Changes in nitrate export upon clear felling: a paired catchment study

This study uses time series analysis to examine long term streamwater nitrate concentration record from a pair of catchments at the Coweeta Hydrologic Laboratory, North Caroline, USA. Monthly mean concentrations were available from 1970 through 1997 for two forested catchments, one of which was clear-felled in 1977 and the other maintained as a control. The time series were decomposed into their trend and annual cycle before modelling as an autoregressive (AR) process. AR models were calculated for both an expanding and an moving window so that pre-felling could be directly compared with the effects of tree clearance. In comparison with flow records for both of the catchments transfer function-noise models were calculated on a moving window basis and the impulse functions derived.

Analysis shows that:

- both catchments show an annual memory effect, but that the clear-felled catchment shows, in addition, a six month memory effect;
- the annual effect in the control catchment responds to drought conditions while in the felled catchment it reflects the change in vegetation;
- the sixth month effect in the felled catchment responds to drought conditions independent of the annual effect and of logging operations;
- the control catchment shows no significant impulse function with respect to flow while for the felled catchment a distinct impulse develops overtime subsequent to logging, but also responds to drought conditions.

Time series analysis represent a useful technique to understand the integrasted response of catchments to both natural and anthropogenic changes.