

Text S1 A list of 30 primary studies from which the data were extracted for this meta-analysis.

1. Assemien, F.L.; Cantarel, A.A.M.; Florio, A.; Lerondelle, C.; Pommier, T.; Gonnety, J.T.; Le Roux, X. Different groups of nitrite-reducers and N₂O-reducers have distinct ecological niches and functional roles in west african cultivated soils. *Soil Biol. Biochem.* **2019**, *129*, 39–47.
2. Bai, W.; Wang, G.; Xi, J.; Liu, Y.; Yin, P. Short-term responses of ecosystem respiration to warming and nitrogen addition in an alpine swamp meadow. *Eur. J. Soil Biol.* **2019**, *92*, 16–23.
3. Bai, Y.; Zhou, Y.; Zhao, J. Community structures of denitrifying bacteria and methanotrophs in wetland soils of dry-up lake in the inner mongolia plateau. *China Environ. Sci.* **2012**, *32*, 1293–1301.
4. Bowen, J.L.; Byrnes, J.E.K.; Weisman, D.; Colaneri, C. Functional gene pyrosequencing and network analysis: An approach to examine the response of denitrifying bacteria to increased nitrogen supply in salt marsh sediments. *Front. Microbiol.* **2013**, *4*, 1–12. <https://doi.org/10.3389/fmicb.2013.00342>.
5. Edwards, K.R.; Picek, T.; Cizkova, H.; Zemanova, K.M.; Stara, A. Nutrient addition effects on carbon fluxes in wet grasslands with either organic or mineral soil. *Wetlands* **2015**, *35*, 55–68.
6. Hester, E.R.; Harpenslager, S.F.; van Diggelen, J.M.H.; Lamers, L.L.; Jetten, M.S.M.; Luke, C.; Lucker, S.; Welte, C.U. Linking nitrogen load to the structure and function of wetland soil and rhizosphere microbial communities. *Msystems* **2018**, *3*, 1–14. <https://doi.org/10.1128/mSystems.00214-17>.
7. Huang, J.; Xu, X.; Wang, M.; Nie, M.; Qiu, S.; Wang, Q.; Quan, Z.; Xiao, M.; Li, B. Responses of soil nitrogen fixation to spartina alterniflora invasion and nitrogen addition in a chinese salt marsh. *Sci. Rep.* **2016**, *6*, 20384.
8. Huang, L.; Hu, W.; Tao, J.; Liu, Y.; Kong, Z.; Wu, L. Soil bacterial community structure and extracellular enzyme activities under different land use types in a long-term reclaimed wetland. *J. Soils Sediments* **2019**, *19*, 2543–2557. <https://doi.org/10.1007/s11368-019-02262-1>.
9. Kim, S.Y.; Veraart, A.J.; Meima-Franke, M.; Bodelier, P.L.E. Combined effects of carbon, nitrogen and phosphorus on CH₄ production and denitrification in wetland sediments. *Geoderma* **2015**, *259*, 354–361.
10. Lee, S.-H.; Megonigal, P.J. Kang, H. How do elevated CO₂ and nitrogen addition affect functional microbial community involved in greenhouse gas flux in salt marsh system. *Microb. Ecol.* **2017**, *74*, 670–680. <https://doi.org/10.1007/s00253-015-6385-8>.
11. Li, X.; Gao, D.; Hou, L.; Liu, M. Salinity stress changed the biogeochemical controls on CH₄ and N₂O emissions of estuarine and intertidal sediments. *Sci. Total Environ.* **2019**, *652*, 593–601.
12. Liao, H.; Li, Y.; Yao, H. Fertilization with inorganic and organic nutrients changes diazotroph community composition and N-fixation rates. *J. Soils Sediments* **2018**, *18*, 1076–1086.
13. McLaughlin, J.W.; Gale, M.R.; Jurgensen, M.F.; Trettin, C.C. Soil organic matter and nitrogen cycling in response to harvesting, mechanical site preparation, and fertilization in a wetland with a mineral substrate. *For. Ecol. Manag.* **2000**, *129*, 7–23.
14. Morrissey, E.M.; Jenkins, A.S.; Brown, B.L.; Franklin, R.B. Resource availability effects on nitrate-reducing microbial communities in a freshwater wetland. *Wetlands* **2013**, *33*, 301–310.
15. Penton, C.R.; Deenik, J.L.; Popp, B.N.; Bruland, G.L.; Engstrom, P.; Louis, D.S.; Tiedje, J. Importance of sub-surface rhizosphere-mediated coupled nitrification-denitrification in a flooded agroecosystem in hawaii. *Soil Biol. Biochem.* **2013**, *57*, 362–373.

16. Peralta, A.L.; Johnston, E.R.; Matthews, J.W.; Kent, A.D. Abiotic correlates of microbial community structure and nitrogen cycling functions vary within wetlands. *Freshw. Sci.* **2016**, *35*, 573–588.
17. Simonin, M.; Nunan, N.; Bloor, J.M.G.; Pouteau, V.; Niboyet, A. Short-term responses and resistance of soil microbial community structure to elevated CO₂ and n addition in grassland mesocosms. *Fems Microbiol. Lett.* **2017**, *364*, 1–6.
18. Sui, X.; Zhang, R.; Liu, Y.; Xu, N.; Ni, H. Influence of simulation nitrogen deposition on soil microbial functional diversity of calamagrostis angusti folia wetland in sanjiang plain. *Acta Agrestia Sin.* **2016**, *24*, 1226–1233.
19. Sun, X.; Tong, B.; Yan, R.; Liu, M.; Han, M.; Lin, X.; Cheng, L. Soil biological nitrogen fixation along with hydrological gradient in chongming dongtan wetland. *China Environ. Sci.* **2018**, *38*, 2304–2313.
20. Sun, Y.; Sheng, S.; Jiang, X.; Bello, A.; Wu, X.; Meng, Q.; Deng, L.; Xu, X.; Li, H. Genetic associations as indices for assessing nitrogen transformation processes in co-composting of cattle manure and rice straw. *Bioresour. Technol.* **2019**, *291*, 121815.
21. Wang, H.; Yu, L.; Zhang, Z.; Liu, W.; Chen, L.; Cao, G.; Yue, H.; Zhou, J.; Yang, Y.; Tang, Y.; He, J.-S. Molecular mechanisms of water table lowering and nitrogen deposition in affecting greenhouse gas emissions from a tibetan alpine wetland. *Glob. Change Biol.* **2017**, *23*, 815–829.
22. Whigham, D.F.; Verhoeven, J.T.A.; Samarkin, V.; Megonigal, P.J. Responses of avicennia germinans (black mangrove) and the soil microbial community to nitrogen addition in a hypersaline wetland. *Estuaries Coasts* **2009**, *32*, 926–936.
23. Wu, D.; Senbayram, M.; Well, R.; Brueggemann, N.; Pfeiffer, B.; Loick, N.; Stempfhuber, B.; Dittert, K.; Bol, R. Nitrification inhibitors mitigate N₂O emissions more effectively under straw-induced conditions favoring denitrification. *Soil Biol. Biochem.* **2017**, *104*, 197–207.
24. Xie, J.; Ma, X.; Dai, Y.; Wu, J.; Xiang, D.; Cheng, S. Effects of organic matters on the abundance of microorganisms in the urban wetland. *Biotechnol. Bull.* **2017**, *33*, 217–224.
25. Xing, Y.; Bubier, J.; Moore, T.; Murphy, M.; Basiliko, N.; Wendel, S.; Blodau, C. The fate of N-15-nitrate in a northern peatland impacted by long term experimental nitrogen, phosphorus and potassium fertilization. *Biogeochemistry* **2011**, *103*, 281–296.
26. Yang, L.; Bai, J.; Zeng, N.; Zhou, X.; Liao, Y.; Lu, Y.; Rees, R.M.; Nie, J.; Cao, W. Diazotroph abundance and community structure are reshaped by straw return and mineral fertilizer in rice-rice-green manure rotation. *Appl. Soil Ecol.* **2019**, *136*, 11–20.
27. Yang, Y.; Nie, J.; Wang, S.; Shi, L.; Li, Z.; Zeng, Z.; Zang, H. Differentiated responses of nirS- and nirK-type denitrifiers to 30 years of combined inorganic and organic fertilization in a paddy soil. *Arch. Agron. Soil Sci.* **2021**, *67*, 79–92.
28. Yang, Y.; Wang, P.; Zeng, Z. Dynamics of bacterial communities in a 30-year fertilized paddy field under different organic-inorganic fertilization strategies. *Agronomy-Basel.* **2019**, *9*, 14.
29. Yu, Y.; Wu, M.; Petropoulos, E.; Zhang, J.; Nie, J.; Liao, Y.; Li, Z.; Lin, X.; Feng, Y. Responses of paddy soil bacterial community assembly to different long-term fertilizations in southeast china. *Sci. Total Environ.* **2019**, *656*, 625–633.
30. Yuan, H.; Qin, H.; Liu, S.; Tong, C.; Ge, T.; Wei, W.; Wu, J. Abundance and composition of CO₂ fixating bacteria in relation to long-term fertilization of paddy soils. *Acta Ecol. Sin.* **2012**, *32*, 183–189.