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Linking soil microbial community dynamics to N₂O emission after bioenergy residue amendments

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References

- Abiven, S., Recous, S., Reyes, V., and Oliver, R. (2005). Mineralisation of C and N from root, stem and leaf residues in soil and role of their biochemical quality. *Biology and Fertility of Soils* 42, 119. doi:10.1007/s00374-005-0006-0
- Aita, C., Schirrmann, J., Pujol, S.B., Giacomini, S.J., Rochette, P., Angers, D.A., et al. (2015). Reducing nitrous oxide emissions from a maize-wheat sequence by decreasing soil nitrate concentration: effects of split application of pig slurry and dicyandiamide. *European Journal of Soil Science* 66, 359-368. doi:10.1111/ejss.12181
- Akram, M., Tan, C.K., Garwood, R., and Thai, S.M. (2015). Vinasse – A potential biofuel – Cofiring with coal in a fluidised bed combustor. *Fuel* 158, 1006-1015. doi:10.1016/j.fuel.2015.06.036
- Allison, M.F., and Killham, K. (1988). Response of soil microbial biomass to straw incorporation. *Journal of Soil Science* 39, 237-242. doi:10.1111/j.1365-2389.1988.tb01210.x
- Allison, S.D., and Martiny, J.B.H. (2008). Resistance, resilience, and redundancy in microbial communities. *Proceedings of the National Academy of Sciences of the United States of America* 105, 11512-11519. doi:10.1073/pnas.0801925105
- Anderson, M.J. (2001). A new method for non-parametric multivariate analysis of variance. *Austral Ecology* 26, 32-46. doi:10.1111/j.1442-9993.2001.01070.pp.x
- Anderson, M.J. (2006). Distance-based tests for homogeneity of multivariate dispersions. *Biometrics* 62, 245-253. doi:10.1111/j.1541-0420.2005.00440.x
- Baggs, E.M., Smale, C.L., and Bateman, E.J. (2010). Changing pH shifts the microbial source as well as the magnitude of N₂O emission from soil. *Biology and Fertility of Soils* 46, 793-805. doi:10.1007/s00374-010-0484-6
- Balota, E.L., Machineski, O., Hamid, K.I.A., Yada, I.F.U., Barbosa, G.M.C., Nakatani, A.S., et al. (2014). Soil microbial properties after long-term swine slurry application to conventional and no-tillage systems in Brazil. *Science of The Total Environment* 490, 397-404. doi:10.1016/j.scitotenv.2014.05.019
- Bardgett, R.D., Lovell, R.D., Hobbs, P.J., and Jarvis, S.C. (1999). Seasonal changes in soil microbial communities along a fertility gradient of temperate grasslands. *Soil Biology and Biochemistry* 31, 1021-1030. doi:10.1016/S0038-0717(99)00016-4
- Barros, R.D.R.O.D., Paredes, R.D.S., Endo, T., Bon, E.P.D.S., and Lee, S.-H. (2013). Association of wet disk milling and ozonolysis as pretreatment for enzymatic saccharification of sugarcane bagasse and straw. *Bioresource Technology* 136, 288-294. doi:10.1016/j.biortech.2013.03.009
- Barton, L., and Schipper, L.A. (2001). Regulation of nitrous oxide emissions from soils irrigated with dairy farm effluent. *Journal of Environmental Quality* 30, 1881-1887. doi:10.2134/jeq2001.1881
- Bateman, E.J., and Baggs, E.M. (2005). Contributions of nitrification and denitrification to N₂O emissions from soils at different water-filled pore space. *Biology and Fertility of Soils* 41, 379-388. doi:10.1007/s00374-005-0858-3
- Bell, C., McIntyre, N., Cox, S., Tissue, D., and Zak, J. (2008). Soil microbial responses to temporal variations of moisture and temperature in a Chihuahuan desert grassland. *Microbial Ecology* 56, 153-167. doi:10.1007/s00248-007-9333-z
- Bender, E.A., Case, T.J., and Gilpin, M.E. (1984). Perturbation experiments in community ecology: Theory and practice. *Ecology* 65, 1-13. doi:10.2307/1939452
- Bhattacharyya, R., Pandey, S.C., Bisht, J.K., Bhatt, J.C., Gupta, H.S., Tuti, M.D., et al. (2013). Tillage and irrigation effects on soil aggregation and carbon pools in the Indian Sub-Himalayas. *Agronomy Journal* 105, 101-112. doi:10.2134/agronj2012.0223
- Biederbeck, V.O., Curtin, D., Bouman, O.T., Campbell, C.A., and Ukrainetz, H. (1996). Soil microbial and biochemical properties after ten years of fertilization with urea and anhydrous ammonia. *Canadian Journal of Soil Science* 76, 7-14. doi:10.4141/cjss96-002
- Boddey, R.M., Soares, L.H.D.B., Alves, B.J.R., and Urquiaga, S. (2008). "Bio-ethanol production in Brazil," in *Biofuels, solar and wind as renewable energy systems: benefits and risks*, ed. D. Pimentel (Dordrecht: Springer Netherlands), 321-356. doi:10.1007/978-1-4020-8654-0_13
- Bolker, B.M., Brooks, M.E., Clark, C.J., Geange, S.W., Poulsen, J.R., Stevens, M.H.H., et al. (2009). Generalized linear mixed models: a practical guide for ecology and evolution. *Trends in Ecology & Evolution* 24, 127-135. doi:10.1016/j.tree.2008.10.008
- Bollmann, A., and Conrad, R. (1998). Influence of O₂ availability on NO and N₂O release by nitrification and denitrification in soils. *Global Change Biology* 4, 387-396. doi:10.1046/j.1365-2486.1998.00161.x
- Boulal, H., Mateos, L., and Gómez-Macpherson, H. (2011). Soil management and traffic effects on infiltration of irrigation water applied using sprinklers. *Irrigation Science* 29, 403-412. doi:10.1007/s00271-010-0245-1

- Bouskill, N.J., Lim, H.C., Borglin, S., Salve, R., Wood, T.E., Silver, W.L., et al. (2013). Pre-exposure to drought increases the resistance of tropical forest soil bacterial communities to extended drought. *ISME J* 7, 384-394. doi:10.1038/ismej.2012.113
- BRAZIL, F.R.O. (2015). Conference of the parties (COP), United nations framework convention on climate change - unfccc. <http://unfccc.int/bodies/body/6383.php>
- BRAZIL, F.R.O. (2016). RenovaBio. <http://www.unica.com.br/renovabio>
- Breiman, L., Friedman, J.H., Olshen, R.A., and J., S.C. (1984). Classification and regression trees. Wadsworth international group: Belmont, CA, USA.
- Brexó, R.P., and Sant'ana, A.S. (2017). Impact and significance of microbial contamination during fermentation for bioethanol production. *Renewable and Sustainable Energy Reviews* 73, 423-434. doi:10.1016/j.rser.2017.01.151
- Brouder, S.M., and Gomez-Macpherson, H. (2014). The impact of conservation agriculture on smallholder agricultural yields: A scoping review of the evidence. *Agriculture, Ecosystems & Environment* 187, 11-32. doi:10.1016/j.agee.2013.08.010
- Buchfink, B., Xie, C., and Huson, D.H. (2015). Fast and sensitive protein alignment using DIAMOND. *Nature Methods* 12, 59–60. doi:10.1038/nmeth.3176
- Buckeridge, K.M., Banerjee, S., Siciliano, S.D., and Grogan, P. (2013). The seasonal pattern of soil microbial community structure in mesic low arctic tundra. *Soil Biology and Biochemistry* 65, 338-347. doi:10.1016/j.soilbio.2013.06.012
- Camargo, O.A., Moniz, A.C., Jorge, J.A., and Valadares, J.M. (1986). *Methods of soil chemical, physical, and mineralogical analysis of the Agronomic Institute in Campinas*. Campinas, Brazil: Instituto Agronômico.
- Canellas, L.P., Velloso, A.C.X., Marciano, C.R., Ramalho, J.F.G.P., Rumjanek, V.M., Rezende, C.E., et al. (2003). Propriedades químicas de um Cambissolo cultivado com cana-de-açúcar, com preservação do palhço e adição de vinhaça por longo tempo. *Revista Brasileira de Ciência do Solo* 27, 935-944. doi:10.1590/s0100-06832003000500018
- Canfield, D.E., Glazer, A.N., and Falkowski, P.G. (2010). The evolution and future of earth's nitrogen cycle. *Science* 330, 192-196. doi:10.1126/science.1186120
- Cantarella, H., Buckeridge, M.S., Van Sluys, M.-A., Souza, A.P.D., Garcia, A.a.F., Nishiyama, M.Y., et al. (2012). Sugarcane. In: C. Kole et al., editors, *Handbook of bioenergy crop plants*. Boca Raton, FL. doi:10.1201/b11711-24
- Cantoni, E., Field, C., Mills Flemming, J., and Ronchetti, E. (2007). Longitudinal variable selection by cross-validation in the case of many covariates. *Statistics in Medicine* 26, 919-930. doi:10.1002/sim.2572
- Caporaso, J.G., Lauber, C.L., Walters, W.A., Berg-Lyons, D., Huntley, J., Fierer, N., et al. (2012). Ultra-high-throughput microbial community analysis on the Illumina HiSeq and MiSeq platforms. *ISME J* 6, 1621-1624. doi:10.1038/ismej.2012.8
- Caranto, J.D., Vilbert, A.C., and Lancaster, K.M. (2016). Nitrosomonas europaea cytochrome P450 is a direct link between nitrification and nitrous oxide emission. *Proceedings of the National Academy of Sciences* 113, 14704-14709. doi:10.1073/pnas.1611051113
- Carbonetto, B., Rascovan, N., Álvarez, R., Mentaberry, A., and Vázquez, M.P. (2014). Structure, composition and metagenomic profile of soil microbiomes associated to agricultural land use and tillage systems in Argentine pampas. *PLOS ONE* 9, e99949. doi:10.1371/journal.pone.0099949
- Carmo, J.B.D., Filoso, S., Zotelli, L.C., De Sousa Neto, E.R., Pitombo, L.M., Duarte-Neto, P.J., et al. (2013). Infield greenhouse gas emissions from sugarcane soils in Brazil: effects from synthetic and organic fertilizer application and crop trash accumulation. *GCB Bioenergy* 5, 267-280. doi:10.1111/j.1757-1707.2012.01199.x
- Carvalho, J.L.N., Nogueiro, R.C., Menandro, L.M.S., Bordonal, R.D.O., Borges, C.D., Cantarella, H., et al. (2017). Agronomic and environmental implications of sugarcane straw removal: a major review. *GCB Bioenergy* 9, 1181-1195. doi:10.1111/gcbb.12410
- Carvalho, L.A., Meurer, I., Silva Junior, C.A., Santos, C.F.B., and Libardi, P.L. (2014). Spatial variability of soil potassium in sugarcane areas subjected to the application of vinasse. *Anais da Academia Brasileira de Ciências* 86, 1999-2012. doi:10.1590/0001-3765201420130319
- Cassman, N.A., Leite, M.F.A., Pan, Y., De Hollander, M., Van Veen, J.A., and Kuramae, E.E. (2016). Plant and soil fungal but not soil bacterial communities are linked in long-term fertilized grassland. *Scientific Reports* 6, 23680. doi:10.1038/srep23680
- Castro, J.D.S., Calijuri, M.L., Assemany, P.P., Cecon, P.R., De Assis, I.R., and Ribeiro, V.J. (2017). Microalgae biofilm in soil: Greenhouse gas emissions, ammonia volatilization and plant growth. *Science of The Total Environment* 574, 1640-1648. doi:10.1016/j.scitotenv.2016.08.205

- Cerri, C.C., Maia, S.M.F., Galdos, M.V., Cerri, C.E.P., Feigl, B.J., and Bernoux, M. (2009). Brazilian greenhouse gas emissions: the importance of agriculture and livestock. *Scientia Agricola* 66, 831-843. doi:10.1590/S0103-90162009000600017
- CETESB. 2014. Norma Técnica P4.231 – Stillage - Criteria and procedures for agricultural soil application. 3rd Edition. Available: <http://www.ibra.com.br/vinhaca-criterios-e-procedimentos-para-aplicacao-no-solo-agricola/> [Accessed 12/03/2017].
- Chadwick, D., Sommer, S., Thorman, R., Fanguero, D., Cardenas, L., Amon, B., et al. (2011). Manure management: Implications for greenhouse gas emissions. *Animal Feed Science and Technology* 166-167, 514-531. doi:10.1016/j.anifeedsci.2011.04.036
- Chao, A. (1984). Nonparametric estimation of the number of classes in a population. *Scandinavian Journal of statistics* 11, 265-270. doi:10.2307/4615964
- Chen, H., Mothapo, N.V., and Shi, W. (2014). The significant contribution of fungi to soil N₂O production across diverse ecosystems. *Applied Soil Ecology* 73, 70-77. doi:10.1016/j.apsoil.2013.08.011
- Christofoletti, C.A., Escher, J.P., Correia, J.E., Marinho, J.F.U., and Fontanetti, C.S. (2013). Sugarcane vinasse: Environmental implications of its use. *Waste Management* 33, 2752-2761. doi:10.1016/j.wasman.2013.09.005
- Clarke, K.R. (1993). Non-parametric multivariate analyses of changes in community structure. *Australian Journal of Ecology* 18, 117–143. doi:10.1111/j.1442-9993.1993.tb00438.x
- CONAB. 2017. Acompanhamento da safra brasileira de cana-de-açúcar: V. 3 - SAFRA 2016/17 N. 3 Available: <http://www.conab.gov.br> [Accessed 15 October 2017].
- Costa, O.Y., Souto, B.M., Tupinamba, D.D., Bergmann, J.C., Kyaw, C.M., Kruger, R.H., et al. (2015a). Microbial diversity in sugarcane ethanol production in a Brazilian distillery using a culture-independent method. *J Ind Microbiol Biotechnol* 42, 73-84. doi:10.1007/s10295-014-1533-1
- Costa, O.Y.A., Souto, B.M., Tupinambá, D.D., Bergmann, J.C., Kyaw, C.M., Kruger, R.H., et al. (2015b). Microbial diversity in sugarcane ethanol production in a Brazilian distillery using a culture-independent method. *Journal of Industrial Microbiology and Biotechnology* 42, 73-84. doi:10.1007/s10295-014-1533-1
- Cregger, M.A., Schadt, C.W., McDowell, N.G., Pockman, W.T., and Classen, A.T. (2012). Response of the Soil Microbial Community to Changes in Precipitation in a Semiarid Ecosystem. *Applied and Environmental Microbiology* 78, 8587-8594. doi:10.1128/aem.02050-12
- Crutzen, P.J., Mosier, A.R., Smith, K.A., and Winiwarter, W. (2008). N₂O release from agro-biofuel production negates global warming reduction by replacing fossil fuels. *Atmospheric Chemistry and Physics* 8, 389-395. doi:10.5194/acp-8-389-2008
- Daims, H. (2014). "The family Nitrospiraceae," in *The prokaryotes: Other major lineages of bacteria and the archaea*, eds. E. Rosenberg, E.F. DeLong, S. Lory, E. Stackebrandt & F. Thompson (Berlin, Heidelberg: Springer Berlin Heidelberg), 733-749. doi:10.1007/978-3-642-38954-2_126
- Daims, H., Lebedeva, E.V., Pjevac, P., Han, P., Herbold, C., Albertsen, M., et al. (2015). Complete nitrification by Nitrospira bacteria. *Nature* 528, 504-509. doi:10.1038/nature16461
- Dametie, A., Fantaye, A., and Teshome, Z. (2014). Estimating effect of vinasse on sugarcane through application of potassium chloride at Metahara sugarcane plantation. *Advances in Crop Science and Technology* 2, 154. doi:10.4172/2329-8863.1000154
- De'ath, G. (2002). Multivariate regression trees: a new technique for modeling species–environment relationships. *Ecology* 83, 1105-1117. doi:10.2307/3071917
- De'ath, G. (2007). mvpart: Multivariate partitioning, R package version 1.6-2.
- De Boer, W., and Kowalchuk, G.A. (2001). Nitrification in acid soils: micro-organisms and mechanisms. *Soil Biology and Biochemistry* 33, 853-866. doi:10.1016/S0038-0717(00)00247-9
- De Figueiredo, E.B., and La Scala Jr, N. (2011). Greenhouse gas balance due to the conversion of sugarcane areas from burned to green harvest in Brazil. *Agriculture, Ecosystems & Environment* 141, 77-85. doi:10.1016/j.agee.2011.02.014
- Deangelis, K.M., Allgaier, M., Chavarria, Y., Fortney, J.L., Hugenholtz, P., Simmons, B., et al. (2011). Characterization of trapped lignin-degrading microbes in tropical forest soil. *PLoS ONE* 6, e19306. doi:10.1371/journal.pone.0019306
- Devêvre, O.C., and Horwáth, W.R. (2000). Decomposition of rice straw and microbial carbon use efficiency under different soil temperatures and moistures. *Soil Biology and Biochemistry* 32, 1773-1785. doi:10.1016/S0038-0717(00)00096-1
- Dhariwal, A., Chong, J., Habib, S., King, I.L., Agellon, L.B., and Xia, J. (2017). MicrobiomeAnalyst: a web-based tool for comprehensive statistical, visual and meta-analysis of microbiome data. *Nucleic Acids Research* 45, W180-W188. doi:10.1093/nar/gkx295
- Di, H.J., Cameron, K.C., Podolyan, A., and Robinson, A. (2014). Effect of soil moisture status and a nitrification inhibitor, dicyandiamide, on ammonia oxidizer and denitrifier growth and nitrous

- oxide emissions in a grassland soil. *Soil Biology and Biochemistry* 73, 59-68. doi:10.1016/j.soilbio.2014.02.011
- Di, H.J., Cameron, K.C., Shen, J.P., Winefield, C.S., O'callaghan, M., Bowatte, S., et al. (2009). Nitrification driven by bacteria and not archaea in nitrogen-rich grassland soils. *Nature Geoscience* 2, 621-624. doi:10.1038/ngeo613
- Dong, H.-P., Hong, Y.-G., Lu, S., and Xie, L.-Y. (2014). Metaproteomics reveals the major microbial players and their biogeochemical functions in a productive coastal system in the northern South China Sea. *Environmental Microbiology Reports* 6, 683-695. doi:10.1111/1758-2229.12188
- Dray, S., and Dufour, A.B. (2007). The ade4 package: implementing the duality diagram for ecologists. *Journal of Statistical Software* 22, 1-20. doi:10.18637/jss.v022.i04
- Edgar, R.C. (2010). Search and clustering orders of magnitude faster than BLAST. *Bioinformatics* 26, 2460-2461. doi:10.1093/bioinformatics/btq461
- Eilers, K.G., Lauber, C.L., Knight, R., and Fierer, N. (2010). Shifts in bacterial community structure associated with inputs of low molecular weight carbon compounds to soil. *Soil Biology and Biochemistry* 42, 896-903. doi:10.1016/j.soilbio.2010.02.003
- Elia-Neto, A., and Nakahodo, T. (1995). *Caracterização físico-química da vinhaça projeto - 9500278. Relatório técnico da seção de tecnologia de tratamento de águas do centro de tecnologia*. Piracicaba: Copersucar.
- Esalq (2016). "Série de dados climatológicos do campus Luiz de Queiroz de Piracicaba, SP". Escola Superior de Agricultura "Luiz de Queiroz".
- Evans, S.E., and Wallenstein, M.D. (2012). Soil microbial community response to drying and rewetting stress: does historical precipitation regime matter? *Biogeochemistry* 109, 101-116. doi:10.1007/s10533-011-9638-3
- Fan, F., Yin, C., Tang, Y., Li, Z., Song, A., Wakelin, S.A., et al. (2014). Probing potential microbial coupling of carbon and nitrogen cycling during decomposition of maize residue by ¹³C-DNA-SIP. *Soil Biology and Biochemistry* 70, 12-21. doi:10.1016/j.soilbio.2013.12.002
- Fao (2015). *World reference base for soil resources 2014, update 2015. International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106*. Rome: Food and Agriculture Organization of the United Nations: The State of Food and Agriculture.
- FAO (2017). World fertilizer trends and outlook to 2020 - summary report. <http://www.fao.org/3/a-i6895e.pdf>
- Felsenstein, J. (1985). Confidence limits on phylogenies: an approach using the bootstrap. *Evolution* 39, 783-791. doi:10.1111/j.1558-5646.1985.tb00420.x
- Ferreira, D.F. (2011). Sisvar: a computer statistical analysis system. *Ciência e Agrotecnologia* 35, 1039-1042.
- Fierer, N., Bradford, M.A., and Jackson, R.B. (2007). Toward an ecological classification of soil bacteria. *Ecology* 88, 1354-1364. doi:10.1890/05-1839
- Fierer, N., Jackson, J.A., Vilgalys, R., and Jackson, R.B. (2005). Assessment of soil microbial community structure by use of taxon-specific quantitative PCR assays. *Applied and Environmental Microbiology* 71, 4117-4120. doi:10.1128/aem.71.7.4117-4120.2005
- Fierer, N., Lauber, C.L., Ramirez, K.S., Zaneveld, J., Bradford, M.A., and Knight, R. (2011). Comparative metagenomic, phylogenetic and physiological analyses of soil microbial communities across nitrogen gradients. *The Isme Journal* 6, 1007. doi:10.1038/ismej.2011.159
- Filoso, S., Carmo, J.B.D., Mardegan, S.F., Lins, S.R.M., Gomes, T.F., and Martinelli, L.A. (2015). Reassessing the environmental impacts of sugarcane ethanol production in Brazil to help meet sustainability goals. *Renewable and Sustainable Energy Reviews* 52, 1847-1856. doi:10.1016/j.rser.2015.08.012
- Fish, J.A., Chai, B., Wang, Q., Sun, Y., Brown, C.T., Tiedje, J.M., et al. (2013). FunGene: the functional gene pipeline and repository. *Frontiers in Microbiology* 4, 291. doi:10.3389/fmicb.2013.00291
- Fortes, C., Trivelin, P.C.O., and Vitti, A.C. (2012). Long-term decomposition of sugarcane harvest residues in São Paulo state, Brazil. *Biomass and Bioenergy* 42, 189-198. doi:10.1016/j.biombioe.2012.03.011
- Francioli, D., Schulz, E., Lentendu, G., Wubet, T., Buscot, F., and Reitz, T. (2016). Mineral vs. organic amendments: Microbial community structure, activity and abundance of agriculturally relevant microbes are driven by long-term fertilization strategies. *Frontiers in Microbiology* 7. doi:10.3389/fmicb.2016.01446
- Francis, C.A., Roberts, K.J., Beman, J.M., Santoro, A.E., and Oakley, B.B. (2005). Ubiquity and diversity of ammonia-oxidizing archaea in water columns and sediments of the ocean.

- Proceedings of the National Academy of Sciences of the United States of America* 102, 14683-14688. doi:10.1073/pnas.0506625102
- Franco, H.C.J., Otto, R., Faroni, C.E., Vitti, A.C., Almeida De Oliveira, E.C., and Trivelin, P.C.O. (2011). Nitrogen in sugarcane derived from fertilizer under Brazilian field conditions. *Field Crops Research* 121, 29-41. doi:10.1016/j.fcr.2010.11.011
- Freire, W.J., and Cortez, L.a.B. (2000). *Vinhaça de cana-de-açúcar*. Guaíba: Agropecuária.
- Friedman, J., Hastie, T., and Tibshirani, R. (2010). Regularization paths for generalized linear models via coordinate descent. *Journal of statistical software* 33, 1-22.
- Fuess, L.T., and Garcia, M.L. (2014). Implications of stillage land disposal: A critical review on the impacts of fertigation. *Journal of Environmental Management* 145, 210-229. doi:10.1016/j.jenvman.2014.07.003
- Fuess, L.T., Rodrigues, I.J., and Garcia, M.L. (2017). Fertilirrigation with sugarcane vinasse: Foreseeing potential impacts on soil and water resources through vinasse characterization. *Journal of Environmental Science and Health, Part A* 52, 1063-1072. doi:10.1080/10934529.2017.1338892
- Galdos, M.V., Cerri, C.C., Lal, R., Bernoux, M., Feigl, B., and Cerri, C.E.P. (2010). Net greenhouse gas fluxes in Brazilian ethanol production systems. *GCB Bioenergy* 2, 37-44. doi:10.1111/j.1757-1707.2010.01037.x
- Ge, G., Li, Z., Fan, F., Chu, G., Hou, Z., and Liang, Y. (2009). Soil biological activity and their seasonal variations in response to long-term application of organic and inorganic fertilizers. *Plant and Soil* 326, 31. doi:10.1007/s11104-009-0186-8
- Gittel, A., Barta, J., Kohoutova, I., Mikutta, R., Owens, S., Gilbert, J., et al. (2014). Distinct microbial communities associated with buried soils in the Siberian tundra. *ISME J* 8, 841-853. doi:10.1038/ismej.2013.219
- Glaser, K., Hackl, E., Inselsbacher, E., Strauss, J., Wanek, W., Zechmeister-Boltenstern, S., et al. (2010). Dynamics of ammonia-oxidizing communities in barley-planted bulk soil and rhizosphere following nitrate and ammonium fertilizer amendment. *FEMS Microbiology Ecology* 74, 575-591. doi:10.1111/j.1574-6941.2010.00970.x
- Gloor, G.B., and Reid, G. (2016). Compositional analysis: a valid approach to analyze microbiome high-throughput sequencing data. *Canadian Journal of Microbiology* 62, 692-703. doi:10.1139/cjm-2015-0821
- Goldemberg, J., Coelho, S.T., and Guardabassi, P. (2008). The sustainability of ethanol production from sugarcane. *Energy Policy* 36, 2086-2097. doi:10.1016/j.enpol.2008.02.028
- Goldfarb, K.C., Karaoz, U., Hanson, C.A., Santee, C.A., Bradford, M.A., Treseder, K.K., et al. (2011). Differential growth responses of soil bacterial taxa to carbon substrates of varying chemical recalcitrance. *Frontiers in Microbiology* 2, 94. doi:10.3389/fmicb.2011.00094
- Good, I.J. (1953). The population frequencies of species and the estimation of population parameters. *Biometrika* 40, 237-264. doi:10.1093/biomet/40.3-4.237
- Goreau, T.J., Kaplan, W.A., Wofsy, S.C., McElroy, M.B., Valois, F.W., and Watson, S.W. (1980). Production of NO₂⁻ and N₂O by nitrifying bacteria at reduced concentrations of oxygen. *Applied and Environmental Microbiology* 40, 526-532.
- Gower, J.C. (1971). "Statistical methods of comparing different multivariate analyses of the same data," in *Mathematics in the Archaeological and Historical Sciences.*, eds. F.R. Hodson, D.G. Kendall & P. Tautu (Edinburgh: Edinburgh University Press), 138-149.
- Gower, J.C. (1975). Generalized procrustes analysis. *Psychometrika* 40, 33-51. doi:10.1007/bf02291478
- Griffiths, B.S., and Philpott, L. (2013). Insights into the resistance and resilience of the soil microbial community. *FEMS Microbiology Reviews* 37, 112-129. doi:10.1111/j.1574-6976.2012.00343.x
- Habteselassie, M., Xu, L., and Norton, J. (2013). Ammonia-oxidizer communities in an agricultural soil treated with contrasting nitrogen sources. *Frontiers in Microbiology* 4, 326. doi:10.3389/fmicb.2013.00326
- Halvorson, A.D., Snyder, C.S., Blaylock, A.D., and Del Grosso, S.J. (2014). Enhanced-efficiency nitrogen fertilizers: Potential role in nitrous oxide emission mitigation. *Agronomy Journal* 106, 715-722. doi:10.2134/agronj2013.0081
- Hastings, R.C., Ceccherini, M.T., Miclaus, N., Saunders, J.R., Bazzicalupo, M., and McCarthy, A.J. (1997). Direct molecular biological analysis of ammonia oxidising bacteria populations in cultivated soil plots treated with swine manure. *FEMS Microbiology Ecology* 23, 45-54. doi:10.1111/j.1574-6941.1997.tb00390.x
- Hayatsu, M., Tago, K., and Saito, M. (2008). Various players in the nitrogen cycle: Diversity and functions of the microorganisms involved in nitrification and denitrification. *Soil Science & Plant Nutrition* 54, 33-45. doi:10.1111/j.1747-0765.2007.00195.x

- Hayden, H.L., Mele, P.M., Bougoure, D.S., Allan, C.Y., Norng, S., Piceno, Y.M., et al. (2012). Changes in the microbial community structure of bacteria, archaea and fungi in response to elevated CO₂ and warming in an Australian native grassland soil. *Environmental Microbiology* 14, 3081-3096. doi:10.1111/j.1462-2920.2012.02855.x
- He, J.-Z., Shen, J.-P., Zhang, L.-M., Zhu, Y.-G., Zheng, Y.-M., Xu, M.-G., et al. (2007). Quantitative analyses of the abundance and composition of ammonia-oxidizing bacteria and ammonia-oxidizing archaea of a Chinese upland red soil under long-term fertilization practices. *Environmental Microbiology* 9, 2364-2374. doi:10.1111/j.1462-2920.2007.01358.x
- Henry, S., Baudoin, E., López-Gutiérrez, J.C., Martin-Laurent, F., Brauman, A., and Philippot, L. (2004). Quantification of denitrifying bacteria in soils by *nirK* gene targeted real-time PCR. *Journal of Microbiological Methods* 59, 327-335. doi:10.1016/j.mimet.2004.07.002
- Henry, S., Bru, D., Stres, B., Hallet, S., and Philippot, L. (2006). Quantitative detection of the *nosZ* gene, encoding nitrous oxide reductase, and comparison of the abundances of 16S rRNA, *narG*, *nirK*, and *nosZ* genes in soils. *Applied and Environmental Microbiology* 72, 5181-5189. doi:10.1128/aem.00231-06
- Herold, M.B., Baggs, E.M., and Daniell, T.J. (2012). Fungal and bacterial denitrification are differently affected by long-term pH amendment and cultivation of arable soil. *Soil Biology and Biochemistry* 54, 25-35. doi:10.1016/j.soilbio.2012.04.031
- Hesselsoe, M., Fureder, S., Schloter, M., Bodrossy, L., Iversen, N., Roslev, P., et al. (2009). Isotope array analysis of Rhodocyclales uncovers functional redundancy and versatility in an activated sludge. *ISME J* 3, 1349-1364. doi:10.1038/ismej.2009.78
- Higgins, S.A., Welsh, A., Orellana, L.H., Konstantinidis, K.T., Chee-Sanford, J.C., Sanford, R.A., et al. (2016). Detection and diversity of fungal nitric oxide reductase genes (*p450nor*) in agricultural soils. *Applied and Environmental Microbiology* 82, 2919-2928. doi:10.1128/AEM.00243-16
- Hink, L., Nicol, G.W., and Prosser, J.I. (2016). Archaea produce lower yields of N₂O than bacteria during aerobic ammonia oxidation in soil. *Environmental Microbiology*. doi:10.1111/1462-2920.13282
- Hothorn, T.H., Hornik, K., Van De Wiel, M.A., and Zeileis, A. (2008). Implementing a class of permutation tests: the coin package. *Journal of Statistical Software* 28, 1-23. doi:10.18637/jss.v028.i08
- Hu, H.-W., Chen, D., and He, J.-Z. (2015). Microbial regulation of terrestrial nitrous oxide formation: understanding the biological pathways for prediction of emission rates. *FEMS Microbiology Reviews* 39, 729-749. doi:10.1093/femsre/fuv021
- Hu, J., Lin, X., Wang, J., Dai, J., Chen, R., Zhang, J., et al. (2011). Microbial functional diversity, metabolic quotient, and invertase activity of a sandy loam soil as affected by long-term application of organic amendment and mineral fertilizer. *Journal of Soils and Sediments* 11, 271-280. doi:10.1007/s11368-010-0308-1
- Huang, N., Wang, W., Yao, Y., Zhu, F., Wang, W., and Chang, X. (2017). The influence of different concentrations of bio-organic fertilizer on cucumber Fusarium wilt and soil microflora alterations. *PLoS ONE* 12, e0171490. doi:10.1371/journal.pone.0171490
- Huang, W., Bai, Z., Hoefel, D., Hu, Q., Lv, X., Zhuang, G., et al. (2012). Effects of cotton straw amendment on soil fertility and microbial communities. *Frontiers of Environmental Science & Engineering* 6, 336-349. doi:10.1007/s11783-011-0337-z
- Huson, D.H., and Weber, N. (2013). "Chapter twenty-one - microbial community analysis using MEGAN," in *Methods in Enzymology*, ed. E.F. Delong (Amsterdam; Boston: Elsevier/Academic Press), 465-485. doi:10.1016/B978-0-12-407863-5.00021-6
- Hutchinson, G.L., and Mosier, A.R. (1981). Improved soil cover method for field measurement of nitrous oxide fluxes. *Soil Science Society of America Journal* 45, 311-316. doi:10.2136/sssaj1981.03615995004500020017x
- Ihara, H., Hori, T., Aoyagi, T., Takasaki, M., and Katayama, Y. (2017). Sulfur-oxidizing bacteria mediate microbial community succession and element cycling in launched marine sediment. *Frontiers in Microbiology* 8, 152. doi:10.3389/fmicb.2017.00152
- IPCC (2013). Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf
- Islam, M.S., Zhang, Y., Mcphedran, K.N., Liu, Y., and Gamal El-Din, M. (2015). Next-generation pyrosequencing analysis of microbial biofilm communities on granular activated carbon in treatment of oil sands process-affected water. *Applied and Environmental Microbiology* 81, 4037-4048. doi:10.1128/aem.04258-14
- Jantalia, C.P., Dos Santos, H.P., Urquiaga, S., Boddey, R.M., and Alves, B.J.R. (2008). Fluxes of nitrous oxide from soil under different crop rotations and tillage systems in the south of Brazil. *Nutrient Cycling in Agroecosystems* 82, 161-173. doi:10.1007/s10705-008-9178-y

- Jemai, I., Ben Aissa, N., Ben Guirat, S., Ben-Hammouda, M., and Gallali, T. (2013). Impact of three and seven years of no-tillage on the soil water storage, in the plant root zone, under a dry subhumid Tunisian climate. *Soil and Tillage Research* 126, 26-33. doi:10.1016/j.still.2012.07.008
- Jombart, T., Devillard, S., and Balloux, F. (2010). Discriminant analysis of principal components: a new method for the analysis of genetically structured populations. *BMC Genetics* 11, 94. doi:10.1186/1471-2156-11-94
- Jones, C.M., Graf, D.R.H., Bru, D., Philippot, L., and Hallin, S. (2013). The unaccounted yet abundant nitrous oxide-reducing microbial community: a potential nitrous oxide sink. *ISME J* 7, 417-426. doi:10.1038/ismej.2012.125
- Jones, R.T. (2015). "A comprehensive survey of soil rhizobiales diversity using high-throughput DNA sequencing," in *Biological Nitrogen Fixation*: John Wiley & Sons, Inc), 769-776. doi:10.1002/9781119053095.ch76
- Joo, H.-S., Hirai, M., and Shoda, M. (2005). Characteristics of ammonium removal by heterotrophic nitrification-aerobic denitrification by Alcaligenes faecalis No. 4. *Journal of Bioscience and Bioengineering* 100, 184-191. doi:10.1263/jbb.100.184
- Kamphake, L.J., Hannah, S.A., and Cohen, J.M. (1967). Automated analysis for nitrate by hydrazine reduction. *Water Research* 1, 205-216. doi:10.1016/0043-1354(67)90011-5
- Karhu, K., Auffret, M.D., Dungait, J.a.J., Hopkins, D.W., Prosser, J.I., Singh, B.K., et al. (2014). Temperature sensitivity of soil respiration rates enhanced by microbial community response. *Nature* 513, 81-84. doi:10.1038/nature13604
- Kielak, A.M., Barreto, C.C., Kowalchuk, G.A., Van Veen, J.A., and Kuramae, E.E. (2016a). The ecology of acidobacteria: Moving beyond genes and genomes. *Frontiers in Microbiology* 7, 744. doi:10.3389/fmicb.2016.00744
- Kielak, A.M., Scheublin, T.R., Mendes, L.W., Van Veen, J.A., and Kuramae, E.E. (2016b). Bacterial community succession in pine-wood decomposition. *Frontiers in Microbiology* 7, 231. doi:10.3389/fmicb.2016.00231
- Kindt, R., and Kindt, M.R. (2015). Package 'BiodiversityR'.
- Kinnunen, M., Dechesne, A., Proctor, C., Hammes, F., Johnson, D., Quintela-Baluja, M., et al. (2016). A conceptual framework for invasion in microbial communities. *ISME J* 10, 2773-2775. doi:10.1038/ismej.2016.75
- Krom, M.D. (1980). Spectrophotometric determination of ammonia: a study of a modified Berthelot reaction using salicylate and dichloroisocyanurate. *Analyst* 105, 305-316. doi:10.1039/AN9800500305
- Kumar, R., Verma, D., Singh, B.L., Kumar, U., and Shweta (2010). Composting of sugar-cane waste by-products through treatment with microorganisms and subsequent vermicomposting. *Bioresource Technology* 101, 6707-6711. doi:10.1016/j.biortech.2010.03.111
- Kumar, S., Stecher, G., and Tamura, K. (2016). MEGA7: Molecular evolutionary genetics analysis version 7.0 for bigger datasets. *Molecular Biology and Evolution* 33, 1870-1874. doi:10.1093/molbev/msw054
- Kuramae, E., Gamper, H., Van Veen, J., and Kowalchuk, G. (2011). Soil and plant factors driving the community of soil-borne microorganisms across chronosequences of secondary succession of chalk grasslands with a neutral pH. *FEMS Microbiology Ecology* 77, 285-294. doi:10.1111/j.1574-6941.2011.01110.x
- Kuramae, E.E., Hillekens, R.H.E., De Hollander, M., Van Der Heijden, M.G.A., Van Den Berg, M., Van Straalen, N.M., et al. (2013). Structural and functional variation in soil fungal communities associated with litter bags containing maize leaf. *FEMS Microbiology Ecology* 84, 519-531. doi:10.1111/1574-6941.12080
- Kuramae, E.E., Yergeau, E., Wong, L.C., Pijl, A.S., Veen, J.A., and Kowalchuk, G.A. (2012). Soil characteristics more strongly influence soil bacterial communities than land-use type. *FEMS Microbiology Ecology* 79, 12-24. doi:10.1111/j.1574-6941.2011.01192.x
- Landell, M.G.D.A., Scarpari, M.S., Xavier, M.A., Anjos, I.a.D., Baptista, A.S., Aguiar, C.L.D., et al. (2013). Residual biomass potential of commercial and pre-commercial sugarcane cultivars. *Scientia Agricola* 70, 299-304. doi:10.1590/s0103-90162013000500003
- Landesman, W.J., and Dighton, J. (2010). Response of soil microbial communities and the production of plant-available nitrogen to a two-year rainfall manipulation in the New Jersey Pinelands. *Soil Biology and Biochemistry* 42, 1751-1758. doi:10.1016/j.soilbio.2010.06.012
- Lauber, C.L., Strickland, M.S., Bradford, M.A., and Fierer, N. (2008). The influence of soil properties on the structure of bacterial and fungal communities across land-use types. *Soil Biology and Biochemistry* 40, 2407-2415. doi:10.1016/j.soilbio.2008.05.021

- Law, Y., Ni, B.-J., Lant, P., and Yuan, Z. (2012). N₂O production rate of an enriched ammonia-oxidising bacteria culture exponentially correlates to its ammonia oxidation rate. *Water Research* 46, 3409-3419. doi:10.1016/j.watres.2012.03.043
- Leal, M.R.L.V., Galdos, M.V., Scarpone, F.V., Seabra, J.E.A., Walter, A., and Oliveira, C.O.F. (2013). Sugarcane straw availability, quality, recovery and energy use: A literature review. *Biomass and Bioenergy* 53, 11-19. doi:10.1016/j.biombioe.2013.03.007
- Leite, M.F.A., Pan, Y., Bloem, J., Berge, H.T., and Kuramae, E.E. (2017). Organic nitrogen rearranges both structure and activity of the soil-borne microbial seedbank. *Scientific Reports* 7, 42634. doi:10.1038/srep42634
- Letunic, I., and Bork, P. (2016). Interactive tree of life (iTOL) v3: an online tool for the display and annotation of phylogenetic and other trees. *Nucleic Acids Research* 44, W242-W245. doi:10.1093/nar/gkw290
- Levine, J.M., and D'antonio, C.M. (1999). Elton revisited: A review of evidence linking diversity and invasibility. *Oikos* 87, 15-26. doi:10.2307/3546992
- Li, L.-J., You, M.-Y., Shi, H.-A., Ding, X.-L., Qiao, Y.-F., and Han, X.-Z. (2013). Soil CO₂ emissions from a cultivated Mollisol: Effects of organic amendments, soil temperature, and moisture. *European Journal of Soil Biology* 55, 83-90. doi:10.1016/j.ejsobi.2012.12.009
- Liang, L.L., Eberwein, J.R., Allsman, L.A., Grantz, D.A., and Jenerette, G.D. (2015). Regulation of CO₂ and N₂O fluxes by coupled carbon and nitrogen availability. *Environmental Research Letters* 10, 034008. doi:10.1088/1748-9326/10/3/034008
- Liang, W., Shi, Y., Zhang, H., Yue, J., and Huang, G.-H. (2007). Greenhouse gas emissions from northeast China rice fields in fallow season. *Pedosphere* 17, 630-638. doi:10.1016/S1002-0160(07)60075-7
- Lipson, D.A. (2007). Relationships between temperature responses and bacterial community structure along seasonal and altitudinal gradients. *FEMS Microbiology Ecology* 59, 418-427. doi:10.1111/j.1574-6941.2006.00240.x
- Lisboa, C.C., Butterbach-Bahl, K., Mauder, M., and Kiese, R. (2011). Bioethanol production from sugarcane and emissions of greenhouse gases – known and unknowns. *GCB Bioenergy* 3, 277-292. doi:10.1111/j.1757-1707.2011.01095.x
- Long, A., Song, B., Fridley, K., and Silva, A. (2015). Detection and diversity of copper containing nitrite reductase genes (*nirK*) in prokaryotic and fungal communities of agricultural soils. *FEMS Microbiology Ecology* 91, 1-9. doi:10.1093/femsec/fiu004
- Lourenço, K.S., Dimitrov, M.R., Pijl, A., Soares, J.R., Carmo, J.B., Van Veen, J.A., et al. (2018). Dominance of bacterial ammonium-oxidizer and fungal denitrifier in the complex pathway of Nitrogen cycle. *GCB Bioenergy*
- Ludwig, J.A., and Reynolds, J.F. (1988). *Statistical ecology : A primer on methods and computing*. New York: John Wiley and Sons.
- Lupatini, M., Jacques, R.J.S., Antoniolli, Z.I., Suleiman, A.K.A., Fulthorpe, R.R., and Roesch, L.F.W. (2013a). Land-use change and soil type are drivers of fungal and archaeal communities in the Pampa biome. *World Journal of Microbiology and Biotechnology* 29, 223-233. doi:10.1007/s11274-012-1174-3
- Lupatini, M., Korthals, G.W., De Hollander, M., Janssens, T.K.S., and Kuramae, E.E. (2017). Soil microbiome is more heterogeneous in organic than in conventional farming system. *Frontiers in Microbiology* 7. doi:10.3389/fmicb.2016.02064
- Lupatini, M., Suleiman, A.K.A., Jacques, R.J.S., Antoniolli, Z.I., Kuramae, E.E., De Oliveira Camargo, F.A., et al. (2013b). Soil-borne bacterial structure and diversity does not reflect community activity in Pampa biome. *PLOS ONE* 8, e76465. doi:10.1371/journal.pone.0076465
- Ma, W.K., Bedard-Haughn, A., Siciliano, S.D., and Farrell, R.E. (2008). Relationship between nitrifier and denitrifier community composition and abundance in predicting nitrous oxide emissions from ephemeral wetland soils. *Soil Biology and Biochemistry* 40, 1114-1123. doi:10.1016/j.soilbio.2007.12.004
- Macedo, I.C., Seabra, J.E.A., and Silva, J.E.a.R. (2008). Greenhouse gases emissions in the production and use of ethanol from sugarcane in Brazil: The 2005/2006 averages and a prediction for 2020. *Biomass and Bioenergy* 32, 582-595. doi:10.1016/j.biombioe.2007.12.006
- Maeda, K., Spor, A., Edel-Hermann, V., Heraud, C., Breuil, M.-C., Bizouard, F., et al. (2015). N₂O production, a widespread trait in fungi. *Scientific Reports* 5, 9697. doi:10.1038/srep09697
- Mandic-Mulec, I., Stefanic, P., and Van Elsas, J.D. (2016). "Ecology of Bacillaceae," in *Microbiology Spectrum*, ed. P. Eichenberger (New York: New York University), 59-85. doi:10.1128/microbiolspec.TBS-0017-2013
- Mariano, E., Leite, J.M., Vieira-Megda, M.X., Ciampitti, I.A., Vitti, A.C., Faroni, C.E., et al. (2016). Biomass and nutrient content by sugarcane as affected by fertilizer nitrogen sources. *Crop Science* 56, 1234-1244. doi:10.2135/cropsci2015.06.0349

- Martins, C.S.C., Nazaries, L., Macdonald, C.A., Anderson, I.C., and Singh, B.K. (2015). Water availability and abundance of microbial groups are key determinants of greenhouse gas fluxes in a dryland forest ecosystem. *Soil Biology and Biochemistry* 86, 5-16. doi:10.1016/j.soilbio.2015.03.012
- Masella, A.P., Bartram, A.K., Truszkowski, J.M., Brown, D.G., and Neufeld, J.D. (2012). PANDAseq: paired-end assembler for illumina sequences. *BMC Bioinformatics* 13, 31. doi:10.1186/1471-2105-13-31
- Mathieu, O., Hénault, C., Lévêque, J., Baujard, E., Milloux, M.J., and Andreux, F. (2006). Quantifying the contribution of nitrification and denitrification to the nitrous oxide flux using ¹⁵N tracers. *Environmental Pollution* 144, 933-940. doi:10.1016/j.envpol.2006.02.005
- Mcmurdie, P.J., and Holmes, S. (2013). phyloseq: an R package for reproducible interactive analysis and graphics of microbiome census data.
- Meinicke, P. (2015). UProC: tools for ultra-fast protein domain classification. *Bioinformatics* 31, 1382-1388. doi:10.1093/bioinformatics/btu843
- Mello, B.L., Alessi, A.M., Mcqueen-Mason, S., Bruce, N.C., and Polikarpov, I. (2016). Nutrient availability shapes the microbial community structure in sugarcane bagasse compost-derived consortia. *Scientific Reports* 6. doi:10.1038/srep38781
- Menandro, L.M.S., Cantarella, H., Franco, H.C.J., Kölln, O.T., Pimenta, M.T.B., Sanches, G.M., et al. (2017). Comprehensive assessment of sugarcane straw: implications for biomass and bioenergy production. *Biofuels, Bioproducts and Biorefining* 11, 488-504. doi:10.1002/bbb.1760
- Mendes, L.W., De Lima Brossi, M.J., Kuramae, E.E., and Tsai, S.M. (2015a). Land-use system shapes soil bacterial communities in southeastern Amazon region. *Applied Soil Ecology* 95, 151-160. doi:10.1016/j.apsoil.2015.06.005
- Mendes, L.W., Kuramae, E.E., Navarrete, A.A., Van Veen, J.A., and Tsai, S.M. (2014). Taxonomical and functional microbial community selection in soybean rhizosphere. *The Isme Journal* 8, 1577. doi:10.1038/ismej.2014.17
- Mendes, L.W., Tsai, S.M., Navarrete, A.A., De Hollander, M., Van Veen, J.A., and Kuramae, E.E. (2015b). Soil-borne microbiome: Linking diversity to function. *Microbial Ecology* 70, 255-265. doi:10.1007/s00248-014-0559-2
- Meyer, F., Paarmann, D., D'souza, M., Olson, R., Glass, E.M., Kubal, M., et al. (2008). The metagenomics RAST server - a public resource for the automatic phylogenetic and functional analysis of metagenomes. *BMC Bioinformatics* 9, 386. doi:10.1186/1471-2105-9-386
- Moraes, B.S., Zaiat, M., and Bonomi, A. (2015). Anaerobic digestion of vinasse from sugarcane ethanol production in Brazil: Challenges and perspectives. *Renewable and Sustainable Energy Reviews* 44, 888-903. doi:10.1016/j.rser.2015.01.023
- Morais, R.F.D., Boddey, R.M., Urquiaga, S., Jantalia, C.P., and Alves, B.J.R. (2013). Ammonia volatilization and nitrous oxide emissions during soil preparation and N fertilization of elephant grass (*Pennisetum purpureum* Schum.). *Soil Biology and Biochemistry* 64, 80-88. doi:10.1016/j.soilbio.2013.04.007
- Moran, M. (2009). Metatranscriptomics: Eavesdropping on complex microbial communities. *Microbe Magazine* 4, 329-334. doi:10.1128/microbe.4.329.1
- Morton, J.T., Sanders, J., Quinn, R.A., McDonald, D., Gonzalez, A., Vázquez-Baeza, Y., et al. (2017). Balance trees reveal microbial niche differentiation. *mSystems* 2, e00162-00116. doi:10.1128/mSystems.00162-16
- Mothapo, N., Chen, H., Cubeta, M.A., Grossman, J.M., Fuller, F., and Shi, W. (2015). Phylogenetic, taxonomic and functional diversity of fungal denitrifiers and associated N₂O production efficacy. *Soil Biology and Biochemistry* 83, 160-175. doi:10.1016/j.soilbio.2015.02.001
- Muangthong, A., Youpensuk, S., and Rerkasem, B. (2015). Isolation and characterisation of endophytic nitrogen fixing bacteria in sugarcane. *Tropical Life Sciences Research* 26, 41-51.
- Mutton, M.A., Rossetto, R., and Mutton, M.J.R. (2014). "Agricultural use of stillage," in *Sugarcane bioethanol — R&D for Productivity and Sustainability*, ed. L.a.B. Cortez (São Paulo: Edgard Blücher), 423-440. doi:10.5151/BlucherOA-Sugarcane-SUGARCANEBIOETHANOL_40
- Navarrete, A.A., Diniz, T.R., Braga, L.P., Silva, G.G.Z., Franchini, J.C., Rossetto, R., et al. (2015a). Multi-analytical approach reveals potential microbial indicators in soil for sugarcane model systems. *PLOS ONE* 10, e0129765. doi:10.1371/journal.pone.0129765
- Navarrete, A.A., Soares, T., Rossetto, R., Van Veen, J.A., Tsai, S.M., and Kuramae, E.E. (2015b). Verrucomicrobial community structure and abundance as indicators for changes in chemical factors linked to soil fertility. *Antonie Van Leeuwenhoek* 108, 741-752. doi:10.1007/s10482-015-0530-3
- Navarro-Noya, Y.E., Gómez-Acata, S., Montoya-Ciriaco, N., Rojas-Valdez, A., Suárez-Arriaga, M.C., Valenzuela-Encinas, C., et al. (2013). Relative impacts of tillage, residue management and

- crop-rotation on soil bacterial communities in a semi-arid agroecosystem. *Soil Biology and Biochemistry* 65, 86-95. doi:10.1016/j.soilbio.2013.05.009
- Nelson, M.B., Martiny, A.C., and Martiny, J.B.H. (2016). Global biogeography of microbial nitrogen-cycling traits in soil. *Proceedings of the National Academy of Sciences* 113, 8033-8040. doi:10.1073/pnas.1601070113
- Németh, D.D., Wagner-Riddle, C., and Dunfield, K.E. (2014). Abundance and gene expression in nitrifier and denitrifier communities associated with a field scale spring thaw N₂O flux event. *Soil Biology and Biochemistry* 73, 1-9. doi:10.1016/j.soilbio.2014.02.007
- Nicol, G.W., Leininger, S., Schleper, C., and Prosser, J.I. (2008). The influence of soil pH on the diversity, abundance and transcriptional activity of ammonia oxidizing archaea and bacteria. *Environmental Microbiology* 10, 2966-2978. doi:10.1111/j.1462-2920.2008.01701.x
- Norton, J.M., Alzerreca, J.J., Suwa, Y., and Klotz, M.G. (2002). Diversity of ammonia monooxygenase operon in autotrophic ammonia-oxidizing bacteria. *Archives of Microbiology* 177, 139-149. doi:10.1007/s00203-001-0369-z
- Oksanen, J., Blanchet, F.G., Friendly, M., Kindt, R., Legendre, P., McGlinn, D., et al. (2017). Vegan: Community ecology package. R package version 2.4-4 <https://cran.r-project.org/web/packages/vegan/vegan.pdf>.
- Oksanen, J., Blanchet, F.G., Kindt, R., Legendre, P., Minchin, P.R., O'hara, R., et al. (2015). Package 'vegan'. *Community ecology package, version, 2.2-1*.
- Oliveira, M.W.D., Trivelin, P.C.O., Penatti, C.P., and Piccolo, M.D.C. (1999). Decomposição e liberação de nutrientes da palhada de cana-de-açúcar em campo. *Pesquisa Agropecuária Brasileira* 34, 2359-2362.
- Orellana, L.H., Rodriguez-R, L.M., Higgins, S., Chee-Sanford, J.C., Sanford, R.A., Ritalahti, K.M., et al. (2014). Detecting nitrous oxide reductase (*nosZ*) genes in soil metagenomes: method development and implications for the nitrogen cycle. *mBio* 5, e01193-01114-e01193-01114. doi:10.1128/mBio.01193-14
- Oren, A., and Xu, X.-W. (2014). "The Family Hyphomicrobiaceae," in *The Prokaryotes: Alphaproteobacteria and Betaproteobacteria*, eds. E. Rosenberg, E.F. Delong, S. Lory, E. Stackebrandt & F. Thompson (Berlin, Heidelberg: Springer Berlin Heidelberg), 247-281. doi:10.1007/978-3-642-30197-1_257
- Orlando, J., Carú, M., Pommerenke, B., and Braker, G. (2012). Diversity and activity of denitrifiers of Chilean arid soil ecosystems. *Frontiers in Microbiology* 3. doi:10.3389/fmicb.2012.00101
- Osborne, M.R., Presnell, B., and Turlach, B.A. (2000). On the LASSO and its Dual. *Journal of Computational and Graphical Statistics* 9, 319-337. doi:10.1080/10618600.2000.10474883
- Otto, R., Castro, S.a.Q., Mariano, E., Castro, S.G.Q., Franco, H.C.J., and Trivelin, P.C.O. (2016). Nitrogen use efficiency for sugarcane-biofuel production: What is next? *BioEnergy Research*, 1-18. doi:10.1007/s12155-016-9763-x
- Ouellette, M.-H., Legendre, P., and Borcard, D. (2012). Cascade multivariate regression tree: a novel approach for modelling nested explanatory sets. *Methods in Ecology and Evolution* 3, 234-244. doi:10.1111/j.2041-210X.2011.00171.x
- Ouyang, Y., Norton, J.M., Stark, J.M., Reeve, J.R., and Habteselassie, M.Y. (2016). Ammonia-oxidizing bacteria are more responsive than archaea to nitrogen source in an agricultural soil. *Soil Biology and Biochemistry* 96, 4-15. doi:10.1016/j.soilbio.2016.01.012
- Oved, T., Shavit, A., Goldrath, T., Mandelbaum, R.T., and Minz, D. (2001). Influence of effluent irrigation on community composition and function of ammonia-oxidizing bacteria in soil. *Applied and Environmental Microbiology* 67, 3426-3433. doi:10.1128/AEM.67.8.3426-3433.2001
- Pajarillo, E.a.B., Chae, J.P., Balolong, M.P., Kim, H.B., Seo, K.-S., and Kang, D.-K. (2014). Pyrosequencing-based analysis of fecal microbial communities in three purebred pig lines. *Journal of Microbiology* 52, 646-651. doi:10.1007/s12275-014-4270-2
- Pan, Y., Cassman, N., De Hollander, M., Mendes, L.W., Korevaar, H., Geerts, R.H.E.M., et al. (2014). Impact of long-term N, P, K, and NPK fertilization on the composition and potential functions of the bacterial community in grassland soil. *FEMS Microbiology Ecology* 90, 195-205. doi:10.1111/1574-6941.12384
- Paredes, D.S., Alves, B.J.R., Dos Santos, M.A., Bolonhezi, D., Sant'anna, S.a.C., Urquiaga, S., et al. (2015). Nitrous oxide and methane fluxes following ammonium sulfate and vinasse application on sugar cane soil. *Environmental Science & Technology* 49, 11209-11217. doi:10.1021/acs.est.5b01504
- Paredes, D.S., Lessa, A.C.R., De Sant'anna, S.a.C., Boddey, R.M., Urquiaga, S., and Alves, B.J.R. (2014). Nitrous oxide emission and ammonia volatilization induced by vinasse and N fertilizer application in a sugarcane crop at Rio de Janeiro, Brazil. *Nutrient Cycling in Agroecosystems* 98, 41-55. doi:10.1007/s10705-013-9594-5

- Parks, D., and Beiko, R. (2013). "STAMP: Statistical Analysis of Metagenomic Profiles," in *Encyclopedia of Metagenomics*, ed. K.E. Nelson (New York, NY: Springer New York), 1-6. doi:10.1007/978-1-4614-6418-1_780-1
- Parnaudeau, V., Condom, N., Oliver, R., Cazeveille, P., and Recous, S. (2008). Vinasse organic matter quality and mineralization potential, as influenced by raw material, fermentation and concentration processes. *Bioresource Technology* 99, 1553-1562. doi:10.1016/j.biortech.2007.04.012
- Peres-Neto, P.R., and Jackson, D.A. (2001). How well do multivariate data sets match? The advantages of a Procrustean superimposition approach over the Mantel test. *Oecologia* 129, 169-178. doi:10.1007/s004420100720
- Phan, H.V., Hai, F.I., Zhang, R., Kang, J., Price, W.E., and Nghiem, L.D. (2016). Bacterial community dynamics in an anoxic-aerobic membrane bioreactor – Impact on nutrient and trace organic contaminant removal. *International Biodeterioration & Biodegradation* 109, 61-72. doi:10.1016/j.ibiod.2016.01.002
- Philippot, L., Hallin, S., and Schloter, M. (2007). Ecology of denitrifying prokaryotes in agricultural soil. *Advances in Agronomy Volume* 96, 249-305. doi:10.1016/S0065-2113(07)96003-4
- Phillips, C.J., Harris, D., Dollhopf, S.L., Gross, K.L., Prosser, J.I., and Paul, E.A. (2000). Effects of agronomic treatments on structure and function of ammonia-oxidizing communities. *Applied and Environmental Microbiology* 66, 5410-5418. doi:10.1128/AEM.66.12.5410-5418.2000
- Phillips, L.A., Scheife, C.R., Friedman, M., O'halloran, N., Armstrong, R.D., and Mele, P.M. (2015). Organic nitrogen cycling microbial communities are abundant in a dry Australian agricultural soil. *Soil Biology and Biochemistry* 86, 201-211. doi:10.1016/j.soilbio.2015.04.004
- Phillips, R.L., Song, B., McMillan, A.M.S., Grelet, G., Weir, B.S., Palmada, T., et al. (2016). Chemical formation of hybrid di-nitrogen calls fungal codenitrification into question. *Scientific Reports* 6, 39077. doi:10.1038/srep39077
- Pierre, W.H. (1928). Nitrogenous fertilizers and soil acidity. I. Effect of various nitrogenous fertilizers on soil reaction. *Journal of the American Society of Agronomy* 20, 254-269.
- Pitombo, L.M., Do Carmo, J.B., De Hollander, M., Rossetto, R., López, M.V., Cantarella, H., et al. (2015). Exploring soil microbial 16S rRNA sequence data to increase carbon yield and nitrogen efficiency of a bioenergy crop. *GCB Bioenergy* 8, 867-879. doi:10.1111/gcbb.12284
- Pommerening-Röser, A., and Koops, H.-P. (2005). Environmental pH as an important factor for the distribution of urease positive ammonia-oxidizing bacteria. *Microbiological Research* 160, 27-35. doi:10.1016/j.micres.2004.09.006
- Prevost-Boure, N.C., Maron, P.-A., Ranjard, L., Nowak, V., Dufrene, E., Damesin, C., et al. (2011). Seasonal dynamics of the bacterial community in forest soils under different quantities of leaf litter. *Applied Soil Ecology* 47, 14-23. doi:10.1016/j.apsoil.2010.11.006
- Prosser, J.I., Head, I.M., and Stein, L.Y. (2014). "The family *Nitrosomonadaceae*," in *The prokaryotes: Alphaproteobacteria and Betaproteobacteria*, eds. E. Rosenberg, E.F. Delong, S. Lory, E. Stackebrandt & F. Thompson (Berlin, Heidelberg: Springer Berlin Heidelberg), 901-918. doi:10.1007/978-3-642-30197-1_372
- Rachid, C.T.C.C., Pires, C.A., Leite, D.C.A., Coutinho, H.L.C., Peixoto, R.S., Rosado, A.S., et al. (2016). Sugarcane trash levels in soil affects the fungi but not bacteria in a short-term field experiment. *Brazilian Journal of Microbiology* 47, 322-326.
- Ramirez, K.S., Craine, J.M., and Fierer, N. (2012). Consistent effects of nitrogen amendments on soil microbial communities and processes across biomes. *Global Change Biology* 18, 1918-1927. doi:10.1111/j.1365-2486.2012.02639.x
- Rao, C.R. (1964). The use and interpretation of principal component analysis in applied research. *Sankhyā: The Indian Journal of Statistics* 26, 329-358.
- Ravishankara, A.R., Daniel, J.S., and Portmann, R.W. (2009). Nitrous Oxide (N₂O): The dominant ozone-depleting substance emitted in the 21st century. *Science* 326, 123-125. doi:10.1126/science.1176985
- Regina, K., Nykänen, H., Silvola, J., and Martikainen, P.J. (1996). Fluxes of nitrous oxide from boreal peatlands as affected by peatland type, water table level and nitrification capacity. *Biogeochemistry* 35, 401-418. doi:10.1007/bf02183033
- Renault, P., Cazeveille, P., Verdier, J., Lahlah, J., Clara, C., and Favre, F. (2009). Variations in the cation exchange capacity of a ferralsol supplied with vinasse, under changing aeration conditions. *Geoderma* 154, 101-110. doi:10.1016/j.geoderma.2009.10.003
- Ritchie, G.a.F., and Nicholas, D.J.D. (1972). Identification of the sources of nitrous oxide produced by oxidative and reductive processes in *Nitrosomonas europaea*. *Biochemical Journal* 126, 1181-1191. doi:10.1042/bj1261181
- Rodrigues Reis, C.E., and Hu, B. (2017). Vinasse from sugarcane ethanol production: better treatment or better utilization? *Frontiers in Energy Research* 5. doi:10.3389/fenrg.2017.00007

- Rossetto, R., Dias, F., Landell, M., Cantarella, H., Tavares, S., Vitti, A., et al. (2010). N and K fertilisation of sugarcane ratoons harvested without burning. *Proc Int Soc Sugar Cane Technol* 27, 1-8.
- Rothauwe, J.H., Witzel, K.P., and Liesack, W. (1997). The ammonia monooxygenase structural gene amoA as a functional marker: molecular fine-scale analysis of natural ammonia-oxidizing populations. *Applied and Environmental Microbiology* 63, 4704-4712.
- Rousk, J., and Bengtson, P. (2014). Microbial regulation of global biogeochemical cycles. *Frontiers in Microbiology* 5, 103. doi:10.3389/fmicb.2014.00103
- Rykiel, E.J. (1985). Towards a definition of ecological disturbance. *Australian Journal of Ecology* 10, 361-365. doi:10.1111/j.1442-9993.1985.tb00897.x
- Saarenheimo, J., Tiirila, M.A., and Rissanen, A.J. (2015). Functional gene pyrosequencing reveals core proteobacterial denitrifiers in boreal lakes. *Frontiers in Microbiology* 6. doi:10.3389/fmicb.2015.00674
- Sacco, L.P., Castellane, T.C.L., Lopes, E.M., De Macedo Lemos, E.G., and Alves, L.M.C. (2016). Properties of polyhydroxyalkanoate granules and bioemulsifiers from *Pseudomonas* sp. and *Burkholderia* sp. isolates growing on glucose. *Applied Biochemistry and Biotechnology* 178, 990-1001. doi:10.1007/s12010-015-1923-5
- Sait, M., Davis, K.E.R., and Janssen, P.H. (2006). Effect of pH on Isolation and Distribution of Members of Subdivision 1 of the Phylum Acidobacteria Occurring in Soil. *Applied and Environmental Microbiology* 72, 1852-1857. doi:10.1128/aem.72.3.1852-1857.2006
- Saitou, N., and Nei, M. (1987). The neighbor-joining method: a new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* 4, 406-425. doi:10.1093/oxfordjournals.molbev.a040454
- Salvetti, E., Torriani, S., and Felis, G.E. (2012). The Genus *Lactobacillus*: A Taxonomic Update. *Probiotics and Antimicrobial Proteins* 4, 217-226. doi:10.1007/s12602-012-9117-8
- Samad, M.S., Biswas, A., Bakken, L.R., Clough, T.J., De Klein, C.a.M., Richards, K.G., et al. (2016). Phylogenetic and functional potential links pH and N₂O emissions in pasture soils. *Scientific Reports* 6. doi:10.1038/srep35990
- Schimel, J. (1995). "Ecosystem consequences of microbial diversity and community structure," in *Arctic and Alpine biodiversity: patterns, causes and ecosystem consequences*, eds. F.S. Chapin & C. Körner (Berlin, Heidelberg: Springer Berlin Heidelberg), 239-254. doi:10.1007/978-3-642-78966-3_17
- Schloss, P.D., Westcott, S.L., Ryabin, T., Hall, J.R., Hartmann, M., Hollister, E.B., et al. (2009). Introducing mothur: open-source, platform-independent, community-supported software for describing and comparing microbial communities. *Applied and Environmental Microbiology* 75, 7537-7541. doi:10.1128/aem.01541-09
- Scotti, R., Bonanomi, G., Scelza, R., Zoina, A., and Rao, M.A. (2015). Organic amendments as sustainable tool to recovery fertility in intensive agricultural systems. *Journal of soil science and plant nutrition* 15, 333-352. doi:10.4067/S0718-95162015005000031
- Seabra, J.E.A., Macedo, I.C., Chum, H.L., Faroni, C.E., and Sarto, C.A. (2011). Life cycle assessment of Brazilian sugarcane products: GHG emissions and energy use. *Biofuels, Bioproducts and Biorefining* 5, 519-532. doi:10.1002/bbb.289
- Segata, N., Izard, J., Waldron, L., Gevers, D., Miropolsky, L., Garrett, W.S., et al. (2011). Metagenomic biomarker discovery and explanation. *Genome Biology* 12, R60. doi:10.1186/gb-2011-12-6-r60
- Sengupta, A., and Dick, W.A. (2015). Bacterial community diversity in soil under two tillage practices as determined by pyrosequencing. *Microbial Ecology* 70, 853-859. doi:10.1007/s00248-015-0609-4
- Shade, A., Peter, H., Allison, S., Bahlo, D., Berga, M., Buergmann, H., et al. (2012). Fundamentals of microbial community resistance and resilience. *Frontiers in Microbiology* 3, 417. doi:doi: 10.3389/fmicb.2012.00417
- Sharmin, F., Wakelin, S., Huygens, F., and Hargreaves, M. (2013). Firmicutes dominate the bacterial taxa within sugar-cane processing plants. *Scientific Reports* 3, 3107. doi:10.1038/srep03107
- Shaw, L.J., Nicol, G.W., Smith, Z., Fear, J., Prosser, J.I., and Baggs, E.M. (2006). Nitrosospira spp. can produce nitrous oxide via a nitrifier denitrification pathway. *Environmental Microbiology* 8, 214-222. doi:10.1111/j.1462-2920.2005.00882.x
- Shoun, H., Fushinobu, S., Jiang, L., Kim, S.-W., and Wakagi, T. (2012). Fungal denitrification and nitric oxide reductase cytochrome P450nor. *Philosophical Transactions of the Royal Society B: Biological Sciences* 367, 1186-1194. doi:10.1098/rstb.2011.0335
- Shoun, H., Kim, D.-H., Uchiyama, H., and Sugiyama, J. (1992). Denitrification by fungi. *FEMS Microbiology Letters* 94, 277-281. doi:10.1016/0378-1097(92)90643-3

- Sidhu, C., Vikram, S., and Pinnaka, A.K. (2017). Unraveling the Microbial Interactions and Metabolic Potentials in Pre- and Post-treated Sludge from a Wastewater Treatment Plant Using Metagenomic Studies. *Frontiers in Microbiology* 8. doi:10.3389/fmicb.2017.01382
- Silva, A.D., Rossetto, R., Bonnecine, J., Piemonte, M., and Muraoka, T. (2013). Net and potential nitrogen mineralization in soil with sugarcane vinasse. *Sugar Tech* 15, 159-164. doi:10.1007/s12355-012-0199-0
- Silva, A.P.M.D., Bono, J.a.M., and Pereira, F.D.a.R. (2014). Aplicação de vinhaça na cultura da cana-de-açúcar: Efeito no solo e na produtividade de colmos. *Revista Brasileira de Engenharia Agrícola e Ambiental* 18, 38-43. doi:10.1590/s1415-43662014000100006
- Simpson, E.H. (1949). Measurement of diversity. *Nature* 163, 688. doi:10.1038/163688a0
- Siqueira Neto, M., Galdos, M.V., Feigl, B.J., Cerri, C.E.P., and Cerri, C.C. (2016). Direct N₂O emission factors for synthetic N-fertilizer and organic residues applied on sugarcane for bioethanol production in Central-Southern Brazil. *GCB Bioenergy* 8, 269-280. doi:10.1111/gcbb.12251
- Smith, A.P., Marín-Spiotta, E., and Balser, T. (2015). Successional and seasonal variations in soil and litter microbial community structure and function during tropical postagricultural forest regeneration: a multiyear study. *Global Change Biology* 21, 3532-3547. doi:10.1111/gcb.12947
- Smith, P.a.S., and Hein, G.E. (1960). The alleged role of nitroxyl in certain reactions of aldehydes and alkyl halides. *Journal of the American Chemical Society* 82, 5731-5740. doi:10.1021/ja01506a043
- Soares, J.R., Cantarella, H., Vargas, V.P., Carmo, J.B., Martins, A.A., Sousa, R.M., et al. (2015). Enhanced-efficiency fertilizers in nitrous oxide emissions from urea applied to sugarcane. *Journal of Environmental Quality* 44, 423-430. doi:10.2134/jeq2014.02.0096
- Soares, J.R., Cassman, N.A., Kielak, A.M., Pijl, A., Carmo, J.B., Lourenço, K.S., et al. (2016). Nitrous oxide emission related to ammonia-oxidizing bacteria and mitigation options from N fertilization in a tropical soil. *Scientific Reports* 6, 30349. doi:10.1038/srep30349
- Soman, C., Li, D., Wander, M.M., and Kent, A.D. (2016). Long-term fertilizer and crop-rotation treatments differentially affect soil bacterial community structure. *Plant and Soil*, 1-15. doi:10.1007/s11104-016-3083-y
- Spott, O., Russow, R., and Stange, C.F. (2011). Formation of hybrid N₂O and hybrid N₂ due to codenitrification: First review of a barely considered process of microbially mediated N-nitrosation. *Soil Biology and Biochemistry* 43, 1995-2011. doi:10.1016/j.soilbio.2011.06.014
- Sradnick, A., Murugan, R., Oltmanns, M., Raupp, J., and Joergensen, R.G. (2013). Changes in functional diversity of the soil microbial community in a heterogeneous sandy soil after long-term fertilization with cattle manure and mineral fertilizer. *Applied Soil Ecology* 63, 23-28. doi:10.1016/j.apsoil.2012.09.011
- Stark, J.M., and Firestone, M.K. (1995). Mechanisms for soil moisture effects on activity of nitrifying bacteria. *Applied and Environmental Microbiology* 61, 218-221.
- Steenwerth, K.L., Jackson, L.E., Calderón, F.J., Scow, K.M., and Rolston, D.E. (2005). Response of microbial community composition and activity in agricultural and grassland soils after a simulated rainfall. *Soil Biology and Biochemistry* 37, 2249-2262. doi:10.1016/j.soilbio.2005.02.038
- Steenwerth, K.L., Jackson, L.E., Carlisle, E.A., and Scow, K.M. (2006). Microbial communities of a native perennial bunchgrass do not respond consistently across a gradient of land-use intensification. *Soil Biology and Biochemistry* 38, 1797-1811. doi:10.1016/j.soilbio.2005.12.005
- Stein, L.Y. (2011). Heterotrophic nitrification and nitrifier denitrification. *Ward BB, Arp DJ, Klotz MG*, 95-116. doi:10.1128/9781555817145
- Stephen, J.R., McCAIG, A.E., Smith, Z., Prosser, J.I., and Embley, T.M. (1996). Molecular diversity of soil and marine 16S rRNA gene sequences related to beta-subgroup ammonia-oxidizing bacteria. *Applied and Environmental Microbiology* 62, 4147-4154.
- Stevens, R.J., and Laughlin, R.J. (1998). Measurement of nitrous oxide and di-nitrogen emissions from agricultural soils. *Nutrient Cycling in Agroecosystems* 52, 131-139. doi:10.1023/a:1009715807023
- Strickland, M.S., Lauber, C., Fierer, N., and Bradford, M.A. (2009). Testing the functional significance of microbial community composition. *Ecology* 90, 441-451. doi:10.1890/08-0296.1
- Su, J.Q., Ding, L.J., Xue, K., Yao, H.Y., Quensen, J., Bai, S.J., et al. (2015). Long-term balanced fertilization increases the soil microbial functional diversity in a phosphorus-limited paddy soil. *Molecular Ecology* 24, 136-150. doi:10.1111/mec.13010
- Subbarao, G.V., Ito, O., Sahrwat, K.L., Berry, W.L., Nakahara, K., Ishikawa, T., et al. (2006). Scope and strategies for regulation of nitrification in agricultural systems—Challenges and

opportunities. *Critical Reviews in Plant Sciences* 25, 303-335.
doi:10.1080/07352680600794232

- Suleiman, A.K.A., Gonzatto, R., Aita, C., Lupatini, M., Jacques, R.J.S., Kuramae, E.E., et al. (2016). Temporal variability of soil microbial communities after application of dicyandiamide-treated swine slurry and mineral fertilizers. *Soil Biology and Biochemistry* 97, 71-82. doi:10.1016/j.soilbio.2016.03.002
- Sun, R., Zhang, X.-X., Guo, X., Wang, D., and Chu, H. (2015). Bacterial diversity in soils subjected to long-term chemical fertilization can be more stably maintained with the addition of livestock manure than wheat straw. *Soil Biology and Biochemistry* 88, 9-18. doi:10.1016/j.soilbio.2015.05.007
- Systatsoftware (2014). "SSI. SigmaPlot for Windows, version 13.0". (San Jose, California, USA: Systat Software).
- Szczerbowski, D., Pitarello, A.P., Zandoná Filho, A., and Ramos, L.P. (2014). Sugarcane biomass for biorefineries: comparative composition of carbohydrate and non-carbohydrate components of bagasse and straw. *Carbohydrate Polymers* 114, 95-101. doi:10.1016/j.carbpol.2014.07.052
- Tao, R., Liang, Y., Wakelin, S.A., and Chu, G. (2015). Supplementing chemical fertilizer with an organic component increases soil biological function and quality. *Applied Soil Ecology* 96, 42-51. doi:10.1016/j.apsoil.2015.07.009
- Taylor, A.E., and Bottomley, P.J. (2006). Nitrite production by *Nitrosomonas europaea* and *Nitrosospira* sp. AV in soils at different solution concentrations of ammonium. *Soil Biology and Biochemistry* 38, 828-836. doi:10.1016/j.soilbio.2005.08.001
- Therneau, T.M., and Atkinson, E.J. (1997). An introduction to recursive partitioning using the RPART routines. Technical report, Mayo foundation.
- Throbäck, I.N., Enwall, K., Jarvis, A., and Hallin, H. (2004). Reassessing PCR primers targeting *nirS*, *nirK* and *nosZ* genes for community surveys of ammonia oxidizer bacteria with DGGE. *FEMS Microbiol Ecol* 49, 401-417. doi:10.1016/j.femsec.2004.04.011
- Tiedje, J.M., Sextone, A.J., Myrold, D.D., and Robinson, J.A. (1983). Denitrification: ecological niches, competition and survival. *Antonie van Leeuwenhoek* 48, 569-583. doi:10.1007/BF00399542
- Torbert, H.A., and Wood, C.W. (1992). Effects of soil compaction and water-filled pore space on soil microbial activity and N losses. *Communications in Soil Science and Plant Analysis* 23, 1321-1331. doi:10.1080/00103629209368668
- Trivelin, P.C.O., Franco, H.C.J., Otto, R., Ferreira, D.A., Vitti, A.C., Fortes, C., et al. (2013). Impact of sugarcane trash on fertilizer requirements for São Paulo, Brazil. *Scientia Agricola* 70, 345-352. doi:10.1590/S0103-90162013000500009
- Tomas, N., Fortin, N., Bedrani, L., Terrat, Y., Cardoso, P., Bird, D., et al. (2017). Characterising and predicting cyanobacterial blooms in an 8-year amplicon sequencing time course. *ISME J* 11, 1746-1763. doi:10.1038/ismej.2017.58
- Ulrich, A., and Becker, R. (2006). Soil parent material is a key determinant of the bacterial community structure in arable soils. *FEMS Microbiology Ecology* 56, 430-443. doi:10.1111/j.1574-6941.2006.00085.x
- Ussiri, D.a.N., Lal, R., and Jarecki, M.K. (2009). Nitrous oxide and methane emissions from long-term tillage under a continuous corn cropping system in Ohio. *Soil and Tillage Research* 104, 247-255. doi:10.1016/j.still.2009.03.001
- Uyeda, C.A., Miranda, J.H.D., Duarte, S.N., Medeiros, P.R.F.D., and Dias, C.T.D.S. (2013). Influence of vinasse application in hydraulic conductivity of three soils. *Engenharia Agrícola* 33, 689-698. doi:10.1590/S0100-69162013000400008
- Vainio, E.J., and Hantula, J. (2000). Direct analysis of wood-inhabiting fungi using denaturing gradient gel electrophoresis of amplified ribosomal DNA. *Mycological Research* 104, 927-936. doi:10.1017/S0953756200002471
- Valverde, A., Makhalanyane, T.P., and Cowan, D.A. (2014). Contrasting assembly processes in a bacterial metacommunity along a desiccation gradient. *Frontiers in Microbiology* 5, 668. doi:10.3389/fmicb.2014.00668
- Van Kessel, M.a.H.J., Speth, D.R., Albertsen, M., Nielsen, P.H., Op Den Camp, H.J.M., Kartal, B., et al. (2015). Complete nitrification by a single microorganism. *Nature* 528, 555-559. doi:10.1038/nature16459
- Van Raij, B., Andrade, J.C., Cantarella, H., and Quaggio, J.A. (2001). *Chemical analysis for evaluation of fertility of tropical soils*. Campinas, Brazil: Instituto Agronômico.
- Van Raij, B., Cantarella, H., Quaggio, J.A., and Furlani, A.M.C. (1996). *Sugarcane*. In: *Recomendações para calagem e adubação para o estado de São Paulo*. Campinas, Brazil: Instituto Agronômico.

- Vargas, V.P., Cantarella, H., Martins, A.A., Soares, J.R., Do Carmo, J.B., and De Andrade, C.A. (2014). Sugarcane crop residue increases N₂O and CO₂ emissions under high soil moisture conditions. *Sugar Tech* 16, 174-179. doi:10.1007/s12355-013-0271-4
- Varner, R.K., Keller, M., Robertson, J.R., Dias, J.D., Silva, H., Crill, P.M., et al. (2003). Experimentally induced root mortality increased nitrous oxide emission from tropical forest soils. *Geophysical Research Letters* 30, 1144. doi:10.1029/2002GL016164
- Verhamme, D.T., Prosser, J.I., and Nicol, G.W. (2011). Ammonia concentration determines differential growth of ammonia-oxidising archaea and bacteria in soil microcosms. *The Isme Journal* 5, 1067–1071. doi:10.1038/ismej.2010.191
- Wakelin, S.A., Macdonald, L.M., Rogers, S.L., Gregg, A.L., Bolger, T.P., and Baldock, J.A. (2008). Habitat selective factors influencing the structural composition and functional capacity of microbial communities in agricultural soils. *Soil Biology and Biochemistry* 40, 803-813. doi:10.1016/j.soilbio.2007.10.015
- Walter, A., Dolzan, P., Quilodrán, O., De Oliveira, J.G., Da Silva, C., Piacente, F., et al. (2011). Sustainability assessment of bio-ethanol production in Brazil considering land use change, GHG emissions and socio-economic aspects. *Energy Policy* 39, 5703-5716. doi:10.1016/j.enpol.2010.07.043
- Wei, W., Isobe, K., Shiratori, Y., Nishizawa, T., Ohte, N., Ise, Y., et al. (2015). Development of PCR primers targeting fungal nirK to study fungal denitrification in the environment. *Soil Biology and Biochemistry* 81, 282-286. doi:10.1016/j.soilbio.2014.11.026
- Whitman, T., Pepe-Ranney, C., Enders, A., Koechli, C., Campbell, A., Buckley, D.H., et al. (2016). Dynamics of microbial community composition and soil organic carbon mineralization in soil following addition of pyrogenic and fresh organic matter. *ISME J* 10, 2918-2930. doi:10.1038/ismej.2016.68
- Williams, A., Börjesson, G., and Hedlund, K. (2013). The effects of 55 years of different inorganic fertiliser regimes on soil properties and microbial community composition. *Soil Biology and Biochemistry* 67, 41-46. doi:10.1016/j.soilbio.2013.08.008
- Wrage, N., Velthof, G.L., Van Beusichem, M.L., and Oenema, O. (2001). Role of nitrifier denitrification in the production of nitrous oxide. *Soil Biology and Biochemistry* 33, 1723-1732. doi:10.1016/S0038-0717(01)00096-7
- Wu, D., Senbayram, M., Well, R., Brüggemann, N., Pfeiffer, B., Loick, N., et al. (2017). Nitrification inhibitors mitigate N₂O emissions more effectively under straw-induced conditions favoring denitrification. *Soil Biology and Biochemistry* 104, 197-207. doi:10.1016/j.soilbio.2016.10.022
- Xiang, X., He, D., He, J.-S., Myrold, D.D., and Chu, H. (2017). Ammonia-oxidizing bacteria rather than archaea respond to short-term urea amendment in an alpine grassland. *Soil Biology and Biochemistry* 107, 218-225. doi:10.1016/j.soilbio.2017.01.012
- Xu, H.-J., Wang, X.-H., Li, H., Yao, H.-Y., Su, J.-Q., and Zhu, Y.-G. (2014). Biochar impacts soil microbial community composition and nitrogen cycling in an acidic soil planted with rape. *Environmental Science & Technology* 48, 9391-9399. doi:10.1021/es5021058
- Xu, X., Liu, X., Li, Y., Ran, Y., Liu, Y., Zhang, Q., et al. (2017). High temperatures inhibited the growth of soil bacteria and archaea but not that of fungi and altered nitrous oxide production mechanisms from different nitrogen sources in an acidic soil. *Soil Biology and Biochemistry* 107, 168-179. doi:10.1016/j.soilbio.2017.01.003
- Yang, L., Zhang, X., and Ju, X. (2017). Linkage between N₂O emission and functional gene abundance in an intensively managed calcareous fluvo-aquic soil. *Scientific Reports* 7, 43283. doi:10.1038/srep43283
- Ying, J., Li, X., Wang, N., Lan, Z., He, J., and Bai, Y. (2017). Contrasting effects of nitrogen forms and soil pH on ammonia oxidizing microorganisms and their responses to long-term nitrogen fertilization in a typical steppe ecosystem. *Soil Biology and Biochemistry* 107, 10-18. doi:10.1016/j.soilbio.2016.12.023
- Zhang, B., Pang, C., Qin, J., Liu, K., Xu, H., and Li, H. (2013). Rice straw incorporation in winter with fertilizer-N application improves soil fertility and reduces global warming potential from a double rice paddy field. *Biology and Fertility of Soils* 49, 1039-1052. doi:10.1007/s00374-013-0805-7
- Zhang, L.-M., Hu, H.-W., Shen, J.-P., and He, J.-Z. (2012). Ammonia-oxidizing archaea have more important role than ammonia-oxidizing bacteria in ammonia oxidation of strongly acidic soils. *The Isme Journal* 6, 1032-1045. doi:10.1038/ismej.2011.168
- Zhang, Y., Shen, H., He, X., Thomas, B.W., Lupwayi, N.Z., Hao, X., et al. (2017). Fertilization shapes bacterial community structure by alteration of soil pH. *Frontiers in Microbiology* 8, 1325. doi:10.3389/fmicb.2017.01325

- Zhao, B., An, Q., He, Y.L., and Guo, J.S. (2012). N₂O and N₂ production during heterotrophic nitrification by *Alcaligenes faecalis* strain NR. *Bioresource Technology* 116, 379-385. doi:10.1016/j.biortech.2012.03.113
- Zhou, Z., Takaya, N., Nakamura, A., Yamaguchi, M., Takeo, K., and Shoun, H. (2002). Ammonia fermentation, a novel anoxic metabolism of nitrate by fungi. *Journal of Biological Chemistry* 277, 1892-1896. doi:10.1074/jbc.M109096200
- Zhu, X., Burger, M., Doane, T.A., and Horwath, W.R. (2013). Ammonia oxidation pathways and nitrifier denitrification are significant sources of N₂O and NO under low oxygen availability. *Proceedings of the National Academy of Sciences* 110, 6328-6333. doi:10.1073/pnas.1219993110

