

**Supplementary Table S2** Estimated N inputs from fertilizer, manure, fixation, deposition, and irrigation, plus crop N uptake and NUE

Type of N inputs	Total N flux (Tg N yr <sup>-1</sup> )			
	1961	1980	2000	2018
N from fertilizer	0.6 (0.4–0.7)	12.3 (9.8–14.7)	22.4 (17.9–26.9)	28.6 (22.9–34.3)
N from manure	2.8 (2.2–3.3)	9.3 (7.4–11.2)	11.2 (8.9–13.4)	12.3 (9.8–14.7)
• Recycled	2.6 (2.1–3.1)	7.0 (5.6–8.4)	5.8 (4.6–6.9)	5.6 (4.5–6.7)
• Non-recycled	0.2 (0.1–0.3)	2.3 (1.8–2.7)	5.4 (4.3–6.4)	6.7 (5.3–8.0)
N from environment	0.9 (0.7–1.1)	3.0 (2.9–3.4)	5.6 (4.9–7.4)	7.1 (6.2–9.4)
• N fixation	0.2 (0.1–0.3)	0.4 (0.3–0.7)	0.5 (0.3–0.8)	0.6 (0.4–0.9)
• N deposition	0.7 (0.6–1.0)	2.5 (2.0–3.0)	4.9 (3.8–5.8)	6.2 (5.0–7.5)
• N irrigation	0.01 (0.01–0.02)	0.1 (0.05–0.2)	0.2 (0.1–0.40)	0.3 (0.1–0.5)
Total N input	4.3 (4.0–4.4)	24.6 (20.1–30.2)	39.2 (31.8–47.7)	48.0 (39.0–58.5)
Crop N uptake	3.0 (2.7–4.1)	11.6 (9.5–14.2)	17.6 (14.3–21.4)	21.6 (17.5–26.3)
NUE (%)	70 (68–73)	47 (45–49)	45 (43–47)	46 (43–48)
NH <sub>3</sub> emissions	0.4 (0.3–0.5)	3.2 (2.6–3.9)	5.9 (4.7–7.1)	7.2 (5.8–8.7)
N leaching and runoff	0.4 (0.3–0.5)	3.2 (2.6–3.9)	5.1 (4.1–6.2)	6.2 (5.1–7.6)
NO, N <sub>2</sub> O and N <sub>2</sub> emissions	0.5 (0.4–0.7)	6.7 (5.4–8.1)	10.6 (8.6–12.9)	13.0 (10.5–15.8)