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DURHAM, N.H -- A new paper published in the November issue of *Ecological Monographs,* one of the most respected journals in the field of ecology, announces the development of a new mathematical model for understanding why ecosystems are the way they are and predicting how ecosystems respond to changes.

This model, described as a "technological breakthrough" by co-author George Hurtt, assistant professor in the Department of Natural Resources and the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire, will enable scientists to study the potential impacts of land use and climate change across a wide range of scales -- from the scale of individual plants to continental regions.

Initially developed for use in the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), the Ecosystem Demography Model is being applied in the Amazon Basin to help researchers understand and ultimately predict the consequences of land use and tropical deforestation on the carbon cycle and climate system. In future studies, the model will be used to address such issues as the sustainability of land use practices, the carbon balance of the Amazon, and the interactions between ecosystems and the climate of the region.

"We are particularly concerned about potential positive feedback loops," says Hurtt, discussing future applications of the model. "For example, we know that the Sahara Desert is growing, in part, because of deforestation. When you cut down trees too fast, the soil dries out and the temperature in the region increases. This could potentially happen even in the wet rainforest."

Mathematical models are frequently used to determine these types of ecosystem responses to human actions. However, existing models typically examine the system from a relatively large-scale viewpoint, and few models can answer questions about both carbon and climate simultaneously. This new model was developed to address both types of concerns in a single framework.

Paul Moorcroft, assistant professor of evolutionary biology at Harvard University and lead author, explains, "Using techniques similar to those used in statistical physics, we show how it is possible to derive equations that correctly capture the behavior of individual-based ecosystem models at large scales. For example, results from a tropical forest site show how the fine-scale heterogeneity generated by the interactions between individuals within the forest canopy determines the time scale of carbon uptake following the abandonment of agriculture."

Another advantage to the model is that by tracking more detail, it can be more easily tested with a greater variety of data. "The world is really complicated, and we get data from a lot of different sources, including, for example, leaf-level measurements, ground-based inventories, atmospheric measurements, and remote sensing" explains Hurtt. "A central challenge for scientists is to figure out the way in which all this complexity at different scales is simultaneously true. This model is a step in that direction."

For more information, contact Hurtt at 603-862-4185 and Moorcroft at 617-496-6744.

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