Using SWAT to support the Habitats Directive - a case study from the east of England

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Overview

• The Thurne catchment
• Habitats Directive
• The Review of Consents procedure
• SWAT modelling
  • Initial attempts
  • Current simulation
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The EC Habitats Directive (Directive 92/43/EEC) aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and species at a favourable conservation status.

189 habitats and 788 species listed in the Directive are protected by a network of protected sites (SAC’s).
Habitats Directive

• Upper Thurne includes part of the Broads SAC
• Primary designation as “Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.”
• Hickling Broad which is the richest Chara spp. site in the UK
• Hickling Broad is currently in “unfavourable declining” status
• A tiered procedure for assessing whether discharges (and abstractions) have an impact on designated sites
  • **Stage 1** - identification of permissions that are relevant to the site
  • **Stage 2** - assesses which permissions, either alone or in combination are likely to have significant effect on the European site
  • **Stage 3** - “Appropriate Assessment” to assess whether permissions can be concluded not to have an adverse effect
  • **Stage 4** - permissions are affirmed, or modified or revoked, subject to appeal
Challenges to SWAT modelling the fluxes in the catchment:

- The relief is subdued with a height range of about 23 m
- The water level in Hickling Broad is on average only +0.4 m above sea level, yet the eventual outlet to the sea is over 20 km away;
- Shrinkage of the alluvium has left the river flowing above the marshes;
- All of the marshes are artificially pumped drained;
- Water levels are between -1 and -3 m below sea level
- Most of the river flow is due to land drainage pump discharges and tidal movements.
Initial model build

SWAT model successfully calibrated and validated in neighbouring ‘normal’ catchments
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Pumps represented as Reservoirs with monthly target release rates.
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Initial results

Catchment delineation

- Initial catchment delineation (50 m grid)
Catchment delineation

• Initial catchment delineation (5 m grid)
Catchment delineation

- Final catchment delineation (5 m grid)
Pump operation

- Calibration of pump discharges is hampered by poor data quality

![Graph showing average daily discharge in m3/s from April 2004 to March 2006. The graph includes the following data points:
- Daily data
- Simulated
- 7 per. Mov. Avg. (Daily data)
- 7 per. Mov. Avg. (Simulated)
Conclusions

- The Thurne catchment is heavily modified
- Early results suggest that SWAT appears to be able to represent dominant processes:
  - Pump discharges
  - Lake P concentrations
- Ongoing work is trying to increase realism of the model set-up
- Scenarios of point source P control vs diffuse source control