Hydrologic variability and forest phenology have large effects on stream biological processes

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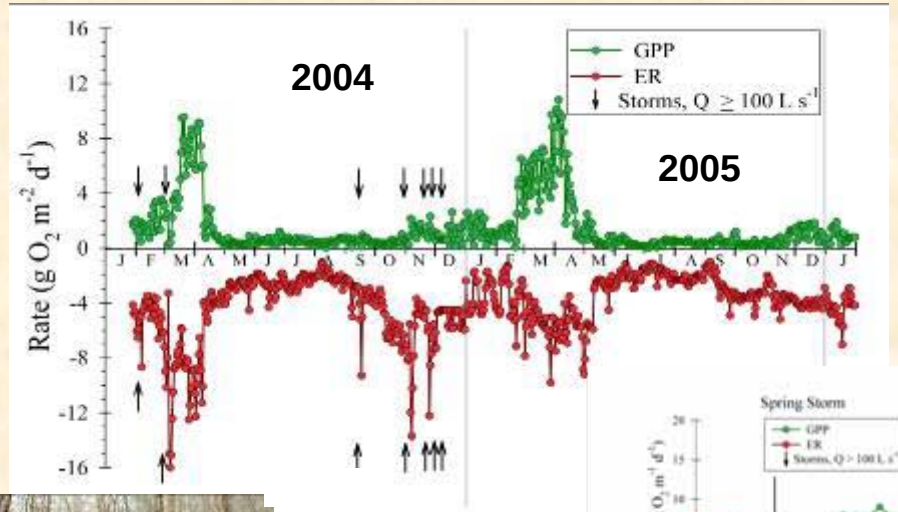
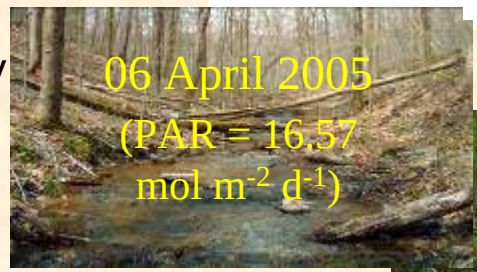
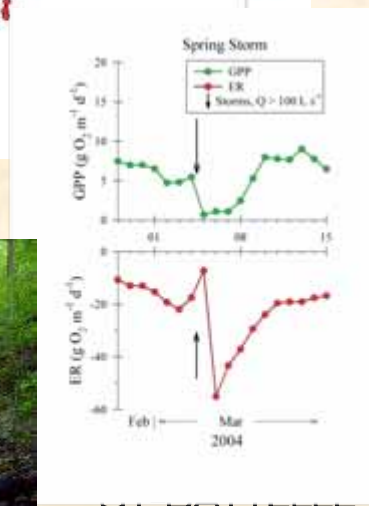
- Rates of gross primary production (GPP) and ecosystem respiration (ER) were measured continuously using the diurnal dissolved oxygen technique and high-frequency dissolved oxygen measurements in Walker Branch, a 1st-order forested stream on DOE's Oak Ridge National Environmental Research Park.

- Rates of GPP and ER varied by over an order of magnitude with early spring and autumn peaks, and short-term depression of GPP and stimulation of ER by large storms.

- These results suggest that increased hydrologic variability and changes in forest phenology as predicted by models of future climatic change may have large effects on the metabolism of stream ecosystems.







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Investigations of stream ecosystem metabolism in Walker Branch Watershed on the Department of Energy's Oak Ridge National Environmental Research Park show that hydrologic variability and seasonal changes in the canopy of the adjacent forest have large effects on biological processes in streams. By measuring metabolism of the entire stream continuously over a 2-year period using high-frequency measurements of dissolved oxygen, researchers were able to identify several important temporal scales of variation resulting in changes in metabolism rates of more than an order of magnitude. These included seasonal peaks in stream primary production and total respiration resulting from high light levels in early spring prior to leaf emergence and input of leaves in autumn. They also included short-term (days to weeks) and long-term (annual) variations in metabolism caused by the frequency and size of storms which scour out biota but deliver fresh organic matter to stream ecosystems. These results offer one of the most detailed examinations of temporal variations in stream processes and the effect of hydrological variations to date. These findings are important because models of future climatic change predict changes in forest phenology and considerably more hydrologic variability as precipitation patterns become more extreme.

Roberts, B. J., P. J. Mulholland, and W. R. Hill. 2007. Multiple scales of temporal variability in ecosystem metabolism rates: results from 2 years of continuous monitoring in a forested headwater stream. *Ecosystems* (DOI: 10.1007/s10021-007-9059-2).