



The  
Rivers  
Trust

# Quantifying Nutrient Reductions

Tools to quantify nutrient reductions from nature-based solutions addressing water quality challenges

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Date: 20/04/2023

# Farmscoper: Overview



- Defra and EA funded project developed by the **Agricultural Development and Advisory Service (ADAS)**
- Version 1 released in **2011**, Version 5 released in **2019**
- The **Farmscoper** model can assess diffuse agricultural pollutant loads on a farm and **quantify the impacts** of farm mitigation methods on these pollutants
- Nitrogen – NEAP-N, Phosphorus - PSYCHIC
- Contains **105** farm mitigation methods
- Originally designed for use at the farm scale but has been updated for use at **catchment scale**
- It's built with and runs using Excel



# Farmscoper: Inputs

- Farmscoper can be populated at a farm scale using inputs provided by farmers:
  - Annual Rainfall
  - Farm type
  - Soil Drainage Type
  - Livestock Numbers
  - Crop Types and Areas
  - Fertiliser and Manure applications
  - Fields next to watercourses (%)
- At catchment scale it is prepopulated using 2019 agricultural census data:
  - 3 versions that differ in the spatial aggregation of data:
    - Water Framework Directive Catchments
    - Natura 2000 Areas
    - UK River Catchments



# Farmscoper: Outputs

- **Baseline:**
  - Allows for the estimation of pollutant loads from a farm or in a catchment without any implementation of mitigation methods

1	2	Results for sets of methods					Baseline												
		Catchment	Farm	NVZ	Climate	Soil	Farm Count	Area per Farm (ha)	Nitrate (kg)	Phosphorus (kg)	Sediment (kg)	Ammonia (kg)	Methane (kg)	Nitrous Oxide (kg)	Pesticides (Units)	FIOs (10 <sup>9</sup> cfu)	Soil Carbon (t)	Energy Use (kg)	Production (£)
3	Total	-	-	-	-	36	327.9	185,188	19,361	9,309,222	79,802	739,781	17,363	212	5,545,154	2,332,449	5,410,437	8,133,331	
4	GB112075070430	Arable	FALSE	Over1500	DrainedAr	2	219.7	2,439	199.3	157,992	315	0	157	14.4	0.0	52,334.6	113,937.4	51,863.3	
5	GB112075070430	Arable	FALSE	Over1500	DrainedArGr	3	219.7	2,402	496.1	326,878	315	0	157	14.3	0.0	52,334.6	113,937.4	51,863.3	
6	GB112075070430	Extensive	FALSE	Over1500	FreeDrain	1	488.2	6,888	294.3	145,568	4,046	39,434	808	0.6	250,166.7	115,268.1	214,455.4	379,474.4	
7	GB112075070430	Extensive	FALSE	Over1500	DrainedAr	3	488.2	8,796	304.7	134,750	4,046	39,434	831	0.8	308,034.8	115,268.1	214,455.4	379,474.4	
8	GB112075070430	Extensive	FALSE	Over1500	DrainedArGr	4	488.2	8,878	1,158.4	475,989	4,046	39,434	832	0.9	314,313.9	115,268.1	214,455.4	379,474.4	
9	GB112075070450	Extensive	FALSE	Over1500	FreeDrain	2	210.7	2,785	131.9	75,539	1,414	13,021	302	4.0	85,968.1	42,718.0	97,749.3	156,018.6	
10	GB112075070450	Extensive	FALSE	Over1500	DrainedAr	1	210.7	3,535	158.4	89,648	1,414	13,021	311	5.3	105,693.8	42,718.0	97,749.3	156,018.6	
11	GB112075070450	Extensive	FALSE	Over1500	DrainedArGr	6	210.7	3,516	511.2	238,228	1,414	13,021	311	5.3	104,502.3	42,718.0	97,749.3	156,018.6	
12	GB112075070460	Extensive	FALSE	Over1500	FreeDrain	4	263.3	3,520	171.2	97,334	1,792	16,544	382	4.8	112,778.7	46,185.1	121,917.5	191,545.9	
13	GB112075070460	Extensive	FALSE	Over1500	DrainedArGr	4	263.3	4,435	641.4	296,359	1,792	16,544	393	6.3	132,486.2	46,185.1	121,917.5	191,545.9	
14	GB112075070490	Extensive	FALSE	Over1500	FreeDrain	2	466.5	5,939	245.8	137,005	3,133	29,127	665	5.6	161,633.3	65,781.3	211,670.5	316,947.5	
15	GB112075070490	Extensive	FALSE	Over1500	DrainedArGr	4	466.5	7,604	1,100.0	509,988	3,133	29,127	685	8.4	226,164.3	65,781.3	211,670.5	316,947.5	
16																			

- **Mitigation methods:**
  - Select the relevant mitigation methods from a list of 105 interventions and set the prior and maximum implementation rate (%)
  - Farmscoper will evaluate the methods (together/separately) and estimates new pollutant load with selected mitigations
  - Considers mutual exclusivity of methods and diminishing returns – no additive impact when evaluated together

**Baseline**     $\longrightarrow$     **With Prior Implementation**     $\longrightarrow$     **With Maximum Implementation**

# Catchment Nutrient Balancing

**Catchment Nutrient Balancing is a water sector initiative to engage with farmers to deliver catchment-based solutions; reducing nutrient loads to help achieve water quality objectives.**

- Using the ‘fair share’ principle 17 interventions were agreed with the Environment Agency
- Farmscoper analysis at a farm and catchment scale identify opportunities and quantify reductions
- Water industry can use different models (SAGIS-Simcat) and is important to consider data exchange
- Monte Carlo approach to account for uncertainty in the Farmscoper outputs

Intervention	Prior implementation %	Max implementation %
Establish in-field grass buffer strips	2	80
Establish riparian buffer strips	39	80
Reduce field stocking rates when soils are wet	10	80
Loosen compacted soil layers in grassland fields	50	100
Increase the capacity of farm slurry stores to improve timing of slurry applications	2	100
Install covers to slurry stores	10	100
Minimise the volume of dirty water produced (sent to dirty water store)	10	100
Minimise the volume of dirty water produced (sent to slurry store)	10	100
Store solid manure heaps on an impermeable base and collect effluent	10	100
Cover solid manure stores with sheeting	2	100
Use liquid/solid manure separation techniques	2	100
Fence off rivers and streams from livestock	39	90
Farm track management	25	90
Establish new hedges	2	90
Establish and maintain artificial wetlands - steading runoff	2	100
Establish tree shelter belts around livestock housing	10	100
Management of woodland edges	2	100

# Nutrient Neutrality

Nutrient Neutrality requires a zero net increase in nutrient levels from new plans or projects within the catchments of sites protected under the Habitats Regulations 2017:

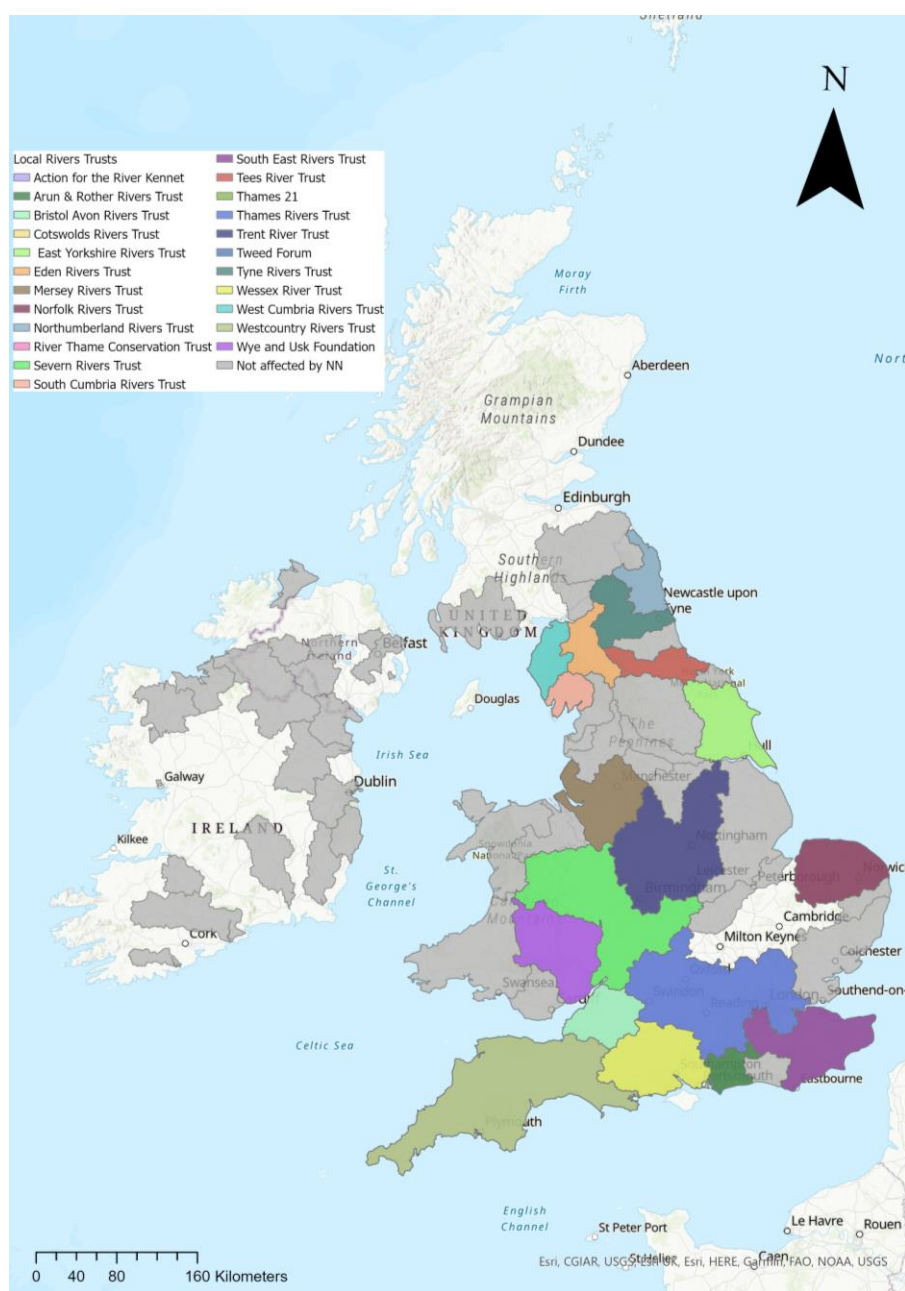
- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Ramsar sites

Each catchment has a ‘Nutrient Budget Calculator’ used to calculate the excess nutrient load from a development. This must be mitigated either onsite (SuDS) or offsite (NbS)

## Previous work by The Rivers Trust:

- [Constructed Wetlands Framework for Natural England](#)
- [Constructed Wetland Hub](#)





# Nutrient Neutrality



Nutrient Neutrality currently applies to 23 local Rivers Trusts and 25 CaBa Partnerships.

## Identifying opportunities:

- SCIMAP – Diffuse Pollution maps
- SAGIS opportunities for P reduction
- WwTW locations
- Farmscoper Upscale analysis
- Monitoring plans

## Rapid Assessment Methodology:

- Upstream Area
- Rainfall
- Soil drainage type
- Land use/Farm type
- Farmscoper export coefficient
- Removal efficiency from literature



# Tänname väga!

Thank you!