B11C MCC: Level 2 Monday 0830h

Environmental Assessment From the Width, Anatomy, and Chemical Composition of Tree Rings I Posters

(joint with A, H, GC)

Presiding: **T E Lewis,** U.S. Environmental Protection Agency**; T Yanosky,** U.S. Geological Survey

B11C-0701 0830h POSTER

Targeting During Sampling and Analysis in Fire History Reconstructions and Fire-Climate Research: Evaluating Methodologies.

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Fire scar datasets have been widely applied to the reconstruction of historical fire regimes, in the investigation of fire-climate linkages and in environmental assessments. These datasets have been collected by numerous methods, yet the spatial and statistical integrity of these methods have not been evaluated. Targeting, an experience-based sampling system, has been explicitly recommended in the literature. Logistically, targeting is a practical method in study areas that are often characterized by difficult terrain. However, targeting may bias datasets by emphasizing areas of the landscape that burn more frequently. Uniform grid-based sampling methods have also been implemented in fire research, and may better represent fire heterogeneity. In this paper, I simulate grid-based and targeted sample designs at multiple scales in a GIS. An existing dataset collected in a Pinus ponderosa forest in Washington with 0.073 samples/ha, is treated as the population of scarred trees. Mean fire return interval (MFRI) is calculated for the sampled subsets of data at multiple scales and compared with the MFRI for the entire dataset. The purpose of this study is to evaluate the validity of targeting, and to investigate the relationship between scale and sampling methods. Results suggest that targeted sampling methods do not bias fire intervals.

B11C-0702 0830h POSTER

Evidence that Earlywood-Latewood Size and Isotope Differences Can Influence Long-term Tree-Ring δ^{13}C Trends

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Inter-annual δ^{13}C analysis of alpha-cellulose was performed on two Chinese pine trees (*P. tabulaeformis* Carr.) for the period of 1896 to 1990A.D. Seasonal δ^{13}C analysis was conducted on the outer 13 annual rings of one of the trees. The inter-annual data exhibit a long-term decline greater than 2‰. This decline is much larger than the actual atmospheric δ^{13}C decrease caused by industrialization since A.D.1850, although results are consistent with the previous studies of other tree rings from the Northern Hemisphere that claim to have recorded the anthropogenic trend of atmospheric δ^{13}C. Here we present evidence that the long-term trend of ^{13}C/^{12}C in tree rings could also result from ecophysiological effects superimposed on the anthropogenic trend. These effects are associated with the decreasing/increasing productivity of earlywood or latewood associated with the changing growth history of the tree. Theoretical calculations show that the long-term trend of ^{13}C/^{12}C in tree rings caused by ecophysiological effects can be enhanced or reduced depending on the seasonal δ^{13}C pattern, which indicate that a 2‰ difference between earlywood and latewood could produce a 1.5‰ long-term change in δ^{13}C during 100-year period by this ecophysiological effect alone. This amplitude is nearly equivalent to the -1.35‰ decline in atmospheric δ^{13}C since pre-industralization. Based on the seasonal δ^{13}C data, we removed the long-term ecophysiological effects on δ^{13}C from one of these trees (HL02). The corrected data are in agreement with the observed size and timing of the δ^{13}C decline in atmospheric CO_2. This study suggests that the long-term tree-ring δ^{13}C data used to infer the anthropogenic impact on atmospheric ^{13}C/^{12}C trend might be improved by correcting for possible ecophysiological effects if latewood and earlywood widths are measured. We argue that previous tree-ring calculations of the transfer of biospheric carbon to the atmosphere from fossil-fuel combustion in the Northern Hemisphere could be overestimated, and perhaps Southern Hemisphere studies finding no decline in $delta^{13}$C can also be re-examined in light of these findings.

B11C-0703 0830h POSTER

The Application of Synchrotron X-ray Fluorescence to Dendroanalysis: Nickel in Salix nigra L.

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Synchotron X-ray Fluorescence microanalysis (SXRF) has been applied to annual rings of willows (Salix nigra L.) collected from an eroding former radiological settling basin and the impacted depositional area downstream. In 1984 the enclosing spillway of Steed Pond breached, and a pulse of U and Ni contaminated sediments moved downstream, accumulating in Lower Tims Branch (LTB), continuing during storm events. The aim of the study was to correlate fluctuations in contaminant concentrations within annual rings of impacted trees with the contaminant history, specifically the major contaminant pulse of 1984. Trees were sampled at Steed Pond, LTB and an uncontaminated reference site. Their rings were measured, aged and sectioned for SXRF analysis. Analysis took several forms: one-dimensional line scans (from pith to cambium) to show fluctuations in metal concentration over the lifetime of the tree; two-dimensional elemental maps to show metal distribution between and within annual rings, and three-dimension fluorescence tomography, to show the structure and composition of regions of interest. Trees from LTB clearly showed a marked increase in Ni concentration within the annual ring formed in 1984, and a series of peaks in subsequent years. Notably, lesser contaminants Cu, Zn and Cr showed an identical pattern. U was not present. Compositional mapping showed Ni associated with annual rings, with a clear demarcation between rings. Closer examination revealed smaller areas (10 to 20 microns in diameter) containing approximately 1000 ppm Ni. These discrete areas were exclusively Ni containing features, and were examined further with three-dimensional fluorescence tomography, showing that the Ni features occurred inside the lumen of vessel elements. We concluded that the Ni signature in annual rings of willows from LTB correlated with known contaminant pulses. Further, the technique quantitatively distinguished between trees growing on the radiological settling pond (having a high Ni content) and those growing further away in the LTB depositional area. Mapping elemental distribution showed that Ni was associated with annual rings, and appeared in both a diffuse form across annual rings, and in a concentrated form within the lumen of xylem elements. Work continues to determine the binding environment and chemical speciation of Ni within annual rings of black willows.

URL: http://www.er.doe.gov/production/ober/ERSD/hl_treerings.html

B11C-0704 0830h INVITED POSTER

Use of Dendrochronology for Determining the Chronology of Landslide Activity Along Meadow Run, Shenandoah Valley, Virginia USA

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The growth rings of living trees were examined to determine the chronology of landslide activity along Meadow Run, a low-order ungaged stream that emerges from the western flank of the Blue Ridge Mountains of Virginia and flows into the South River in the eastern Shenandoah Valley. At the study site, Meadow Run meanders over a Pleistocene-Quaternary alluvial fan comprised of fresh and weathered sands and cobbles derived from quartzites and sandstones of the Antietam Formation. The alluvium is underlain by the Shady Dolomite, which has limited exposure as saprolite in some stream cuts and slope failures. Stream migration and undercutting of topographically higher fan surfaces creates bluffs up to 20 m in height that show signs of past and recent slope instability. Tilting of trees and slope surfaces indicate that rotation is the dominant type of slope movement; hence, these landslides are termed earth slumps. Two of these slides are contiguous and were investigated in detail. The geomorphology of the downstream slide suggests episodic movement since the mid 1930s. A white oak near the main scarp of the slide shows an abrupt and sustained decrease in ring width beginning in 1937, suggesting that the tree was tilted and root pruned; a sprout from the base of the tilted trunk started to grow no later than 1940. A nearby sprout that began growth no later than 1941 from a tilted black gum supports the general dating of the initial slide. Along the South River at Harriston, floods were recorded in March 1936 (12,600 cfs) and April 1937 (11,700 cfs), suggesting that slope instability along Meadow Run resulted from the undercutting of bluffs by flood waters or from over-saturation of soils during heavy rains. The synchronous formation of reaction wood beginning in the early 1970s in the oak and gum sprouts, and in the parent trunk of a nearby Virginia pine, suggests an episode of slope movement triggered by the peak flow (21,300 cfs) following Hurricane Agnes in June 1972. The proximal, upstream slide shows fresh scarp exposures of very recent landslide reactivation. The germination of seedlings on disturbed soils and growth responses of previously established trees suggest episodic slope instability in approximately 1993, 1997, and 1999. For example, a 50-year old Virginia pine formed reaction wood beginning in 1993 followed by a virtual cessation of radial growth after 1997. Changes in the quality and quantity of growth in this tree seemingly are related to two episodes of slope movement that first tilted the tree and then severely pruned its roots. During the period of record (1924-2002) for the South River, recent floods occurred in April 1992 (9,840 cfs), March 1993 (7,360 cfs), September 1996 (28,900 cfs), and February 1998 (10,000 cfs). In addition to the correlation between the dendrochronology and the peak-discharge data, geomorphic evidence suggests that the main channel of Meadow Run has a history of realignment during large storms. The base of the downstream slide is in direct line with the trajectory flow of a paleo channel of unknown age. Additionally, the base of the upstream slide is being removed by the modern channel. Preliminary evidence suggests recent stream avulsion of this channel, as the remnants of an upstream debris jam has redirected flow, and the active channel that impacts the slide appears underfit compared to upstream and downstream reaches. The multiple and quasi-braided paleo channels in Meadow Run suggest a long history of realignment in many locations during floods, further contributing to slope instability.

B11C-0705 0830h POSTER

Potential use of Oxygen Isotopes From α-Cellulose in Tree Rings to Examine Climate Trends, El Malpais National Monument, New Mexico, USA

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The development of high-resolution geological proxies is key to understanding long-term climate variability. Tree-ring studies have shown the potential to provide a uniquely high resolution, precisely dated record of climate change. The oxygen isotope composition of α-cellulose in tree rings may provide a high resolution, dateable proxy for examining precipitation source, variability, and other long-term climate trends and parameters. We are examining the potential of tree ring α-cellulose oxygen isotopes to record changes in precipitation activity in the southwestern United States, at a site within El Malpais National Monument. Here, more than half of the annual precipitation is derived from the North American Monsoon (NAM). It has been previously suggested that the precipitation sources for the NAM may change on long-term scales. Tree rings from El Malpais that have already been subject to a 2129 -year precipitation reconstruction and are absolutely dated in time are the basis of this study. We hypothesize that a change in the precipitation source should be reflected in the oxygen isotope composition of the α-cellulose within the tree rings. Intra-annual latewood and earlywood α-cellulose samples were extracted and analyzed by pyrolysis-IRMS for the period 1992-1964. The oxygen isotope analysis revealed $\delta\ ^{18}O$ values ranging from $\sim$ 33-37$^o/_{oo}$ for the earlywood and $\sim$ 33-38$^o/_{oo}$ for the latewood. Latewood samples are generally 0.5 to 2$^o/_{oo}$ heavier than earlywood. Interannual trends are also observed, in particular, the average $\delta\ ^{18}O$ values are $\sim 2^o/_{oo}$ heavier after the mid-1970's. Numerous other proxies, including tree-ring width analysis, show changes in the mid-1970's that are inferred to be related to a shift in the Pacific Decadal Oscillation. While further work must be done to better understand the factors influencing the tree ring oxygen isotopes, they appear to record a major change coincident with that shift.

B11C-0706 0830h POSTER

Radial Distribution of Photosynthetically Spiked Carbon-13 Tracer in a Tree Ring

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Among other stable isotopes, stable carbon isotope ratio in tree rings is most commonly used for reconstruction of precipitation, drought or soil water status. However, the time lag between carbon incorporation by photosynthesis and use of the assimilated carbon for xylem formation is poorly documented. For example, how much of the stored carbon assimilated at the end of growing season can be used for the following year's xylem growth is not well understood. Our objective was to clarify how carbon assimilated at a given time in different seasons (spring and summer) is used for succeeding xylem growth and eventually distributed radially in a tree ring. Using a 4-year old Japanese cedar tree (Cryptomeria japonica) growing in Tsukuba, Japan, we fed carbon isotope tracer (99 atom %) photosynthetically to the tree on May. 29 and Sep. 18 in 2001, and the tree was cut down in March 2002. At the same time, the cambium was pin-marked on Sep.18. Tangential sections of 60 m thickness were cut continuously from the tree ring formed in 2001 with an ultra microtome. d13C was measured on both balk and holocellulose samples of these sections. Two peaks of d13C were detected in the tree ring, and the outer d13C peak corresponded to the location of pin-marking on Sep. 18. Small difference in d13C profile between bulk and holocellulose samples was observed at the first part (closer to the pith) of the peaks, probably reflecting lignification pattern.

B11C-0707 0830h POSTER

Tree Rings and Volcanic Eruptions: Reviewing the Potential of Dendrochemistry for the Absolute Dating of Past Volcanism

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Investigations of volcanic impact on human society and the environment are presently restrained by a lack of secure absolute dates for eruptions prior to the last few hundred years. The degree of impact and recovery, and the scope of any sociological repercussions, can only be fully explored if working from a precise, known, starting point and against a secure absolute timescale. A potential means to high resolution dating for the majority of the Holocene lies with globally available, absolutely dated tree ring chronologies. Many of these have been shown to record short term climatic alterations in periods following volcanic eruptions of known or approximate date. This argument however, has been based on an apparent correlation between the dates of specific tree ring growth anomalies and the dates of a number of eruptions in the recent historical period. The statistical correlation is less than decisive and the exact volcano-climate-tree growth linkage is by no means universally agreed. It has been suggested that a potential means to solve this problem and to attach absolute dates to volcanic eruptions via tree rings may lie in the chemistry of the annual woody increment. This paper assesses the potential of conventional Inductively Coupled Plasma Mass Spectrometry (ICP-MS) versus laser ablation ICP-MS (LA-ICP-MS) in terms of exploring this research objective. It also reviews the prospects for a dendrochemical resolution to the problem of attributing an absolute date to the volcanic eruptions of prehistory.

B11C-0708 0830h POSTER

Review of PIXE Mercury Detection Research at the Louisiana Accelerator Center

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Particle Induced X-Ray Emission (PIXE) is nondestructive and allows the simultaneous analysis of elements in solid, liquid, and gas samples. When incident energetic ions strike a target, inner shell electrons of these atoms are ejected as they acquire energy from the incident particle. Outer shell electrons then fill vacancies in the inner shell caused by the ionization. This de-excitation is accompanied by the emission of an Auger electron or x-ray. The ratio of the x-ray production to the probability of ejection of an Auger electron is the fluorescence yield, which ranges from a value of nearly 100% for heavy elements to as low a few percent for light elements. The energy of the emitted x-rays depends on the specific elements present in the target. Since each target element has its own set of characteristic energies in the x-ray spectrum, identifying and determining the concentration of elements is possible. Typically 1-3 MeV ions (usually protons) from a small electrostatic accelerator are used for PIXE analysis. This technique is fast and sensitive; typical limits of detection fall below the ng/cm2 region in the case of surface analysis, or ng/mg (ppm) in the case of concentration measurements. PIXE is two orders of magnitude more sensitive than similar electron-based analysis techniques. Over the last several years, the authors have been using PIXE to detect low concentrations of mercury in tree ring samples. For example, southern magnolia (magnolia grandiflora) tree samples, with known concentrations of mercury, were analyzed using PIXE. Recent published results from these measurements indicate that the average mercury absorption percentage was found to be 85$\pm$ 4%. The distribution of mercury was found to be reasonably homogeneous over the sample surface. However, small variations in mercury concentration are most likely caused by the structure of cellulose in the wood. Mercury in the samples appears to be stable to a total integrated charge of 10 C. Three mercury L-shell x-rays are easily observed in the resulting PIXE spectrum. Using PIXE, the mercury detection limit was calculated to be approximately 1 ppm. This poster will provide a history of our mercury detection efforts using PIXE. Our research was completed at the Louisiana Accelerator Center (LAC), which is located on the campus of the University of Louisiana at Lafayette.

URL: http://physics.louisiana.edu/

B11C-0709 0830h POSTER

Characterization of a high elevation tropical pine forest for isotopic analysis of the North American Monsoon System: Nevado de Colima, Mexico

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The area watered by the North American Monsoon encompasses a vast geographic region, from tropical Mexico to the deserts of the Great Basin. The system is ultimately driven by tropical ocean-atmosphere interactions, which in turn orchestrate global climate variability over a range of timescales. Instrumental observations at the end points of the system span only the past few decades in the tropical south and are limited to only a few decades more in the desert north. At both locations, high-resolution proxy records of climate can supplement existing data. The Mexican mountain pine (Pinus hartwegii) has been shown to hold a paleoclimate record at a high elevation site in tropical Mexico. Warm-season precipitation regime is the dominant year-to-year signal in a 400-year tree-ring chronology from Nevado de Colima, Mexico, where an automated weather station and a range of automatic tree growth sensors (phytograms, point and band dendrometers) have been installed at 3770 m (12,370 ft) elevation. Co-measuring tree growth and climate over a three-year period, has contributed to a better understanding of the complex response of low latitude, high elevation trees to changing environmental conditions. This characterization is necessary for interpretation of the stable isotopic record of Monsoon fluctuation as recorded by the trees. Stable isotopic characterization of the source waters before and after the Monsoon has been completed and analysis of tree ring cellulose is underway. Preliminary results show a strong seasonal isotopic signal and highlight the importance of context dependent analysis.

B11C-0710 0830h POSTER

Examination of Environmental Trends in Hawaii Based on the Trace Element Distributions in Cores of the Kiawe tree (Prosopis pallida)

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Annual growth rings of trees have the potential for providing a chronology of bioavailable contaminants extant in the environment in which the trees grow. Recent studies have documented a significant correlation between concentrations of metals in atmospheric particulate matter and those observed in surface and groundwater. The Kiawe (Prosopis pallida), a hardwood tree commonly found in Hawaii, represents a potential environmental tape recorder because of its life span on the order of multiple decades. Because the Kiawe is phreatophytic and has high transpiration rates, it may be ideally suited to examine past (temporal) and current (spatial) variability in the quality of groundwater where these trees grow. Because of the potential correlation between airborne and groundwater pollution we hypothesize that growth rings of Kiawe may yield clues to help unravel recent (50-100 yrs) changes in contamination patterns in Hawaii. We will present concentrations of trace elements (Cr, Mn, Co, Ni, Cu, Zn, Pb, Cd, Sb, and Pb) in cores of Kiawe trees growing on the island of Oahu, Hawaii. Oahu, the locus of more than 80 percent of the population of the State of Hawaii, is heavily urbanized, but other land uses include agriculture, conservation (rainforest), and military reservations, where live-fire military training activities over the past 60 years have raised public concern about potential contamination of natural resources. Preliminary analyses indicate that trace element concentrations in Kiawe wood range from a less than one to tens of micrograms per kilogram, depending on the element and the provenance of the tree.

B11C-0711 0830h POSTER

Estimating Paleoflood Magnitude From Tree-Ring Anatomy and the Height of Abrasion Scars

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Evidence of floods preserved in the growth rings of trees can be used to extend the historical record of flooding or to estimate the magnitude of extraordinary floods on ungaged streams. Floods that damage the aerial parts of trees during the growing season sometimes induce striking anatomical changes in subsequent growth of rings in the lower trunk. In ring-porous species, this growth most commonly produces concentric bands of atypically large vessels within the latewood. The number and diameter of anomalous vessels seem positively related to the amount of flood damage, and thus can be used to refine estimates of flood magnitude when also considering the position of the tree relative to the channel and its approximate height during the flood. Floods of long duration on low-gradient streams are less likely to damage trees directly, but prolonged root flooding often results in the formation of narrow rings with atypically small vessels; shorter-duration floods, sometimes inundating roots for as little as several days, are followed by the production of fibers (non-conducting cells) with large lumens and thin walls that appear as light-colored bands compared to earlier-formed tissue. In these instances, a series of trees increasingly distant from the channel can be used to estimate a minimum flood elevation. Abrasion scars from flood-borne debris often are the most easily observed evidence of flood damage and, like anatomical abnormalities, can be precisely dated. The relation between the heights of scars and maximum flood stages depends in part upon channel slope. Previous studies have indicated that scar heights along low-gradient streams are the same or slightly lower than maximum flood elevations. Along the high-gradient (6% maximum slope) Buffalo Creek, Colorado USA, scar heights measured in 102 trees following a flood in 1996 ranged from -0.6 to +1.5 m relative to the actual crest elevation. Scar elevations exceeding flood elevations by 3-4 m, however, were observed following a flood in 2002 along a small Colorado stream with slopes ranging from 6 to 15%.

B11C-0712 0830h POSTER

Tropical Cyclone Activity and Climate Fluctuations Captured by Oxygen Isotopes in Tree-Ring Cellulose From the Southeastern US

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Tropical cyclone activity in the Atlantic Ocean and Gulf of Mexico fluctuates on seasonal to century scales. Large climate oscillations, such as the El Nino Southern Oscillation, Atlantic Multidecadal Oscillation, and the Pacific Decadal Oscillation may affect this tropical cyclone activity. To better discern and understand factors influencing long-term trends in hurricane occurrence, proxies are needed that extend the record beyond historical documents. Tree rings preserve excellent records of climate that can be tracked on an intra-annual scale. Two trees in southern Georgia, slash and longleaf pine, were collected and dated using dendrochronological techniques and a 156- year record (1840-1997) was examined. The tree rings were processed to alpha cellulose, with intra-annual resolution, for examination of oxygen isotopes from both earlywood (EW) and latewood (LW) growing seasons. In the southeastern U.S., temperature variation across the growing season for slash and longleaf pines is modest (27-33°C) and oxygen isotope compositions largely reflect the composition of precipitation. Tropical cyclones produce precipitation that is significantly depleted in ^{18}O compared to average seasonal rainfall and generally occur during the LW growing season. The relatively depleted oxygen isotope ratios are incorporated into LW cellulose and thus the annual ring set is marked by a large difference between EW and LW δ ^{18}O values. For years without a significant event, EW-LW differences are expected to be nominal. The 156-year long tree-ring oxygen isotope record of major hurricane occurrence corresponds well with known tropical cyclone occurrence in the study area. The record also captures evidence of EW drought. The tropical cyclone record appears to be overprinted upon a much larger climate oscillation that is characterized by periods of relative separation (i.e., apart from the larger differences due to hurricanes) vs. coincidence of the EW/LW oxygen isotope compositions. The frequency of tropical cyclones appears to be much greater during the EW/LW separation phase of this larger climate oscillation, in particular the decades of 1840 to mid-1920's and mid-1940 to mid-1970's.

B11D MCC: Level 2 Monday 0830h

Disturbance, Climate, and Management Impacts on Carbon Budgets of Forested Ecosystems I Posters *(joint with A, GC)*

Presiding: **K A Hibbard,** Oregon State University**; M Apps,** Canadian Forest Service**; D J Barrett,** CSIRO Plant Industry

B11D-0713 0830h POSTER

Climatic versus biotic constraints on carbon uptake in ponderosa pine forests

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An assessment of the trade-offs between climatic versus biotic controls on carbon uptake in forests is critical to developing a clearer understanding of disturbance on carbon cycling in terrestrial ecosystems. We used a detailed, process-based simulation model to investigate the effects of interannual variation of precipitation on carbon assimilation in ponderosa pine (Pinus ponderosa var. Laws.) forests in the Cascade Mountains of central Oregon, USA, characterized by cool, wet winters and hot, dry summers that result in seasonal drought stress. We selected three ponderosa pine stands representing a range of ages since the previous stand-initiating disturbance, clearcut logging. In 2002, the young stand (YS) was about 25 years old and had a mean total leaf area index (LAI) of about 1.1. The mature stand (MS) was around 90 years old with a mean LAI of about 3.0, and the old stand (OS) was never logged and had a mean LAI of about 2.3. Simulations of carbon and water fluxes at each site were performed using the Soil-Plant-Atmosphere (SPA) model (Williams et al. 2001) using stand and meteorological data. Comparisons between simulations and eddy flux measurements at each site indicated generally good agreement, with relative differences between the model and measurements across the three sites of about 25% for tree transpiration, 30% for total latent energy fluxes, and 25% for gross carbon uptake, GPP. Four years of climate data (1999-2002) for the sites showed three- to four-fold variation in winter precipitation, nearly five-fold variation in summer precipitation, and over 50% variation in total annual precipitation. Based on the simulations, mean annual carbon uptake across the four years was 850 gC m$-$2 y$-$1 at the YS, 1260 gC m$-$2 y$-$1 at the OS, and 1530 gC m$-$2 y$-$1 at the MS. Despite the substantial interannual variation in precipitation, the interannual variation in GPP at each of the three sites was only about 5%, suggesting that variation in precipitation across the four years was not a major constraint on GPP, whereas soil CO2 efflux measurements at the OS and YS showed large interannual variation that could be attributed to soil moisture availability in the deeper soil horizons (OS) and the quantity of summer precipitation (YS), suggesting that interannual variation in net ecosystem production (NEP) is largely due to the respiration responses to moisture availability. Additional simulations, eliminating summer drought conditions, indicated that annual GPP could increase by up to 20% at the sites if soil moisture was not limiting. Moreover, the large differences in annual GPP among the three sites, suggest that stand development following disturbance probably plays the largest role in limiting carbon uptake in these forests. Finally, sensitivity tests involving maximum rooting depth at each site, suggests that this factor may be crucial to enabling these semi-arid forests to minimize the effects of summer drought.

B11D-0714 0830h POSTER

Interannual variability of carbon fluxes from forest ecosystems and other regions

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A dynamic vegetation model is used to study the interannual CO2 variability in relation to climate variability and disturbance. The tropical forest ecosystem plays a major role in the global total land fluxes, particularly in relation to ENSO. The boreal forests varies at amplitude comparable to tropical forests, but with high spatial variability. The mechanisms are distinctly different in the tropics and at the boreal regions in that the precipitation and temperature effects on NPP and respiration have the same or opposite effects due to the difference in climate chrateristics. Fire also plays an important role in the interannual carbon flux variability.

B11D-0715 0830h POSTER

Impacts of 130 years of grazing on ecosystem carbon dynamics in the subalpine zone of the Wasatch Plateau

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Intensive grazing by domestic livestock likely began in the subalpine region of the Wasatch Plateau by 1870, and has been a continuous disturbance since then. Eight sites within the Great Basin Experimental Range were identified, with each site containing an area that has been protected from livestock for 80-90 years and a continuously grazed area. I specifically evaluated the impacts of long-term protection from grazing on soil C dynamics, N-availability, and aboveground net primary production. I found that grazing leads to an accumulation of actively cycling soil organic matter (SOM); isotopic evidence suggests that the accumulation of active SOM may be due to lower soil moisture in long-term grazed areas compared to protected areas. While there is higher labile SOM C in grazed areas than in protected areas, in situ soil respiration rates were significantly higher in protected areas. This evidence of an environmental constraint on decomposition in grazed areas indicates that lower primary production in grazed sites is being offset by lower decomposition rates, with total ecosystem C storage remaining nearly unchanged between grazed and ungrazed plots. However, it does suggest that historically grazed areas have a larger pool of potentially mineralizable C that could be lost from this system if these subalpine areas become warmer and wetter with climate change.

B11D-0716 0830h POSTER

Health Assessment of the White Pine Community in the Lincoln National Forest of New Mexico through Spectral Reflectivity Variance

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