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Effects of Multiple Environmental Factors on Forest Carbon: What Can We Learn from Inventories?

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Forest inventories have been conducted for many decades around the world, and constitute the most comprehensive long-term data available on how forests have changed. Is it possible to determine the relative contribution of multiple environmental factors on forest carbon from inventory data, or from inventory data combined with other approaches? Successive sample inventories provide several critical pieces of information: how forests change as a consequence of all factors combined; the specific contribution of human factors such as land-use change and timber harvesting; and how selected natural disturbances such as wildfire or insect epidemics effect forests. By quantifying the effects of these factors, it may be possible to consider that the remaining portion of observed change is the consequence of climate and air pollution combined. Here we review several attempts to use inventory data to separate environmental factors from other factors. In the 1980's in the U.S., there was strong interest in how air pollution affected forest growth. More recently, statistical analysis of U.S. inventory data revealed the relative magnitude of effects from forest land use and environmental factors. A new analysis of historical Russian forest inventory data revealed how climate change and other factors affected forest productivity. Based on experience from these studies, which reveal both opportunities and limitations, we suggest ways to integrate inventory data with process models to achieve a more complete quantification of the relative contribution of human and environmental factors.