, as this uncertainty is due to bias and not random error, the differences in annual NEP values can be much smaller than the uncertainty and still be statistically significant. Therefore, even with these uncertainties, we can still reliably identify which environmental factors are responsible for the interannual variation in carbon uptake.

For our method of analysis (friction velocity threshold of 0.3 m s<sup>-1</sup>, no energy balance closure correction), the annual NEP values after gap filling were 320 (1998), 370 (1999), 390 (2000), and 460 g C m<sup>-2</sup> (2001). These differences were due largely to differences in the ecosystem respiration (R) between the four years. In the El Niño year of 1998, high soil temperatures led to a comparatively high annual R, while annual gross ecosystem photosynthesis (GEP) was comparable to 2000 and 2001. Only in the La Niña year 1999 with its cool and

cloudy conditions was a reduction in annual R accompanied by a reduction in annual GEP. This resulted in an annual NEP similar to 2000, when both R and GEP were high. Finally, in 2001, R decreased since conditions were comparatively cool, but the reduced cloudiness allowed annual GEP to remain high, leading to the high carbon uptake for that year.

#### B71C-06 0945h

##### Ecosystem Respiration in a Northern Mixed Hardwood Forest: Source Dynamics and Interannual Variation

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Carbon losses from forests by autotrophic and heterotrophic respiration are large and may be a primary determinant of regional differences in annual carbon sequestration. Different sources of respiratory CO<sub>2</sub>, such as microbes, roots, wood, and leaves also respond differently to altered temperature and moisture. This suggests that as local environments change, due to changing climate, land-use, or species composition, the magnitude and dynamics of ecosystem respiration will change as well. At the UMBS Forest Carbon Cycle Research Program in northern lower Michigan USA (45.6° N, 84.7° W), we have measured respiration from individual source components using eco-physiological methods and at the whole ecosystem-scale, above the canopy using eddy covariance equipment. Measurements were made throughout the year and across three years, 1999-2001. Our objectives were to partition ecosystem respiration (R<sub>e</sub>) among the major contributing fluxes, quantify respiratory temperature and moisture response functions, and account mechanistically for annual and interannual variation in R<sub>e</sub> at our site. Across years, soil respiration varied from a high of 11.6 Mg C ha<sup>-1</sup> in 1999 to a low of 9.8 Mg C ha<sup>-1</sup> in 2000 and paralleled annual differences in soil temperature. In 1999 during maximum canopy development, soil respiration accounted for ~80% of daytime R<sub>e</sub> and ~60% of nighttime R<sub>e</sub>. Aboveground wood and leaves each accounted for ~20% of nighttime R<sub>e</sub>, with leaf respiratory losses becoming zero during the day. Soil respiration was ~5 times more sensitive to changing temperature than was woody tissue respiration. These data help establish a process-level understanding of CO<sub>2</sub> exchange by this forest and provide a framework for predicting the consequences of climate change on future carbon storage in the northern Great Lakes region.

URL: <http://www.biosci.ohio-state.edu/~pcurtis/UMBS~Flux>

#### B71C-07 1020h

##### Isolating vegetation and soil contributions to energy and carbon fluxes in Siberian forest tundra

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In the middle of the summer growing season from July 14 to August 10, 2001, we made eddy covariance measurements of carbon and energy fluxes in a larch-tundra ecosystem near Cherskii (69°N, 161°E), Siberia, and simultaneously at a second site that had similar vegetation and soil characteristics. We manipulated the vegetation cover at the second site in two ways to assess the influence of the surface vegetation on energy

and carbon exchange in this ecosystem. At the beginning of the measurement period we removed the sparse tree cover at the second site, but left the surface vegetation and cover intact. Later in the growing season (July 28 to 30), we made an additional modification, removing the surface layer to a depth of approximately 10-15 cm. Before the surface vegetation removal, the net radiation, sensible heat and latent heat fluxes at the two sites were similar, suggesting only a minor role for larch trees in contributing to the surface energy budget. On average, the mid-day net radiation was approximately 350 W m<sup>-2</sup> over the period from July 14 to July 28. The mid-day sensible heat flux approached 180 W m<sup>-2</sup>, and exceeded the mid-day values for the latent heat flux that was about 75 W m<sup>-2</sup>. The averaged daily evaporation rate was about 1.3 mm day<sup>-1</sup>. During this first part of the growing season, both sites were carbon sinks, with the unmodified larch tundra site accumulating carbon at a rate of -0.58 g C m<sup>-2</sup> day<sup>-1</sup>, and the modified site (without trees) at a rate of -0.32 g C m<sup>-2</sup> day<sup>-1</sup>. After the removal of the surface vegetation, carbon and energy fluxes changed substantially. On average, the albedo decreased from 0.14 to 0.09, the aerodynamic roughness length of the surface decreased from 0.072 m to 0.015 m. The latent heat flux was still as large as that at the unmodified site due to direct evaporation from the bare soil. The half hour-average CO<sub>2</sub> flux showed a small and mostly uniform respiration rate (0.450.26 mol m<sup>-2</sup> s<sup>-1</sup>) during both day and night. The small and relatively uniform emissions from the manipulated site, as compared with the control site, suggests that much of the diurnal and short term variability in ecosystem fluxes originates from aboveground vegetation and the surface layer.

#### B71C-08 1035h

##### KoFlux: Korean Regional Flux Network in AsiaFlux

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AsiaFlux, the Asian arm of FLUXNET, held the Second International Workshop on Advanced Flux Network and Flux Evaluation in Jeju Island, Korea on 9-11 January 2002. In order to facilitate comprehensive Asia-wide studies of ecosystem fluxes, the meeting launched KoFlux, a new Korean regional network of long-term micrometeorological flux sites. For a successful assessment of carbon exchange between terrestrial ecosystems and the atmosphere, an accurate measurement of surface fluxes of energy and water is one of the prerequisites. During the 7th Global Energy and Water Cycle Experiment (GEWEX) Asian Monsoon Experiment (GAME) held in Nagoya, Japan on 1-2 October 2001, the Implementation Committee of the Coordinated Enhanced Observing Period (CEOP) was established. One of the immediate tasks of CEOP was and is to identify the reference sites to monitor energy and water fluxes over the Asian continent. Subsequently, to advance the regional and global network of these reference sites in the context of both FLUXNET and CEOP, the Korean flux community has re-organized the available resources to establish a new regional network, KoFlux. We have built up domestic network sites (equipped with wind profiler and radiosonde measurements) over deciduous and coniferous forests, urban and rural rice paddies and coastal farmland. As an outreach through collaborations with research groups in Japan, China and Thailand, we also proposed international flux sites at ecologically and climatologically important locations such as a prairie on the Tibetan plateau, tropical forest with mixed and rapid land use change in northern Thailand. Several sites in KoFlux already begun to accumulate interesting data and some highlights are presented at the meeting. The sciences generated by flux networks in other continents have proven the worthiness of a global array of micrometeorological flux towers. It is our intent that the launch of KoFlux would encourage other scientists to initiate and participate in this cooperative effort in advancing the flux network and we look forward to prosperous results. Acknowledgement. The financial support for KoFlux researchers were made by the Ministry of Environment (Next Generation Core Environmental Technology Development Program); Korea Science & Engineering Foundation (SRC Program); the Ministry of Science and Technology (NRL Program); and the Ministry of Education (Brain Korea 21 Program).

#### B71C-09 1050h

##### Improving regional and continental CO<sub>2</sub> flux estimates with surface concentration measurements

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A robust relationship is found between monthly and annual mean daily surface CO<sub>2</sub> concentration draw-down and CO<sub>2</sub> flux measured by eddy covariance above several forested sites across a wide range of latitudes. The finding implies that surface concentrations can be quantitatively related to mean boundary layer concentrations, a result supported by investigation of tall tower data. We conclude that concentration data are regionally representative, and surface concentration draw-down (daily minimum minus daily average) averaged at monthly or annual resolution may be used at isolated sites for regional flux estimates, or in a network of sites for larger scale flux estimates. Estimation of monthly mean boundary layer concentrations from the relationship found here have an associated error that is comparable to that at continental sites within the Globalview-CO<sub>2</sub> network. Surface concentration measurements at flux towers can therefore potentially be incorporated into regional and global scale atmospheric inversion models for improved resolution of longitudinal flux partitions.

#### B71C-10 1105h

##### Measurements of Regional-Scale Isotopic Discrimination and CO<sub>2</sub> Flux for the North-Central U.S.

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Here we describe a method to estimate regional-scale <sup>13</sup>C isotope discrimination and CO<sub>2</sub> flux using the mean gradients in CO<sub>2</sub> isotopes and concentration between the planetary boundary layer and the free troposphere. Using monthly flask measurements from a 400 m tall tower in Wisconsin and a mountain top in Colorado, in concert with continuous environmental measurements from the tower, we constructed monthly and annual estimates of the net isotopic signature and CO<sub>2</sub> flux imparted to the free troposphere. Furthermore, the resultant flux weighted isotope signatures allowed us to constrain natural versus anthropogenic contributions to the annual CO<sub>2</sub> budget for the region.

#### B71C-11 1120h

##### Results from the stable isotope sampling network in Carboeuroflux

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Integrating stable isotopic measurements of canopy air and ecosystem organics with flux tower and ecophysiological data provides a powerful tool to differentiate between carbon sources and sinks, and scale-up processes from plant to ecosystem levels.

During the 2001 and 2002 growing-seasons monthly flask samples of nocturnal canopy air and ecosystem organics were collected from selected forest flux sites within the Carboeuroflux network (13 sites in 2001 and 18 in 2002). Flask air was analysed for CO<sub>2</sub> concentration ([CO<sub>2</sub>]), and the carbon and oxygen isotopic compositions ( $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$ ) of this CO<sub>2</sub>. The  $\delta^{18}\text{O}$  of waters distilled from leaf, stem and soil samples, and the  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  of these dried, homogenised organic samples were also measured. Analytical precisions were  $\pm 0.1$  ppmv for [CO<sub>2</sub>],  $\pm 0.1$  permil and  $\pm 0.2$  permil for the  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  of atmospheric CO<sub>2</sub>,  $\pm 0.05$  permil for water  $\delta^{18}\text{O}$  and  $\pm 0.1$  permil for both the  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  of organics.

The  $\delta^{13}\text{C}$  of ecosystem respired CO<sub>2</sub> ( $\delta^{13}\text{C}_R$ ) was determined for each sampling period and location using a Keeling plot approach. Ecosystem discrimination ( $\Delta^{13}\text{C}_E$ ) was estimated as the difference between the

$\delta^{13}\text{C}$ s of background atmospheric CO<sub>2</sub> and ecosystem respired CO<sub>2</sub>. The seasonal and spatial variation in these variables, and the  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  compositions of the organic samples are examined relative to meteorological and ecophysiological conditions. We assessed the potential for using the  $\delta^{18}\text{O}$  of ecosystem respired CO<sub>2</sub> ( $\delta^{18}\text{O}_R$ ) together with that of soil and leaf waters to partition between the soil and above-ground respired CO<sub>2</sub> sources. At sites where soil  $\delta^{13}\text{C}$  varied significantly from leaf  $\delta^{13}\text{C}$ , we also assessed the partitioning potential in using the  $\delta^{13}\text{C}$  data. More intensive sampling campaigns, including incubations in branch-bags, and leaf, trunk and soil chambers, were also conducted at specific sites to examine the partitioning and scale relationships between individual source CO<sub>2</sub> contributions and  $\delta^{13}\text{C}_R$ . These experiments are still being conducted and their final results will be presented.

Significant variations are observed in  $\Delta^{13}\text{C}_E$  and  $\delta^{13}\text{C}_R$  spatially, seasonally and between years. The observed variations in  $\Delta^{13}\text{C}_E$  and  $\delta^{13}\text{C}_R$  follow a general trend with daytime average temperature, such that the most enriched compositions are typically observed during the mid-season and in warmer, more continental climatic locations. The average seasonal range in  $\delta^{13}\text{C}_R$  at individual sites is 5 permil, between -26 permil and -21 permil, although, the average range between sites is also 5 permil.

The average  $\delta^{18}\text{O}$  compositions of soil and twig waters for both years were 6.6 permil and 6.0 permil respectively (SD=2.5 permil). Throughout each season and between sites these compositions varied from 0 permil to 10 permil.

The results of this network highlight some of the applications of stable isotope monitoring for assessing local and regional-scale terrestrial ecosystem dynamics. In particular, the observed regional variations in  $\Delta^{13}\text{C}_E$  may have implications for modelling regional carbon sources and/or sinks from measurements of the  $\Delta^{13}\text{C}$  of atmospheric CO<sub>2</sub>, as these estimates currently assume constant  $\Delta^{13}\text{C}_E$ .

URL: <http://www.weizmann.ac.il/ESER/wp5/>

#### B71C-12 1135h

##### Modeling Forest Productivity in a Complex Forested Landscape Using High Spectral Resolution Remote Sensing and Extensive Field Data

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Spatial estimates of forest carbon fluxes are needed for a growing number of environmental issues that range from local to global scales. Although integration of ecosystem models and remote sensing data has become a relatively common approach, prediction accuracy is often limited by a lack of detailed input data for important physiological variables such as plant photosynthetic capacity, as well as errors within the models themselves. However, understanding the various sources of prediction error can be challenging in areas that lack extensive field data for rigorous model validation.

Previous work with high spectral resolution remote sensing has suggested that the ability to remotely detect biochemical properties of a plant canopy, most notably leaf N concentrations, may improve our ability to derive high-quality productivity estimates. In this study, we evaluated the effectiveness of this approach in a topographically-complex forested landscape in New Hampshire's White Mountain National Forest. Spatial estimates of net primary productivity were generated by combining an ecosystem model (PnET) with a canopy nitrogen coverage derived using NASA's Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). Model predictions were compared with field-measured productivity data from an extensive network of forest inventory plots, as well as with predictions derived using directly-measured canopy nitrogen. Results showed that model predictions using remotely-sensed canopy N were improved substantially over those generated using input data that were aggregated by cover type. However, remaining prediction error was most likely related to error in the remote sensing coverage, indicating that model accuracy was largely a function of input data quality and that future improvements can be achieved through improved methods for canopy N detection.

#### B72A MCC: Hall C Sunday 1330h

##### Using Microbial Community Structure, Activity and Reaction Modeling to Evaluate Biogeochemical Cycles in Sediment and Soil Environments I Posters (joint with H, OS)

**Presiding:** L Proctor, University of Maryland Biotechnology Institute and U.S. Geological Survey; E Roden, University of Alabama

#### B72A-0744 1330h POSTER

##### Microbial Dynamics in Shallow Peat in Calcareous Fen

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This paper presents the results of fine-scale vertical investigation of pore water geochemistry and anaerobic microbial communities present in the upper humified peat in the McLean Fen (NY). Equilibrium diffusion chambers were used to collect anoxic pore waters at every 2cm depth from the land surface to approximately 50 cm depth at two sites along a groundwater flow path. One site, with a degraded vegetation assemblage, was at the edge of the wetland and adjacent to a farmer's field which had been fertilized in the past. The second site was down gradient in a pristine part of the wetland. Peat cores were also taken and subsampled every 2 cm. The upper peat near the edge of the wetland has an average bulk density 5 times greater than that in the pristine area. Strong downward vertical gradients of Fe and Mn at the degraded site suggest concurrent reduction of these two elements in the upper peat, whereas the absence of similar vertical gradients at the pristine suggests an absence of much Fe and Mn reduction. At both sites, concentrations of NO<sub>3</sub>- and SO<sub>4</sub><sup>2-</sup> indicate nitrogen reducers in the upper 5-10 cm layers and sulfate reducers in the lower part of the measured peat profile. Molecular biology techniques were used to quantify the abundance of nitrogen-reducers, iron-reducers, sulfate-reducers, and methanogens. Preliminary results indicate that the anaerobic microbial communities within the peat are highly complex and that different microbial groups coexist within the same peat zones.

#### B72A-0745 1330h POSTER

##### Effect of Forest Conversion Practices on the Composition of Soil Microbial Key Populations Involved in N-Cycling

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Investigations on the effect of forest conversion practices on composition of soil microbial populations involved in N-cycling were performed at the Hglwald Forest site (Southern Germany, near the city of Augsburg: 100 year old spruce stand) and at 4 forest sites in the Northeastern German Lowlands (pine forests, pine forests mixed with beech and a beech forest, respectively). While at the Hglwald Forest, the short term effects of forest conversion practices on microbial populations were studied (thinning of a spruce stand, and clear cutting of a spruce stand, respectively), in the Northeastern German Lowlands a chronosequence of forests was studied consisting of different stages of pine forest conversion to mixed pine-beech forests (pure pine stand: c. 80 years old; pine stand with 10 year old beech; pine stand with 40 year old beech) and results were compared with those obtained at a 130 year old beech stand.

At the Hglwald Forest, one year after clear cutting, this forest management practice had led to a dramatic increase of cell numbers of denitrifiers (c. 8-fold) in the