Total error propagated and partitioned in a LiDAR driven single tree growth model. Gertner, G. (*University of Illinois, USA; gertner@illinois.edu*).

The U.S. Forest Service FVS (Forest Vegetation Simulator) is a very widely used growth model developed for projecting individual trees and forest development through time. FVS is now being used to evaluate a variety of global change scenarios as it relates to forest health, carbon life cycle analysis, sustainability, wildlife habitat, and wildland fires. In this paper, the total error in form of an uncertainty budget is developed for FVS projections, where initial model inputs are spatially explicit single-tree stem maps developed with small-footprint airborne LiDAR (Laser Imaging Detection and Ranging). An uncertainty budget shows the overall precision of estimates/predictions made with a system, partitioned according to different types of uncertainty sources within and outside of the system. In a comprehensive fashion, sources of uncertainties due to measurements, classification, sampling error, and model parameter estimates are accounted for in the LiDAR derived stem maps and within the FVS system. Spatially identifying the sources of uncertainties in time, modeling their propagation and accumulation, and finally, quantifying them locally on a tree basis and globally on a forest level are presented. Uncertainties in future forest responses due to uncertainties in projected global climatic change predictions that will also drive this type of forest model will also be discussed.

Parameterization of 3-PG model for slash pine trees: assessing climate change effects on stand dynamics and productivity. Gonzalez-Benecke, C., Gezan, S., Bracho-Garrillo, R., Jokela, E., Martin, T. (*University of Florida, USA; cgonzabe@ufl.edu; sgezan@ufl.edu; rbracho@ufl.edu; ejokela@ufl.edu; tamartin@ufl.edu*).

The physiological-process based model 3-PG was parameterized for slash pine stands. New functions were included to better estimate changes in NPP allocation, biomass allometry, mortality, and canopy structure dynamics. Species-specific physiological parameters were determined using long term experimental data, as canopy quantum yield and the sensitivity of canopy conductance to vapor pressure deficit, which were determined using more than 10 years of eddy-covariance measurements on two sites. The fertility rating, the arbitrary growth modifier that has been largely argued as the weakest aspect of the model, was determined as a function of stand's site index using data from a long-term experiment that manipulated resources availability. New general functions to estimate tree height and merchantable volume partitioning were also included, allowing economic analysis. The model was validated against a large number of studies and operational plots across the natural range of distribution of the species. The model was also validated against data of stands growing in South America. Using the new set of functions and parameters, the model was used to estimate the impact of future climate change scenarios on stand dynamics and productivity in the SE United States**.**

On identifying and establishing confidence limits of trends. Guan, B. (*National Taiwan University, China-Taipei; btguan@ntu.edu.tw*).

By definition the effect of recent warming on an ecosystem attribute should be a trend. The question is how to detect the trend and to establish confidence bounds on the trend. One possibility is to combine a time series bootstrap method to generate bootstrap samples with characteristics resemble that of the original series, and a trend extraction method for extracting trends embedded in the time series. In this study, the approach was applied to two long-term European first flowering dates (FFD) series and the corresponding average February to April (FMA) monthly mean of daily maximum temperature (Tmax) series. For each anomaly series (base period 1961–1990), bootstrap samples were generated using Maximum Entropy bootstrapping, and each sample was then decomposed into an oscillatory component and a trend using ensemble empirical mode decomposition. Based on point-wise 95% confidence limits, the FFD of both species began to advance around 1977~1978, whereas the two regional FMA Tmax started to warm up around 1982~1983. Thus, recent warming has already impacted the phenophase development before we can declare the warming to be significant statistically.

A systematic framework for Monte Carlo simulation of remote sensing errors map in carbon assessments. Healey, S., Patterson, P., Urbanski, S. (*U.S. Forest Service, USA; seanhealey@fs.fed.us; plpatterson@fs.fed.us; surbanski@fs.fed.us*).

Remotely sensed observations can provide unique perspective on how management and natural disturbance affect carbon stocks in forests. However, integration of these observations into formal decision support will rely upon improved uncertainty accounting. Monte Carlo (MC) simulations offer a practical, empirical method of accounting for potential remote sensing errors as maps are used as inputs in ecosystem carbon assessment. We present a generic approach for coordinating the MC alteration of map values so that specific levels of both pixel-level and map-wide systematic error may be simulated. This approach is based on constructing systems of linear equations and inequalities which incorporate results of map validation exercises. Solution of these systems provides probability functions capable of simulating different levels of error. We illustrate this approach, using error assessments calibrated by the United States (U.S.) national forest inventory data, in an assessment of the effects of wildfire and harvest on carbon storage over 20 years on a forested landscape in the western U.S. This assessment utilized the Forest Carbon Management Framework approach, which is being implemented across the U.S. National Forest System. Results showed that systematic map errors can contribute significant uncertainty in MC analysis, but that impacts of fire and harvest on landscape-level carbon storage can nevertheless be clearly identified and differentiated using remotely sensed maps.

Testing of soil carbon models using repeated inventories. Lange, H., Dalsgaard, L., Borgen, S., Skår, S. (*Norwegian Forest and Landscape Institute, Norway; holger.lange@skogoglandskap.no; lid@skogoglandskap.no; sbo@skogoglandskap.no; ssk@skogoglandskap.no*).

Reliable methods are required to predict changes in soil carbon stocks. Process-based models often require many parameters which are largely unconstrained by observations. This induces uncertainties which are best met by using repeated measurements from the same sites. Here, we compare two carbon models, Yasso07 and Romul, in their ability to reproduce a set of field observations in Norway. The models are different in the level of process representation, structure, initialization requirements and calibration- and parameterization strategy. Field sites represent contrasting tree species, mixture, and soil types. The number of repetitions of C measurements varies from two to six over a period of up to 35 years, and for some of the sites which are part of