31. FARMSCOPER

FAIRWAY partner: Fiona Nicholson (ADAS, UK)

Brief description	
FARMSCOPER (FARM Scale Optimisation of Pollutant Emission Reduction) can be used to assess diffuse agricultural pollutant loads on a farm and quantify the impacts of farm mitigation methods on these pollutants. The farm systems within the tool can be customised to reflect management and environmental conditions representative of farming across England and Wales. The tool contains over 100 mitigation methods, including many of those in the latest Defra Mitigation Method User Guide.	
Contaminants covered (e.g. nitrate, pesticides etc.)	Nitrate, phosphorus, sediment, FIOs, pesticides.
Intended end users (e.g. farmer, water quality manager, policy maker)	Advisors; catchment managers, policy makers.
Level of expertise and/or training required	Good understanding of farm systems and mitigation methods needed. Moderate level of training required to use the software.
Geographical resolution (e.g. field, catchment, national)	Farm scale. Outputs can be scaled up to catchment, regional or national level.
Temporal resolution (e.g. daily, annual, long-term).	Annual
Real-time component (e.g. live weather data, soil moisture data feeds etc.)	None
Number and type of mitigation measures included	Contains over 100 mitigation methods which can be applied to different farming systems and environments.
Platform (e.g. paper-based tool, phone app, bespoke software).	Bespoke software with an interface consisting of 5 Excel workbooks linked to an Access database (mdb). Software (in English only) can be downloaded from the following website: http://www.adas.uk/Service/farmscoper
Frequency of updates	Catchment scale data updated in 2015. Most recent version released July 2017 (FARMSCOPER v4)
Cost/availability	Free to download
Number of users or number of copies distributed/ downloaded/purchased	Used by UK policy makers including Defra, Environment Agency and Natural England
Links to demo material and other relevant information (e.g. user guides).	FAQs and tutorials on various aspects of FARMSCOPER are available on the DST website: https://www.adas.uk/Service/farmscoper A presentation (in English) on FARMSCOPER can be found here: https://www.forestresearch.gov.uk/documents/7287/Farmscoper_PESFORW.pdf Information (in English) about FARMSCOPER use in the Wensum in Demonstration Test Catchment is available here: http://www.wensumalliance.org.uk/factsheets.html Information (in English) about FARMSCOPER use in the Avon in Demonstration Test Catchment is available here: http://www.avondtc.org.uk/Mitigation.aspx
Additional comments	The mitigation methods detailed in the Defra Mitigation Methods User Guide are included within FARMSCOPER

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Input data required to run the DST	Information needed to build a 'model farm' includes rainfall zone, soil type, drainage status, farm type, livestock numbers, cropping, manure management, details of field operations. User selects from a list of pollutants of interest and mitigation methods to be tested.
Outputs (including links to water quality and economic or financial aspects)	Graphs and reports produced which specify the relative importance of each pollutants and reductions achieved for each mitigation method. Pollutant losses shown as kg or t lost from the whole farm or apportioned by land use. A Cost workbook determines the cost effectiveness of the different methods and the total costs of method implementation.
Age/provenance of supporting data used to develop the DST	Phosphorus (P) and nitrate losses based on existing models (PSYCHIC for P and NEAP-N for nitrate)
Country-specific calibration or data requirements (including restrictions on use)	Contains default data on climate, farm type, crop and livestock types etc. that are applicable/relevant to England and Wales. Could be modified for other countries or regions. Baseline levels of pollutant losses can be replaced with measured data. The default library of mitigation methods can be edited and expanded. Economic information is reported in pounds sterling (£).
Details of validation and testing	FARMSCOPER has been used in two Demonstration Test Catchments and has been demonstrated and used by farm advisors in workshop settings.
Date developed/released (or planned release date)	FARMSCOPER was originally developed under Defra project WQ0106 (2006-10). It was expanded under Defra Project SCF0104 to include additional pollutants and two new workbooks – one providing greater detail on the costs of mitigation method implementation, the other allowing the tool to be applied at catchment to national scale. Under Environment Agency funding, the catchment scale data has been updated to 2015, with data now included for a range of smaller spatial scales. New documentation on applying FARMSCOPER at smaller spatial scales is included in the installation package.
Author/developer names and affiliations	R. Gooday, S. Anthony, P. Newell-Price, D. Harris, D. Duethmann. (ADAS, UK); R. Fish, M. Winter (University of Exeter, UK) A. Collins, (University of Southampton, UK) D. Chadwick (Bangor University, UK)
Member state(s) where developed	UK
Member State(s) where currently used	UK
Key publication references (including url)	R. Gooday, S. Anthony, D. Chadwick, P. Newell-Price, D. Harris, D. Duethmann, R. Fish, A. Collins & M. Winter (2014). Modelling the cost-effectiveness of mitigation methods for multiple pollutants at farm scale. *Sci. Total Environ*, 468-469, 1198-1209. https://www.sciencedirect.com/science/article/pii/S0048969713005123 Y. Zhang, A.L. Collins, R.D. & Gooday (2012). Application of the FARMSCOPER tool for assessing agricultural diffuse pollution mitigation methods across the Hampshire Avon Demonstration Test Catchment, UK. *Environ. Sci. Policy*, 24, 120-131. https://www.sciencedirect.com/science/article/abs/pii/S1462901112001360 R. Gooday, S. Anthony, C. Durrant, D. Harris, D. Lee, P. Metcalfe, P. Newell-Price & A. Turner (2015). *Developing the Farmscoper Decision support tool*. Final Report for Defra Project SCF0104. http://randd.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=18702 Collins AL, Newell Price JP, Zhang Y, Gooday R, Naden PS, Skirvin D. Assessing the potential impacts of a revised set of on-farm nutrient and sediment 'basic' control measures for reducing agricultural diffuse pollution across England. *Sci Total Environ*. 2018;621:1499-1511. https://www.sciencedirect.com/science/article/pii/S004896971732781X

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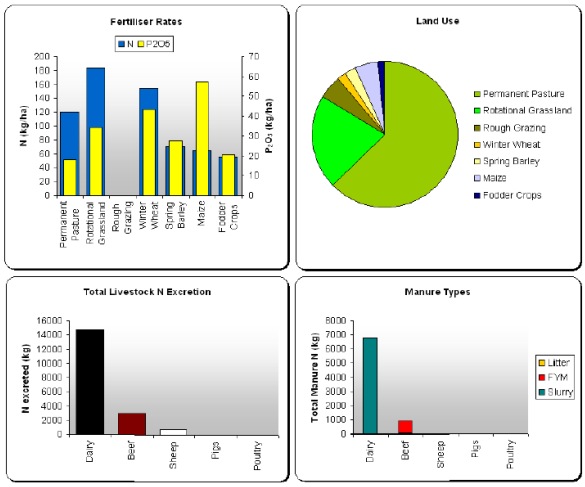
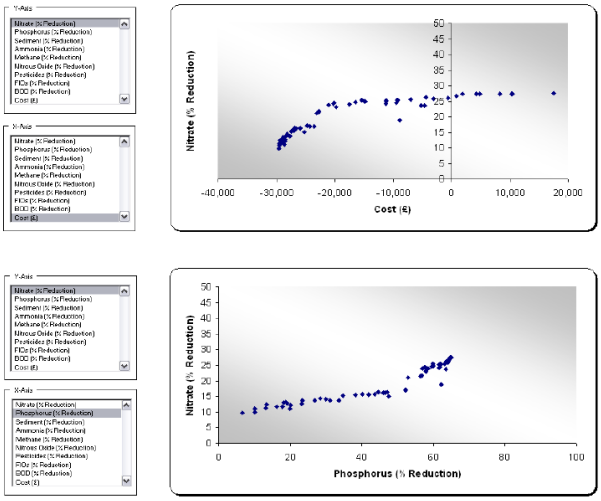
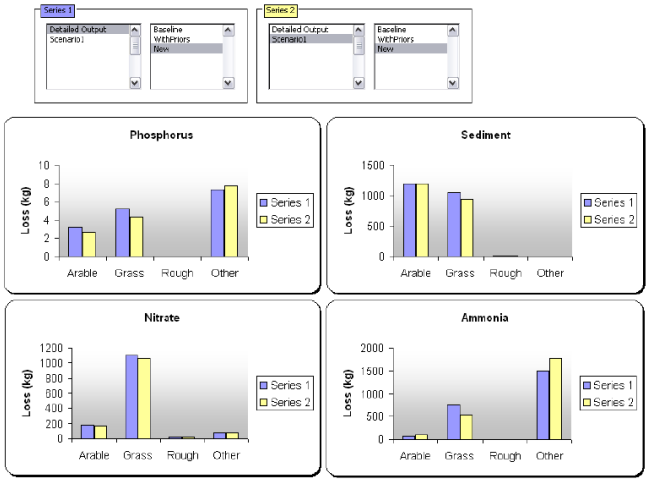
Any other useful information (e.g. screenshots of DST input/outputs)



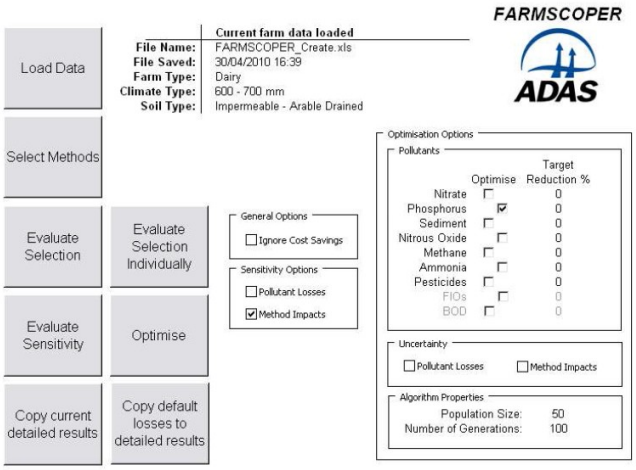
Graphs of farm data from the Farm Design Workbook



Optimisation results for cost-effective mitigation for multiple pollutants



Comparison of the results of different suites of mitigation methods from multiple pollutants from different source areas



User interface from the Farm Solver Workbook