

Home

Online Library HESS

- Recent Final Revised Papers
- [Volumes and Issues](#)
- Special Issues
- Library Search
- Title and Author Search

Online Library HESSD

Alerts & RSS Feeds

General Information

Submission

Review

Production

Subscription

Comment on a Paper

Impact
Factor
2.270

ISI
indexed



[Volumes and Issues](#) [Contents of Issue 4](#) [Special Issue](#)

Hydrol. Earth Syst. Sci., 8, 764-777, 2004
www.hydrol-earth-syst-sci.net/8/764/2004/

© Author(s) 2004. This work is licensed
under a Creative Commons License.

Water quality improvements from afforestation in an agricultural catchment in Denmark illustrated with the INCA model

A. Bastrup-Birk and P. Gundersen

Danish Centre of Forest, Landscape and Planning, University of Veterinary and Agricultural Sciences, Hørsholm Kongevej 11, DK-2970 Hørsholm, Denmark
E-mail for corresponding author: ab@kvl.dk

Abstract. Intensive agricultural land use across Europe has altered nitrogen (N) budget of catchments substantially, causing widespread N pollution of freshwater. Although the N cycle in forests has changed due to increased N deposition, most forest soil waters in Europe have low nitrate concentrations. The protective function of forests on water quality has led to increasing interest in the planting of new forests on arable land as a measure to protect valuable or sensitive freshwater resources. The paper illustrates the effects of afforestation on water and N cycling using the Integrated Nitrogen Catchment (INCA) model. The model was calibrated on the Horndrup catchment in the eastern part of Jutland, Denmark, which is dominated by agricultural land use but also covered by 18% of forest land. The dynamics of nitrate concentrations in the stream water were simulated successfully by INCA over a three-year period. The simulation of the dynamics of nitrate concentrations in the soil water is closely linked to the simulation of the hydrological dynamics and especially to the rainfall. The best fit was achieved for both arable and forest land during the wettest year of the study period. The model was then used to simulate the effect of afforestation of a catchment dominated by agriculture on N fluxes with seepage and runoff. Scenarios of whole catchment conversion to forest were run, based on observations of evapotranspiration and N deposition from other Danish sites. The simulated conversion to mature forest reduced runoff by 30–45% and reduced the nitrate concentrations in the soil water by 50–70%. The simulated effect of afforestation on N leaching was an almost direct reflection of the change in the N input: substantial changes in the plant demand and soil N dynamics over the afforestation period were not simulated. To simulate the N dynamics over longer time-scales, appropriate for the study of afforestation, it is suggested that the INCA model be run with transient scenarios and linked to more detailed plant and soil models.

Keywords: afforestation, arable land, forest hydrology, INCA, modelling, nitrogen, nitrate leaching

[Final Revised Paper](#) (PDF, 1092 KB)

Citation: Bastrup-Birk, A. and Gundersen, P.: Water quality improvements from afforestation in an agricultural catchment in Denmark illustrated with



Search HESS

Library Search

Author Search

News

- New Service Charges
- Financial Support for Authors
- ISI Impact Factor: 2.270

Recent Papers

01 | HESS, 06 Mar 2009:
Uncertainty analysis of hydrological ensemble forecasts in a distributed model utilising short-range rainfall prediction

02 | HESSD, 06 Mar 2009:
EAGLE 2006 – multi-purpose, multi-angle and multi-sensor in-situ, airborne and space borne campaigns over grassland and forest

03 | HESSD, 06 Mar 2009:
Evaluation of a probabilistic hydrometeorological forecast system

the INCA model, Hydrol. Earth Syst. Sci., 8, 764-777,
2004. [Bibtex](#) [EndNote](#) [Reference Manager](#)