

# **Benchmarking models for the Water Framework Directive: evaluation of SWAT for use in the Ythan catchment, UK.**

**Caroline F. Dilks, Sarah M. Dunn,  
Robert C. Ferrier.**

*SWAT Conference: Bari, Italy, 2 - 4 July 2003.*



***Craigiebuckler, Aberdeen, AB15 8QH, UK***

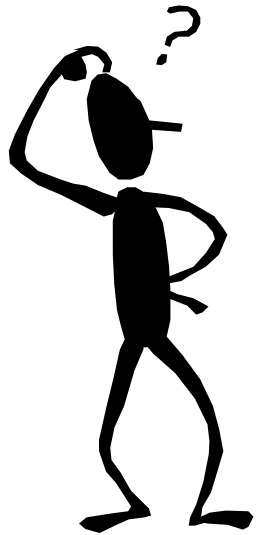
# Context



## WFD

Mandates the development of river basin management plans.

## MATHEMATICAL MODELS



- Provide a practical technique for examination of non-point source pollutant transport at the river basin scale.
- Numerous mathematical models have been developed. These exhibit a wide range of complexity.
- Each model possesses a unique set of characteristics.

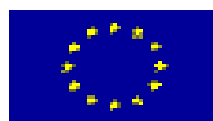


# Benchmark Models for the Water Framework Directive (BMW)

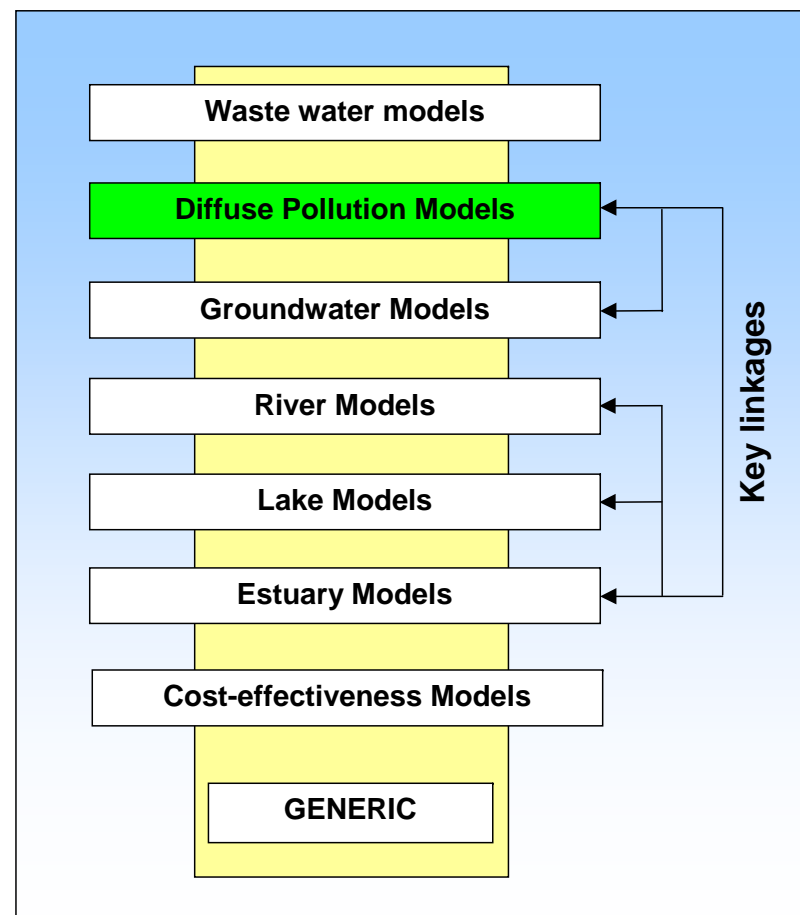


## OBJECTIVE

Establishment of a set of benchmark criteria to assess the appropriateness of models for use in the implementation of the WFD, specifically development of river basin management plans.



<http://www.vyh.fi/eng/research/euproj/bmw/homepage.htm>

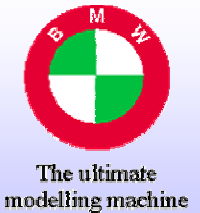


Project structure - Model Domains.



SWAT Conference: 2 - 4 July 2003

# Application of the Benchmark criteria



**SWAT is evaluated to determine suitability for use in the Ythan catchment, UK.**

## **Specifically for:**

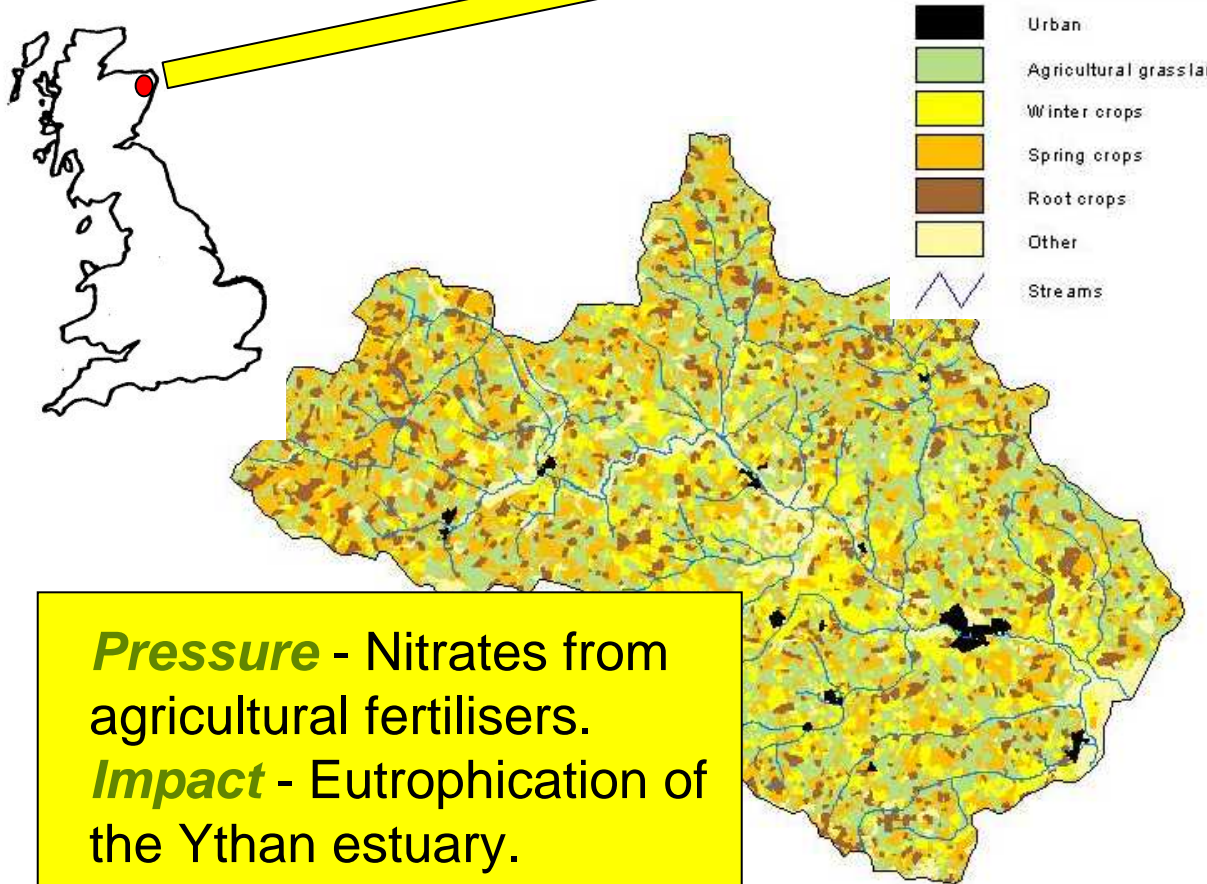
- Identifying and quantifying nutrient source areas.
- Investigating nutrient delivery from land to water.
- Assessing potential management scenarios.



*SWAT Conference: 2 - 4 July 2003*



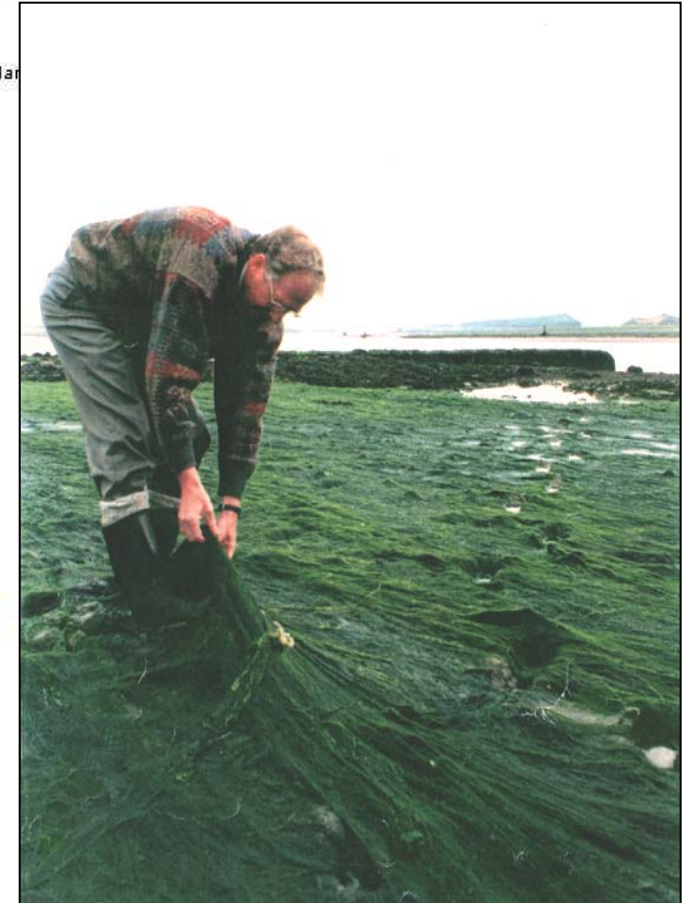
# The Ythan catchment



**Pressure** - Nitrates from agricultural fertilisers.

**Impact** - Eutrophication of the Ythan estuary.

**Designation** - NVZ 2000.



Eutrophication of the estuary.

# Benchmark criteria



The ultimate  
modelling machine

- **Generic** - applicable to all models.
- **Domain specific** - applicable to individual modelling domains.

## DIFFUSE POLLUTION CRITERIA

- Suitability for use.
- Data availability.
- Modelling objective / WFD.
- Spatial and temporal scale.
- Transportation and transformation processes.
- Processing and output.
- Integration.



SWAT Conference: 2 - 4 July 2003

# Benchmark criteria: an example

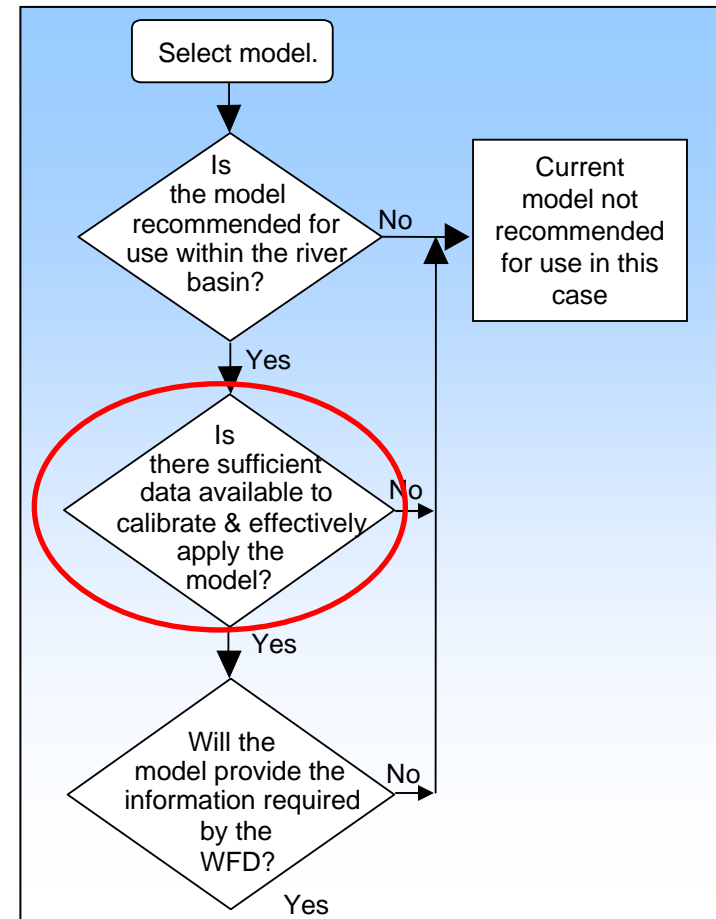


The ultimate  
modelling machine

## Data requirement versus data availability

Good	Sufficient field data available to calibrate, validate and apply model.
OK	Good balance between data requirement and availability. Where necessary data can be derived or taken from literature to supplement field data. Any assumptions made must be robust.
Not recommended	Insufficient data to reliably run the model.

Example of a benchmark question.



Hierarchy of benchmark  
criteria.



SWAT Conference: 2 - 4 July 2003



# Evaluation of SWAT (I)



**SWAT achieved a 'good' classification for 70% of the benchmark questions.**

- Operates at an appropriate spatial extent.
- Considered to capture the nature of the Ythan region.
- Good balance between data requirement and availability.
- Includes inputs for main nutrient sources.
- Adequate spatial resolution.
- Appropriate temporal scale / resolution.



*SWAT Conference: 2 - 4 July 2003*





# Evaluation of SWAT (II)



- Simulates key bio-geo-chemical processes and interactions.
- Simulates main transport pathways.
- Comprehensive and stand alone.
- Suitable tool for evaluation of management scenarios.

## DRAWBACK

- Suitability of MUSLE / USLE for use in Scotland has been queried (Lilly *et al.*, 2002).
- Failure to deal with soils with higher (>4%) organic matter contents.



SWAT Conference: 2 - 4 July 2003



# Conclusion



**SWAT performed successfully when evaluated against the diffuse pollution benchmark criteria and is therefore believed suitable for use in the Ythan catchment.**



*SWAT Conference: 2 - 4 July 2003*



**Thank you**

BMW homepage:

<http://www.vyh.fi/eng/research/euproj/bmw/homepage.htm>

