



Hampshire Avon
Demonstration Test Catchment

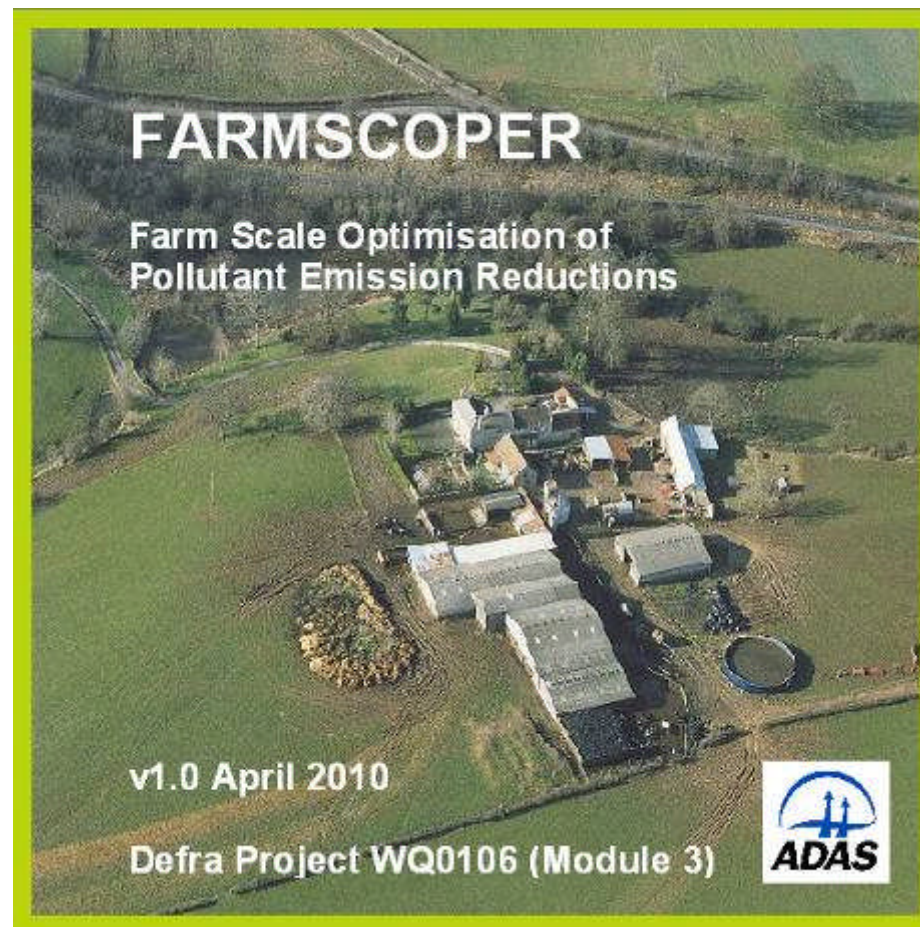
Application of FARMSCOPER to optimise options for mitigating agricultural diffuse pollution across the Hampshire Avon DTC

Yusheng Zhang, Adrian Collins and Richard Gooday



A novel application of FARMSCOPER

- **Farm scale tool**
- **But recently applied at catchment scale for the Hants Avon DTC**
- **To support engagement with stakeholders and mitigation planning**



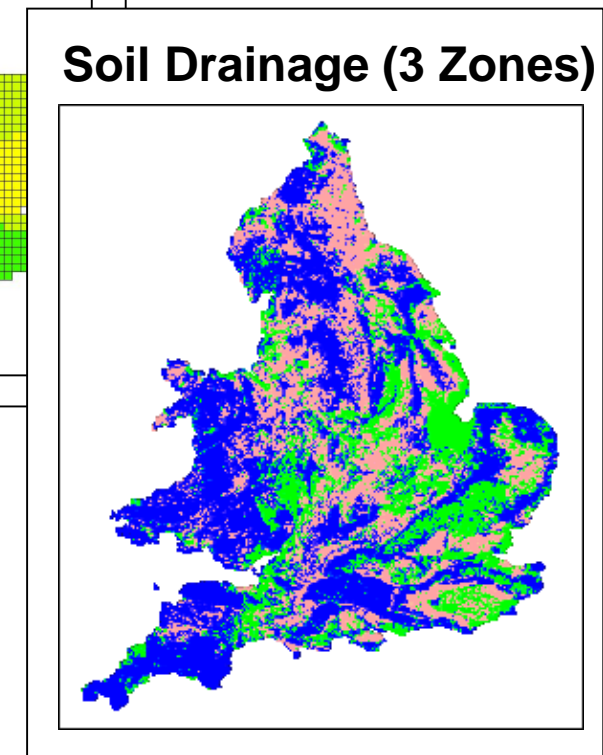
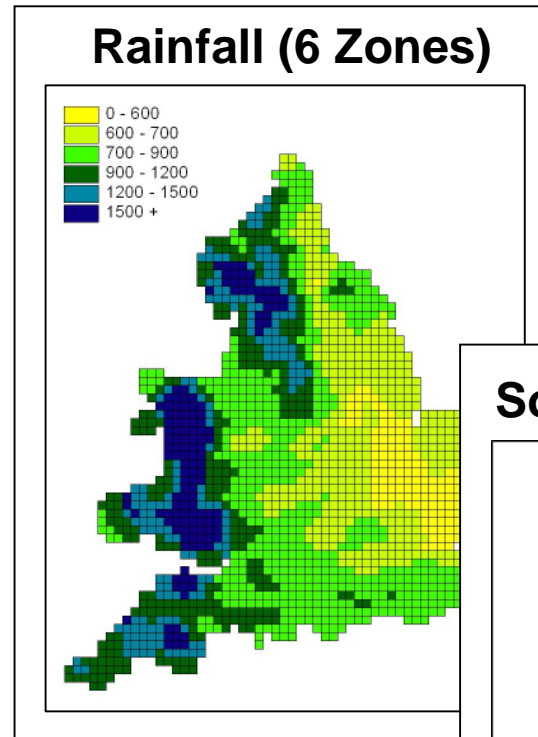
FARMSCOOPER: main features

- **Excel based decision support tool**
- **Calculates air and water pollutant losses for a farm type in England and Wales**
- **Predictions are based on ADAS developed models (PSYCHIC, NEAP-N, and NARSES) and IPCC methodology**
- **Assesses costs and impacts of mitigation**
- **Optimises selection of mitigation methods**
- **Accounts for uncertainty in pollutant losses and impacts of mitigation methods**

FARMSCOPER: farm type and environment

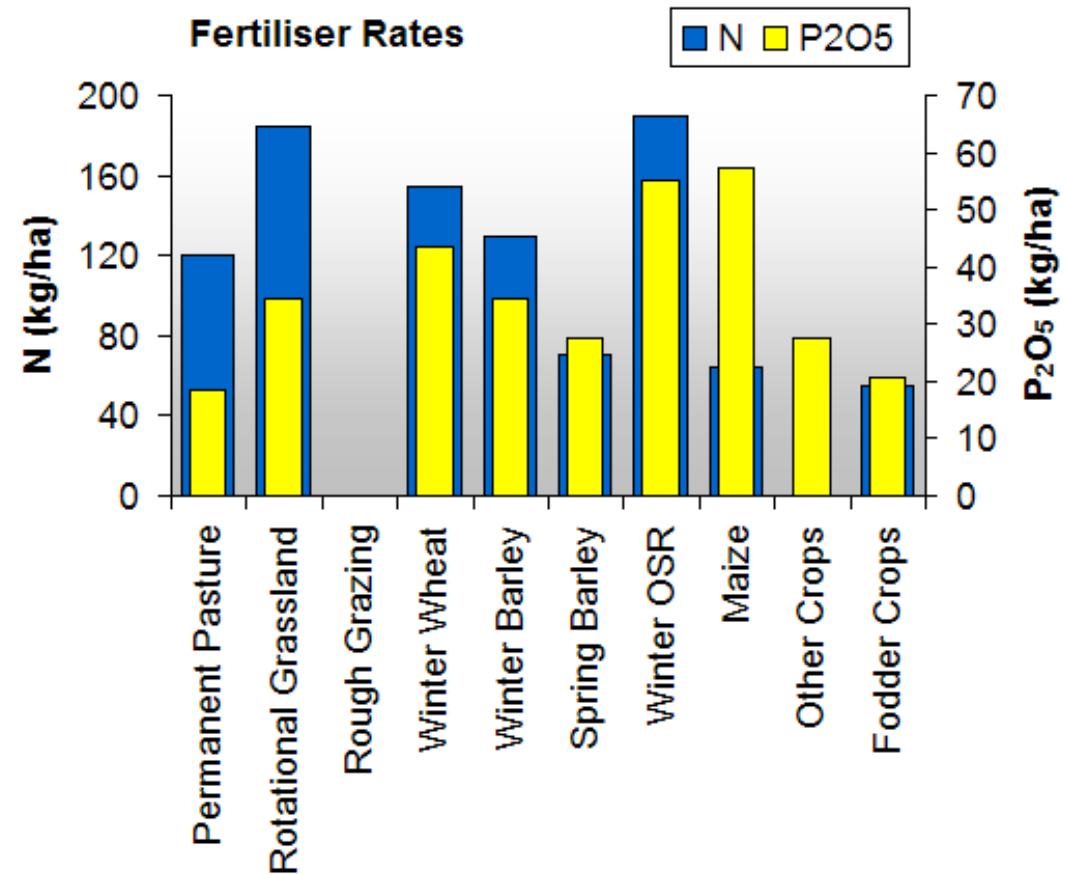
Farm Systems

- Dairy
- LFA Grazing
- Lowland Grazing
- Mixed
- Indoor Pig
- Outdoor Pig
- Poultry
- Winter Combinable
- Mixed Combinable
- Roots & Combinable
- Horticulture



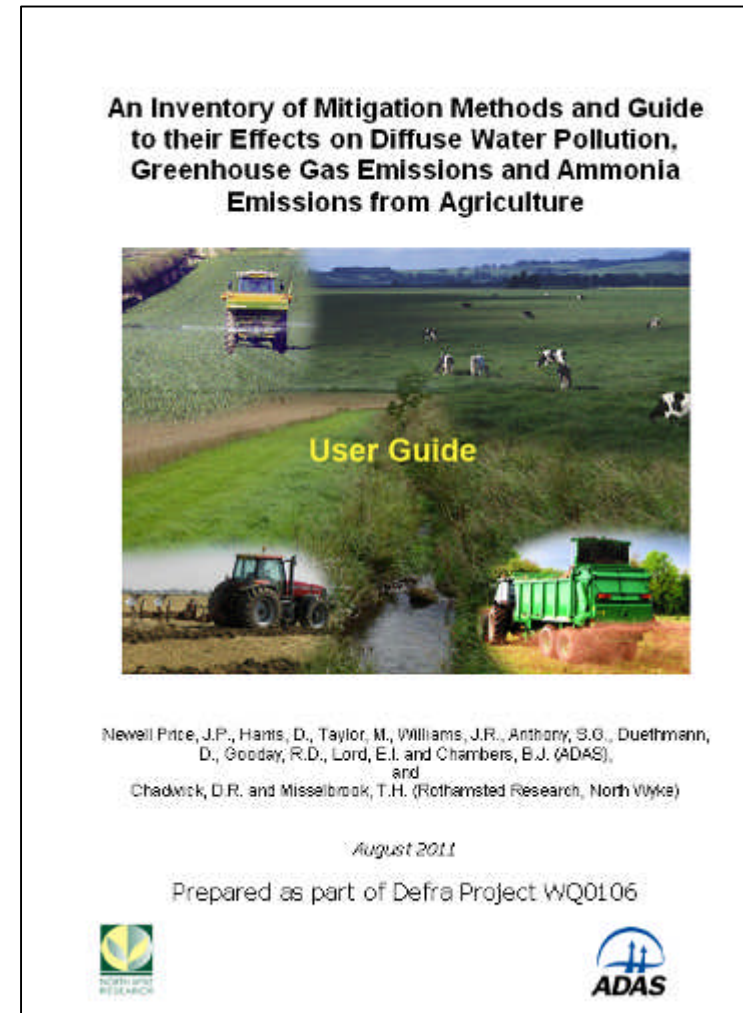
FARMSCOPER: farm definition

- Land use
- Crop specific fertiliser type, rate and timing
- Animal specific manure type, application rate and timing



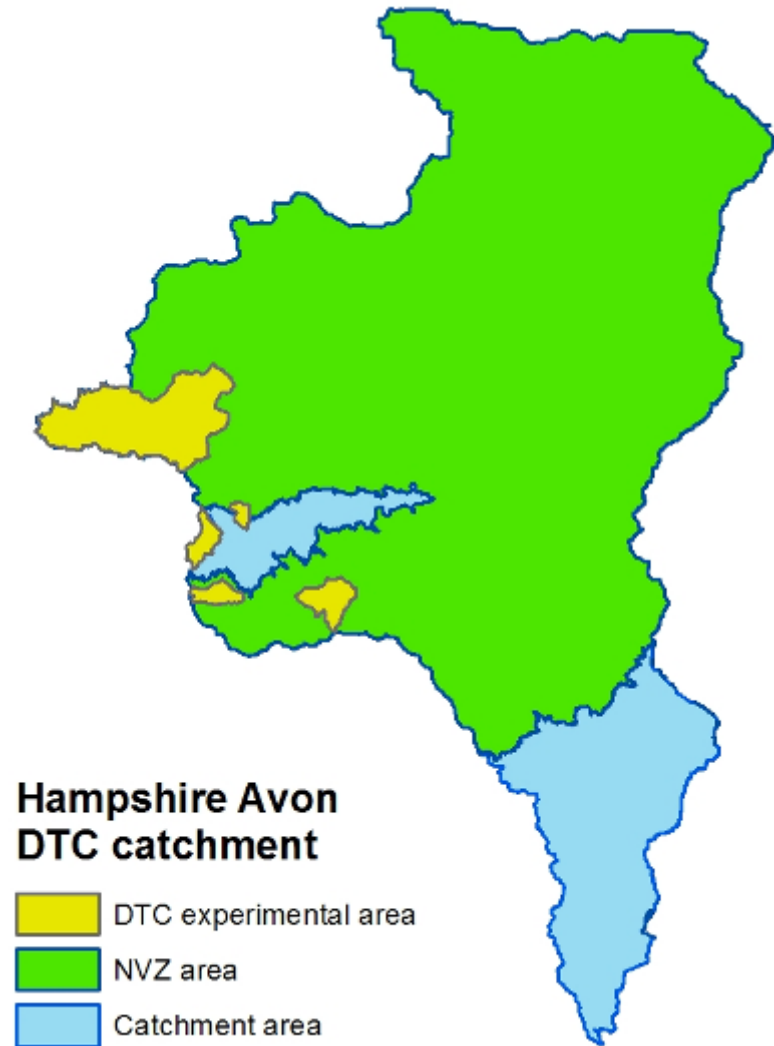
FARMSCOPER: optimisation of mitigation method selection

- 75 methods from new User Guide
- Method centric approach
- Effect and cost
- Method interaction
- Single and multiple pollutants



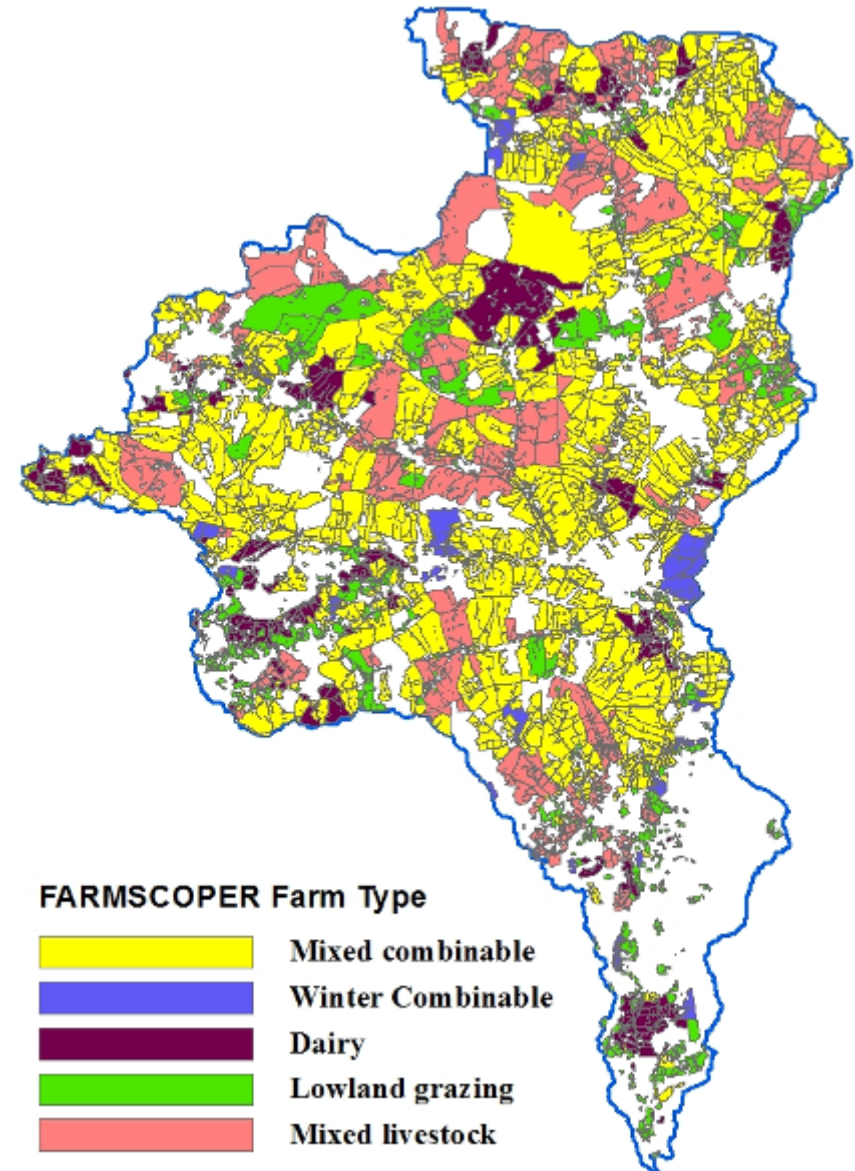
Scenarios for Hampshire Avon DTC

- 1. No mitigation**
- 2. Prior mitigation**
Estimate of current uptake of all methods listed in User Guide
- 3. Full implementation**
Complete uptake of all mitigation methods listed in User Guide



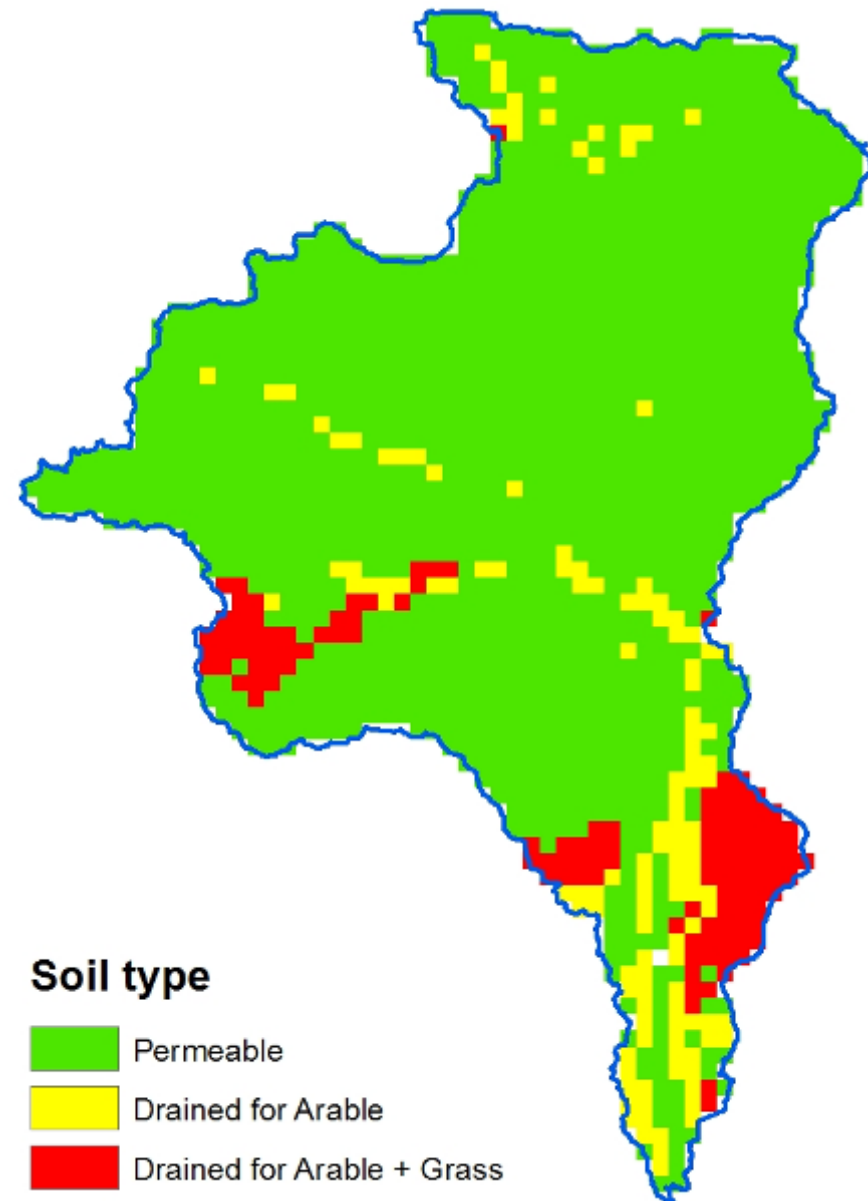
Parameterisation of catchment farms

- Land use from **FARMSCOOPER**
- Spatial distribution of farm types
 - Rural Land Registry
 - June Agricultural Survey



Parameterisation of catchment farms

- Farms mapped by location
- Animal numbers
 - June Agricultural Survey
 - Adjusted to match catchment totals
- Fertiliser rates
 - BSFP 2009 by farm type



Major combinations

FARMSOPER Farm type	Soil type	Rainfall band	%
Mixed Combinable	Permeable	<900	42
Mixed Livestock	Permeable	<900	15
Mixed Combinable	Permeable	>900	12
Lowland Grazing	Permeable	<900	9
Dairy	Permeable	<900	5
Mixed Livestock	Permeable	>900	3
Winter Combinable	Drained for arable	<900	2

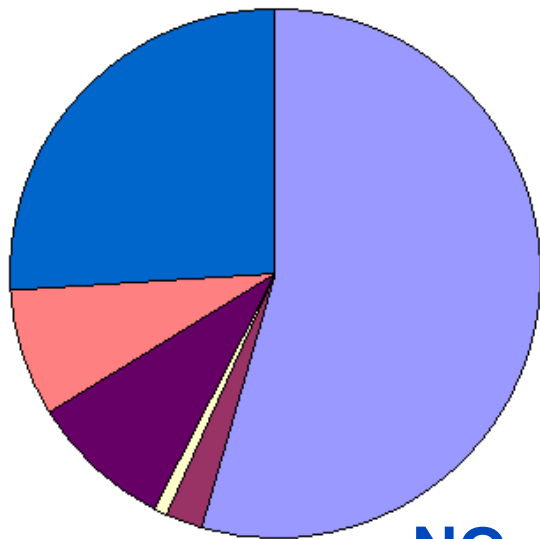
Baseline pollutant loadings (kg ha⁻¹)

Robust Farm type	NO ₃ -N	P	SS	NH ₃	CH ₄	N ₂ O
Cereals	38	0.2	159	7	0	7
General Cropping	37	0.1	117	7	0	7
Horticulture	34	0.3	147	5	0	4
Pigs	42	0.2	112	6	5	7
Dairy	40	0.5	104	36	173	10
Lowland Grazing	24	0.4	80	15	98	7
Mixed	51	0.4	95	43	90	10

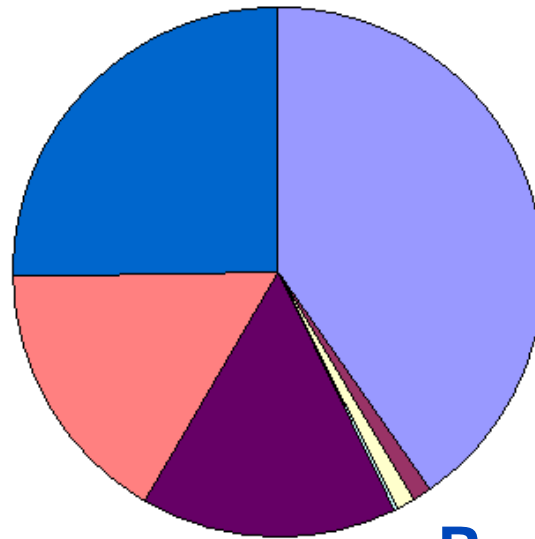
NEAP-N; PSYCHIC; MANNER; SWAT; NARSES; IPCC

Lord and Anthony, 1999; Davison et al., 2008; Gooday et al., 2008; Chambers et al., 2000; Brown and Hollis, 1996; Webb and Misselbrook, 2004; Baggott et al., 2006

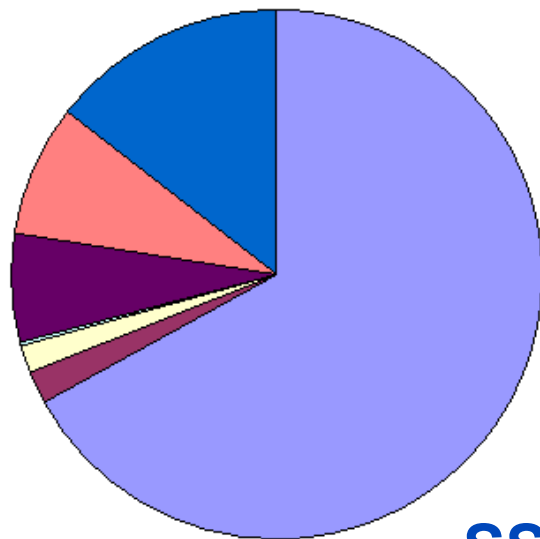
Relative baseline pollutant loadings



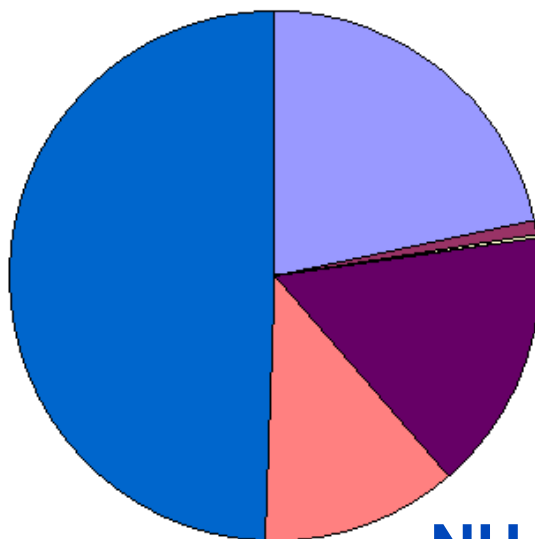
$\text{NO}_3\text{-N}$



P



SS

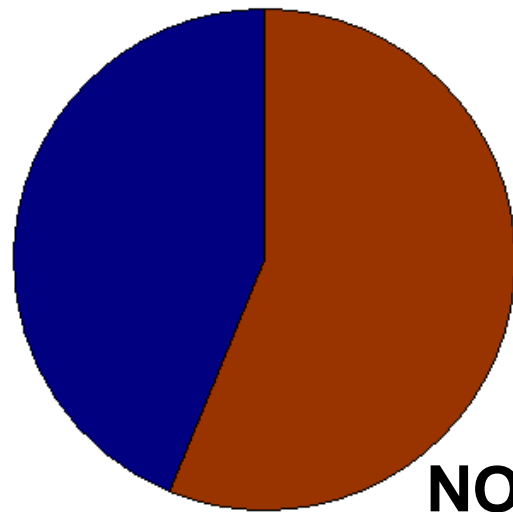


NH_3

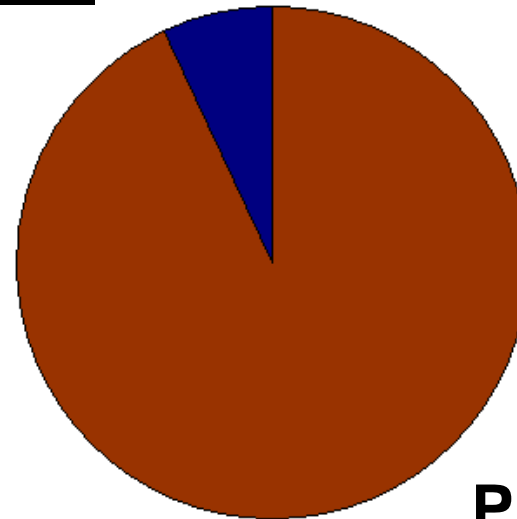
- Cereals
- General Cropping
- Horticulture
- pigs
- Dairy
- Lowland Grazing
- Mixed

Source apportionment of pollutant loss

Cereal Farm

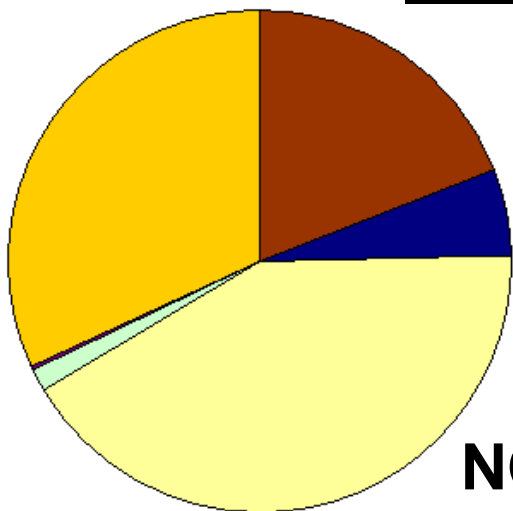


$\text{NO}_3\text{-N}$

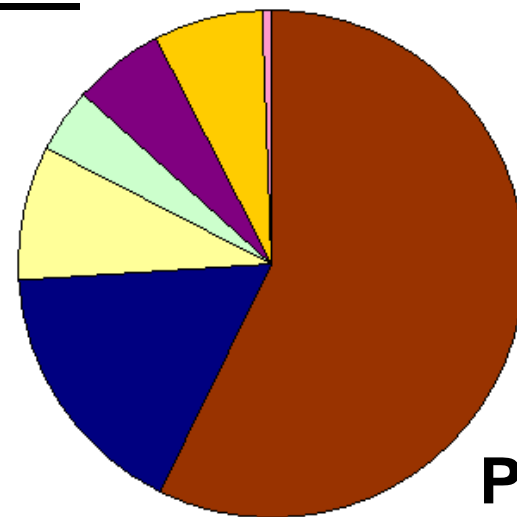


P

Mixed Farm



$\text{NO}_3\text{-N}$



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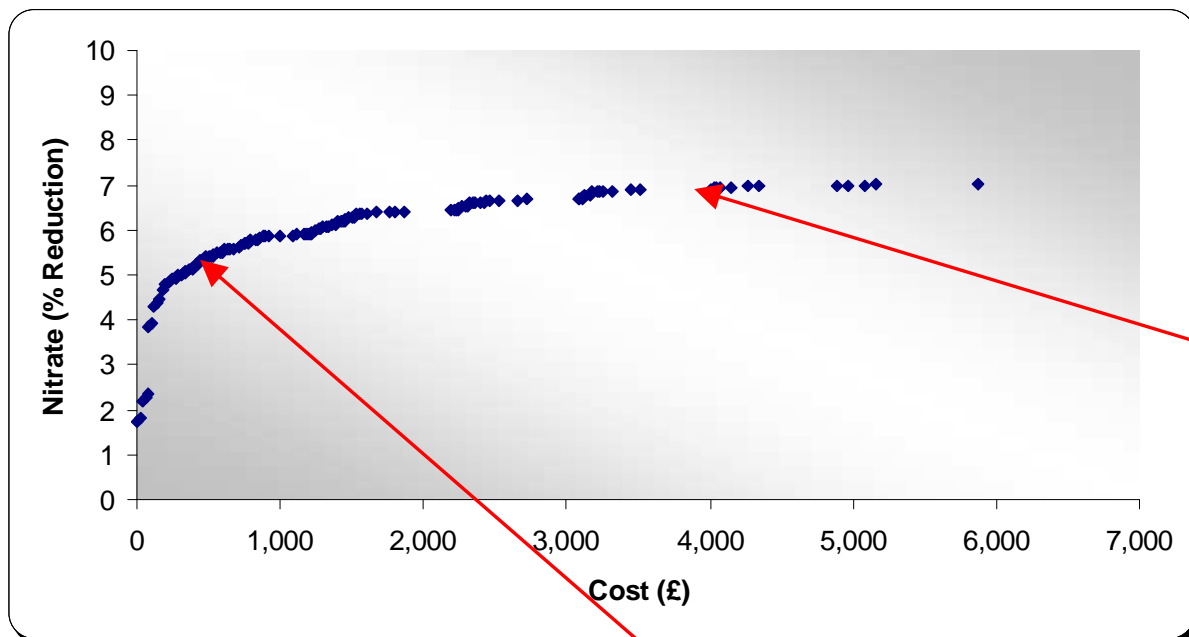
- Soils_&_Residues
- Fertiliser
- FYM
- Slurry
- Litter
- Voided
- Enteric
- Dirty_Water

Catchment wide pollutant loadings (kg ha⁻¹)

Scenario	NO ₃ -N	P	SS	NH ₃	CH ₄	N ₂ O
Baseline						
estimated	30.0	0.21	103	13.4	34.3	6.1
Observed range	10 – 56	0.15-1.4	14 - 125			
Prior						
implementation	28.9	0.19	93	12.5	33.1	5.7
All methods						
selected	22.5	0.1	32	8.7	32.2	4.8

(Cooper et al. 2008; Jarvie HP et al., 2005)

Cost Curves: single & multiple pollutants

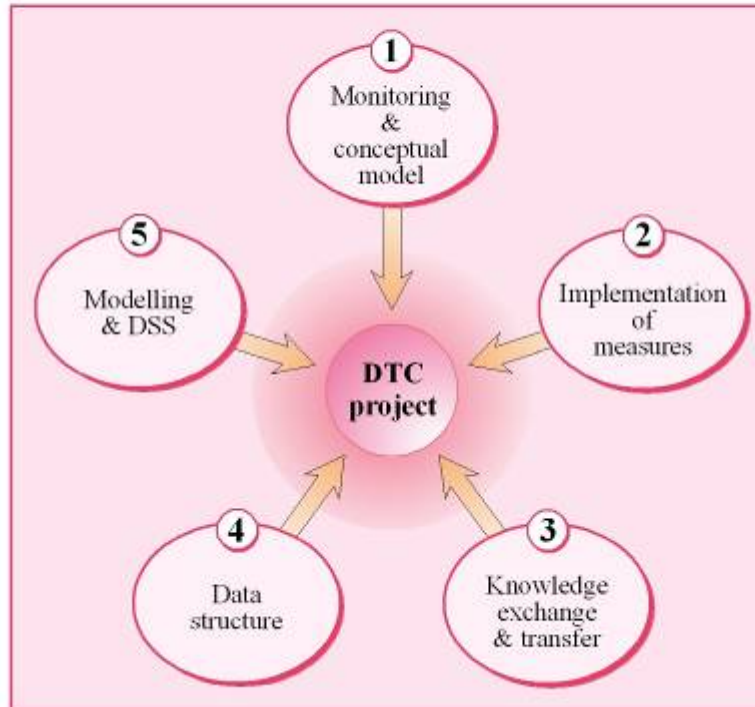


• **Over 20
Methods**

- **Establish cover crops in the autumn**
- **Use a fertiliser recommendation system**
- **Integrate fertiliser and manure nutrient supply**
- **Store solid manure heaps away from watercourses/drains**
- **Do not spread FYM to fields at high-risk times**

Discussion

- **FARMSCOOPER has been applied across the Hampshire Avon to:**
 - **Estimate catchment wide pollutant losses**
 - **Assess impacts of mitigation methods**
 - **Optimise selection of mitigation methods**
- **Results will be used to stimulate discussion at DTC knowledge exchange activities**
- **Useful to have more information on existing mitigation, land drainage condition etc**



Partners

Flood Management
HR Wallingford

Freshwater Ecology
QMUL
Game & Wildlife
Conservation Trust
CEH

Hydrology & Hydrogeology
University of Bristol
Entec
Wessex Water
BGS

Climate Change Adaptation
ADAS
North Wyke Research

Water Quality
ADAS
CEH
North Wyke Research
University of Kingston
University of Reading
QMUL
University of Plymouth
University of Aberystwyth

Agricultural Science
University of Exeter
ADAS
North Wyke Research

Social Science
Brook Lynhurst

Soil Science
ADAS
North Wyke Research
University of Reading

Economics
ADAS

Modelling and DSS
ADAS
North Wyke Research
Entec
University of Bristol
University of Reading

International
NERI, Denmark



**An updated version of
FARMSCOPER will soon be
available for download.**

For more info visit:

<http://www.avondtc.org.uk/Mitigation.aspx>

**There will be a software
demonstration during a poster
session**