

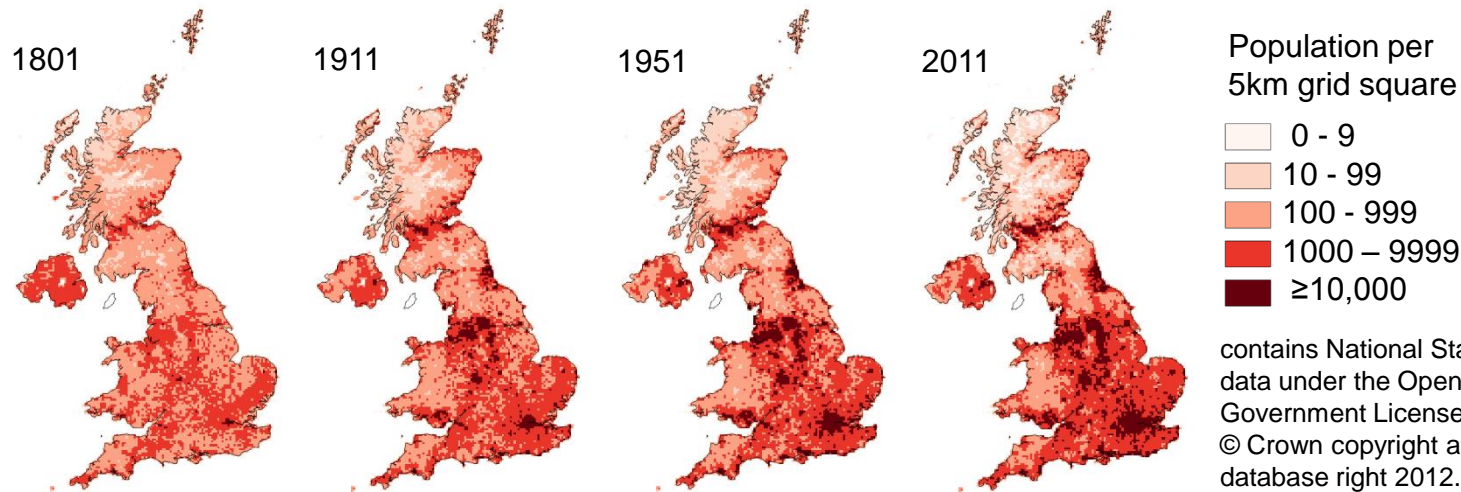
Nutrients from sewage effluent: past and future

**Pam Naden, Vicky Bell, Ed Carnell, Sam Tomlinson,
Ulli Dragosits, Jacky Chaplow, Linda May and Ed Tipping**

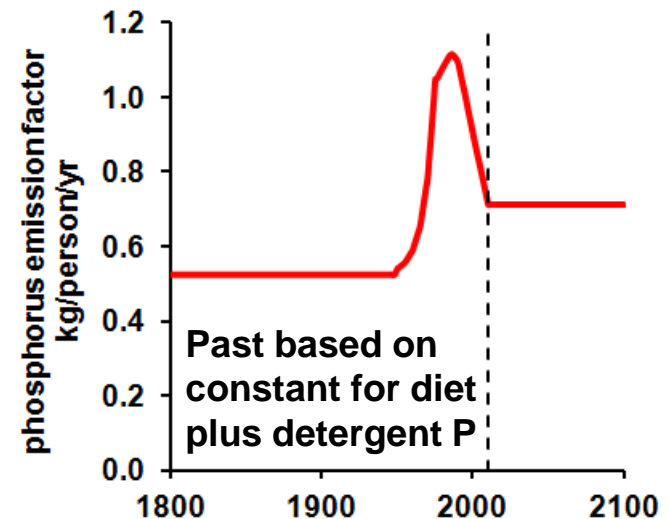
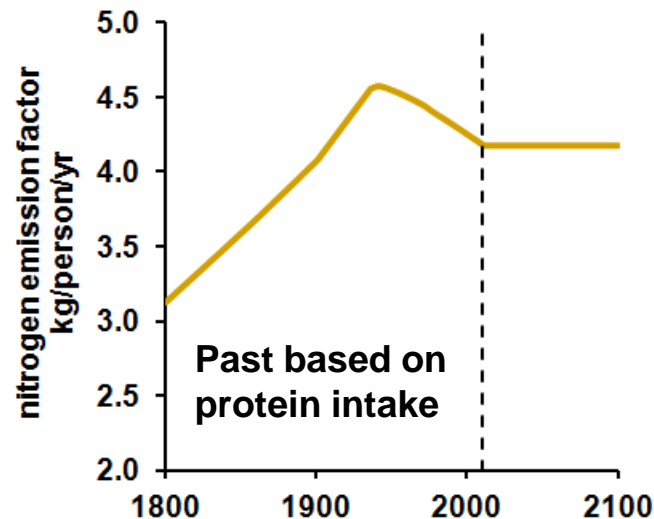
*Nutrient fluxes from domestic wastewater: a national-scale historical perspective
for the UK 1800-2010. Science of the Total Environment (in press)*

Estimating nutrient emissions

Population * Emission factor

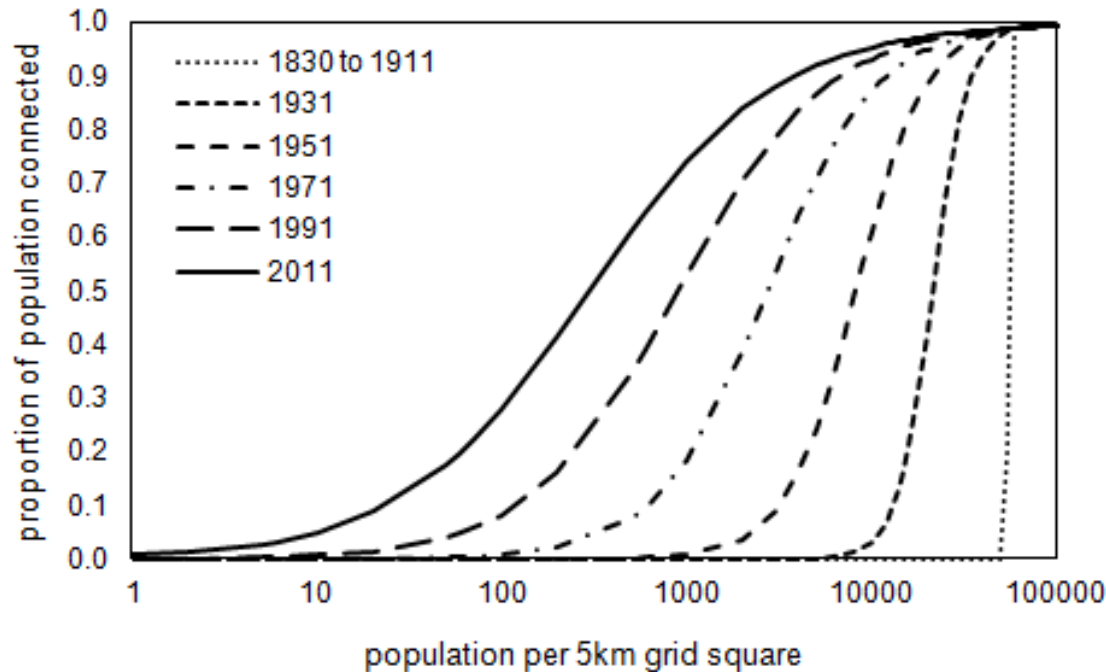


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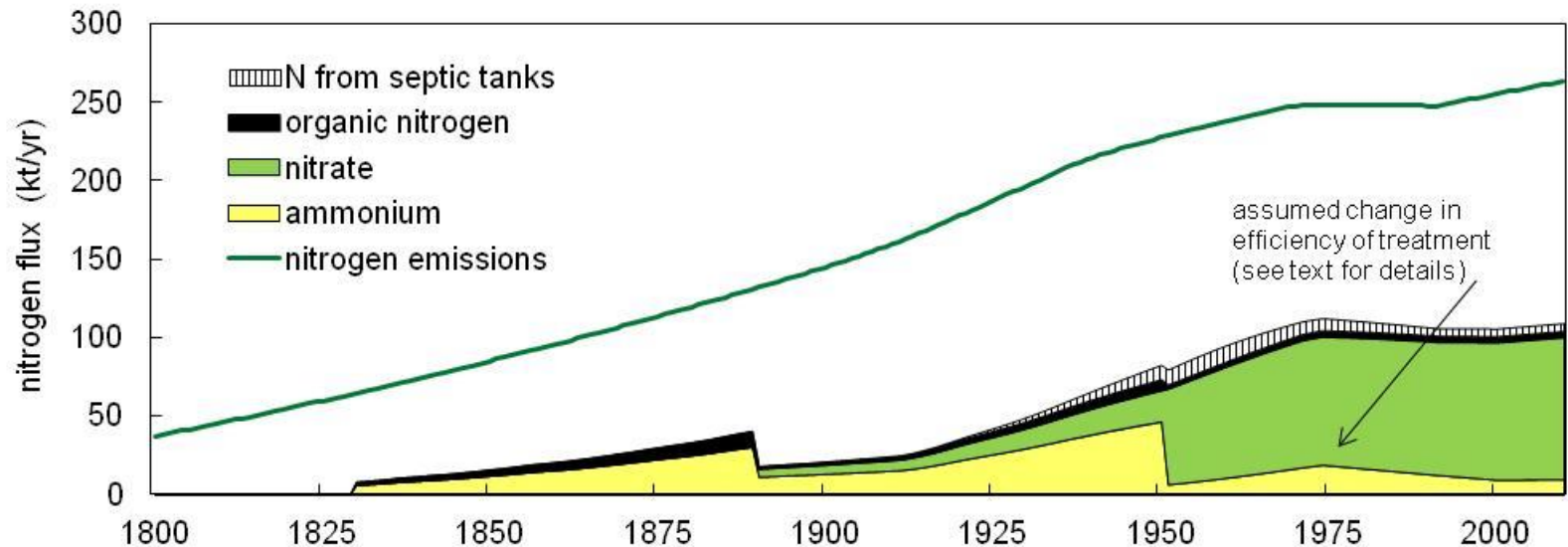
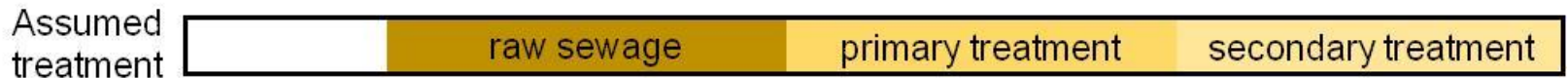
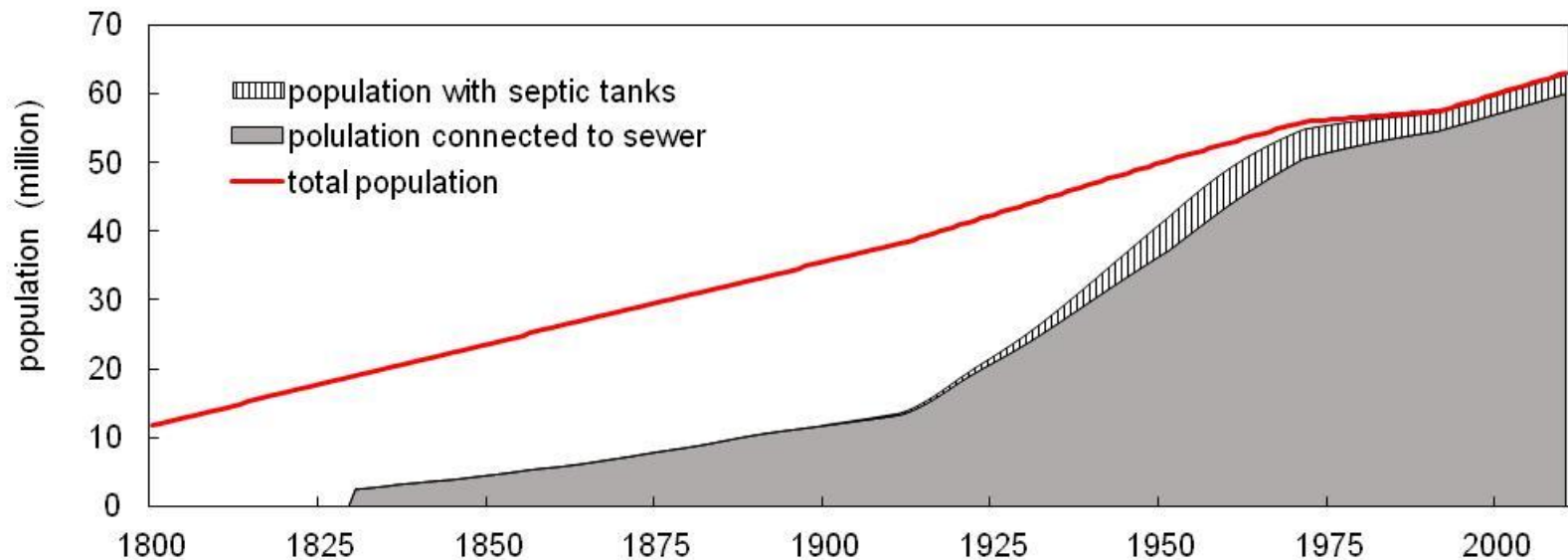
Estimating nutrients in effluent

Emissions * connection to sewer * (1 - loss on treatment)

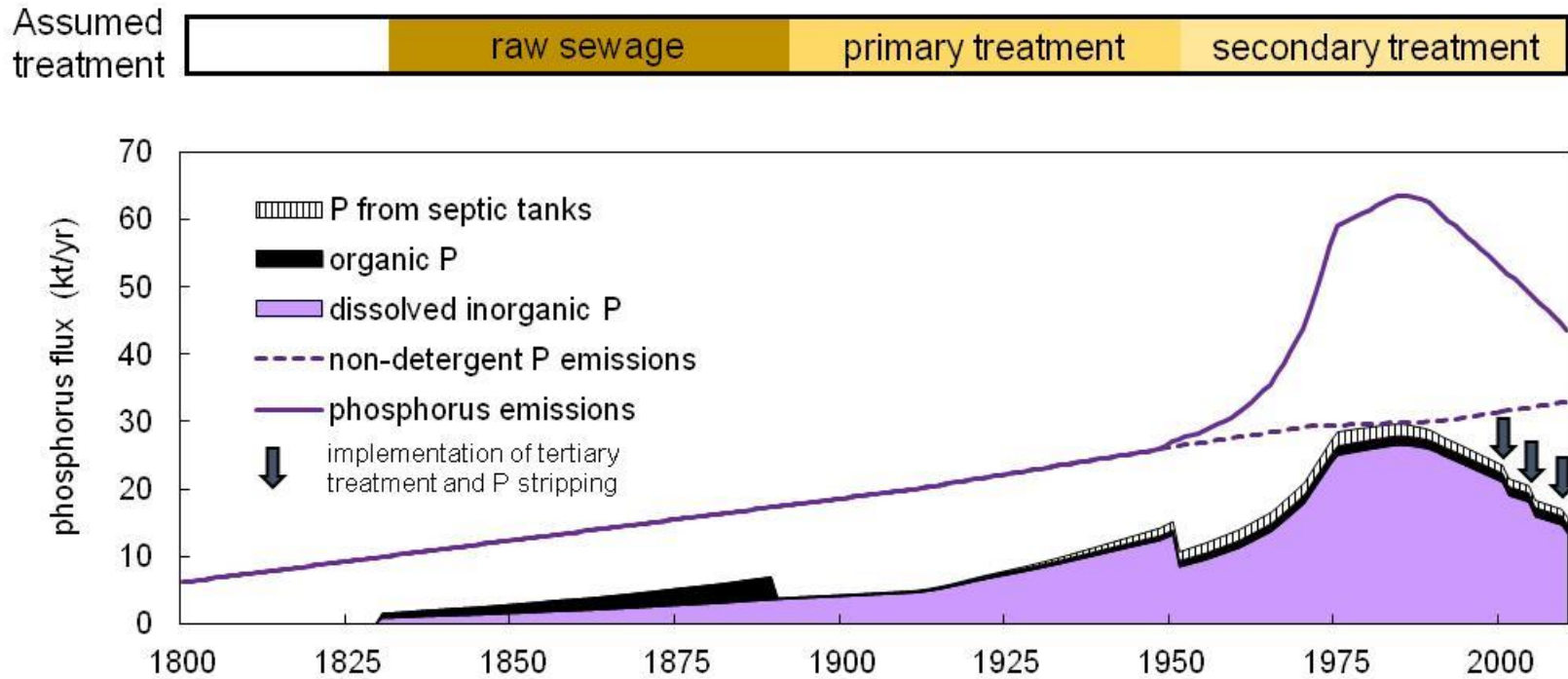


	Raw	Primary	Secondary	Tertiary	P stripping
DIN	0.75	0.4	0.4	0.4	0.4
DIP	0.67	0.67	0.42	0.35	0.16
Nitrate as prop ⁿ DIN	0	0.3	0.9	0.9	0.9

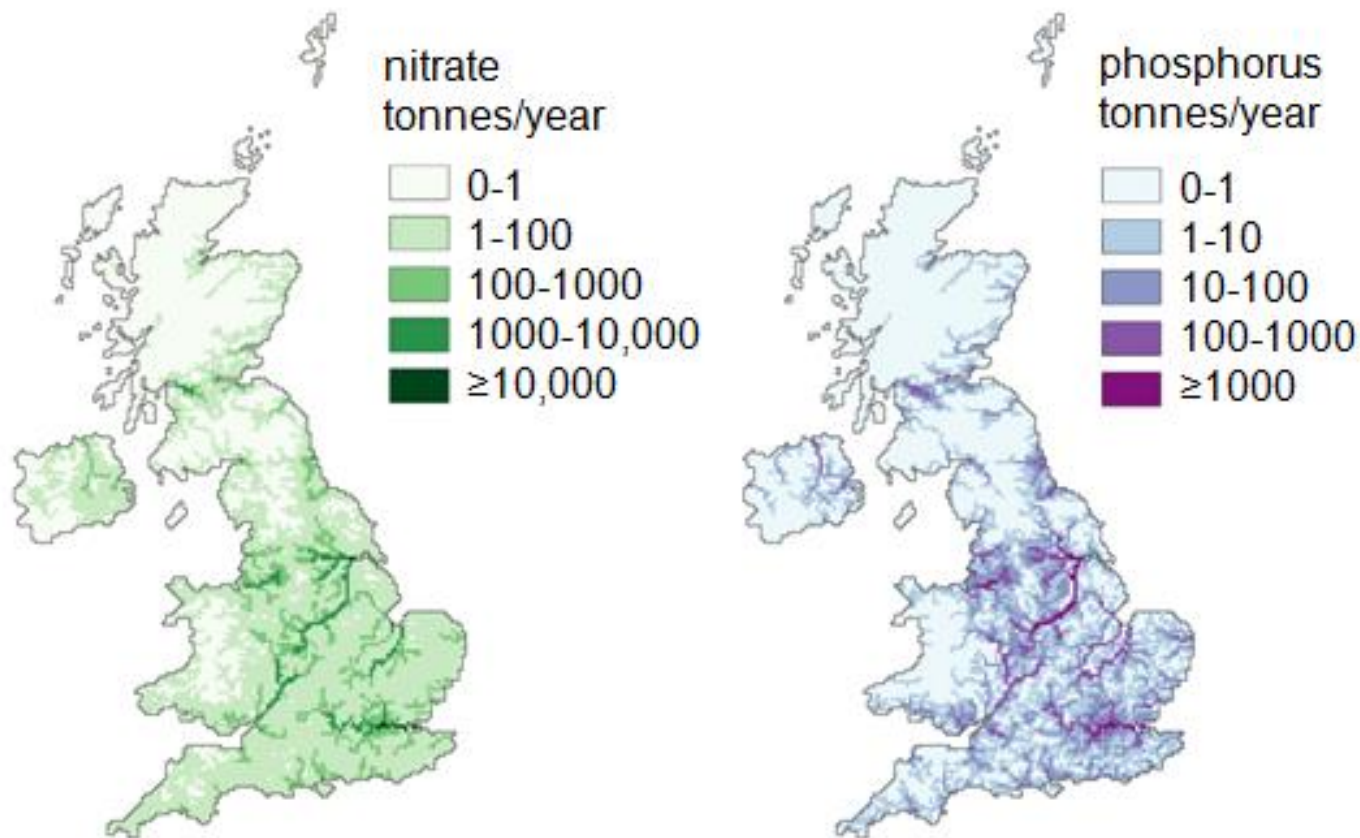
Historical sewage nitrogen flux for UK



Historical sewage phosphorus flux for UK



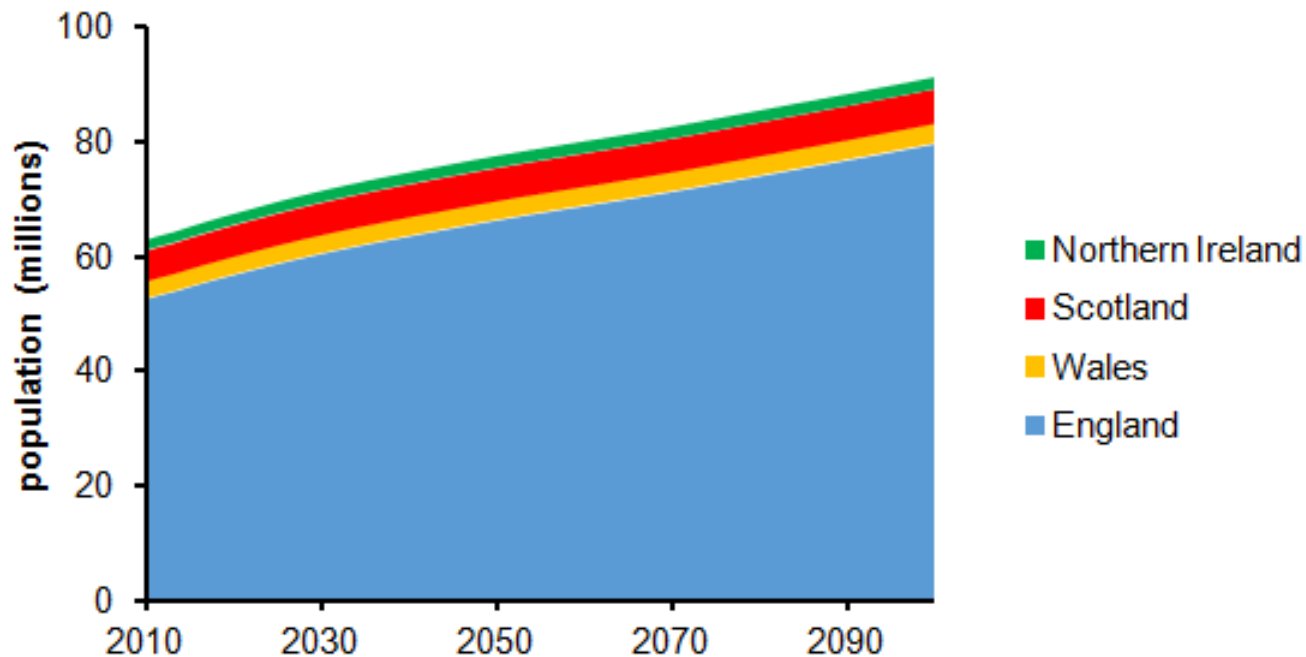
Nutrients through the river system



Future scenarios

P1: population projections from Office of National Statistics to 2089; extended in proportion to UN projections to 2100
emission and treatment factors held constant

P2: population as above; P stripping applied everywhere



Future scenario results

	Population million	Nitrogen emissions kT/yr	Nitrate* sewage flux kT/yr	P emissions kT/yr	P sewage flux kT/yr	P sewage flux with stripping kT/yr
2010	63	263	91	44	13	7
2030	72	299	103	50	15	8
2050	78	325	112	54	17	8
2100	92	283	132	63	20	10



**Influent to be
treated at
WWTWs**



**Effluent flux
to river/sea**

**NB. Phosphate dosing not
included in P calculations.**

*ammonium flux 10kT/yr
rising to 15 kT/yr