

Leverhulme Centre for Climate Change Mitigation (LC³M)

Full publication listing through to September 2021

2021

- 39) James, R., Bullock, L., Larkin, C. & Matter, J. (2021) Geological solutions for carbon dioxide removal. *Geoscientist* (autumn), 16-22.
- 38) Gomez-Casanoas, N., Blanc-Betes, E., Moore, C.E., Bernachi, C.J., Kantola, I. & DeLucia, E.H. (2021) A review of transformative strategies for climate mitigation by grasslands. *Science of the Total Environment*, **799**, 149466.
- 37) Vakilifard, N., Kantzas, E.P., Edwards, N.R., Holden, P.B. & Beerling, D.J. (2021) The role of enhanced weathering deployment with agriculture in limiting future warming and protecting coral reefs. *Environmental Research Letters*, **19**, 094005.
- 36) Lewis, A.L., Sarkar, B., Wade, P., Kemp, S.J., Hodson, M.E., Taylor, L.L., Yeong, K.L., Davies, K., Nelson, P.N., Bird, M.I., Kantola, I.B., Masters, M.D., DeLucia, E., Leake, J.R., Banwart, S.A. & Beerling, D.J. (2021) Effects of mineralogy, chemistry and physical properties of basalts on carbon capture potential and plant-nutrient element release via enhanced weathering. *Applied Geochemistry*, **132**, 105023.
- 35) Spence, E., Cox, E. & Pidgeon, N. (2021) Exploring cross-national public support for the use of enhanced weathering as a land-based carbon dioxide removal strategy. *Climatic Change*, **165**, art. 23 <https://doi.org/10.1007/s10584-021-03050-y>.
- 34) Horton, P., Long, S.P., Smith, P., Banwart, S.A. & Beerling, D.J. (2021) Technologies to deliver food and climate security through agriculture. *Nature Plants*, **7**, 250–255.
- 33) Epihov, D.Z., Saltonstall, K., Batterman, S.A., Hedin, L.O., Hall, J.S., van Breugel, M., Leake, J.R. & Beerling, D.J. (2021) Legume-microbiome interactions unlock mineral nutrients in regrowing tropical forests. *Proceedings of the National Academy of Sciences, USA*, **118**, e2022241118. <https://doi.org/10.1073/pnas.2022241118>.
Paper #33 reports enhanced weathering by N₂-fixing legumes trees in tropical forests facilitated by the recruitment of a below-ground microbiome that also benefits neighbouring trees.
- 32) Cox, E., Spence, E. & Pidgeon, N. (2021) But They told us it was safe! Carbon dioxide removal, fracking, and ripple effects in risk perceptions. *Risk Analysis*. <https://doi.org/10.1111/risa.13717>.
- 31) Cox E., Spence, E. & Pidgeon, N. (2021) What people think about Carbon Dioxide Removal. Leverhulme Centre for Climate Change Mitigation, University of Sheffield, U.K. [White Paper] Available at <http://lc3m.org/publications/>
- 30) Cox, E., Boettcher, M., Spence, E. & Bellamy, R. (2021) Casting a wider net on ocean NETs. *Frontiers in Climate*. <https://doi.org/10.3389/fclim.2021.576294>.
- 29) Taylor, L.L., Driscoll, C.T., Groffman, P.M., Rau, G.H., Blum, J.D. & Beerling, D.J. (2021) Increased carbon capture by a silicate-treated forested watershed affected by acid deposition. *Biogeosciences*, **18**, 169–188.

2020

- 28) Blanc-Betes, E., Kantola, I.B., Gomez-Casnovas, N., Hartman, M.D., Parton, W.J., Lewis, A.L., Beerling, D.J. & DeLucia, E.H. (2020) In silico assessment of the potential of basalt amendments to reduce N₂O emissions from bioenergy crops. *GCB Bioenergy*, **13**, 224-241.
Paper #28 reports first evidence from LC³M field trials for consistent mitigation of N₂O fluxes from US corn-belt soils over three growing seasons following basalt amendment.
- 27) Beerling, D.J., Kantzas, E., Lomas, M.R., Wade, P., Eufrazio, R.M., Renforth, P., Quirk, J., Sarkar, B., Andrews, G., James, R.H., Pearce, C.R., Khanna, M., Koh, L., Quegan, S., Pidgeon, N.F., Janssens, I., Hansen, J. & Banwart, S.A. (2020) Potential for large-scale CO₂ removal via enhanced rock weathering with croplands. *Nature*, **583**, 242-248.

Paper #24 develops the theory to simulate the weathering of particle size distributions, and an initial nation-by-nation assessment of CO₂ removal potential by enhanced weathering constrained by current and future energy policy scenarios using an advanced and robust computationally efficient modelling approach. [Commentary on #26: News & Views, *Nature*, **583**, 204-205; Editorial, *Nature*, **583**, 167-168, 2020]

26) Cox, E., Spence, E. & Pidgeon, N. (2020) Public perceptions of carbon dioxide removal in the United States and the United Kingdom. *Nature Climate Change*, **10**, 744-749.

25) MacDougall, A.H., Frölicher, T.L., Jones, C.D., Rogelj, J., Matthews, H.D., Zickfeld, K., Arora, V.K., Barrett, N.J., Brovkin, V., Burger, F.A., Eby, M., Eliseev, A.V., Hajima, T., Holden, P.B., Jeltsch-Thömmes, A., Koven, C., Mengis, N., Menviel, L., Michou, M., Mokhov, I.I., Oka, A., Schwinger, J., Séférian, R., Shaffer, G., Sokolov, A., Tachiiri, K., Tjiputra, J., Wiltshire, A. & Ziehn, T. (2020) Is there warming in the pipeline? A multi-model analysis of the Zero Emissions Commitment from CO₂. *Biogeosciences*, **17**, 2987–3016.

24) Kelland, M.E., Wade, P.W., Lewis, A.L., Taylor, L.L., Sarkar, B., Andrews, M.G., Lomas, M.R., Cotton, T.E.A., Kemp, S.J., James, R.H., Pearce, C.R., Hartley, S.E., Hodson, M.E., Leake, J.R., Banwart, S.A. & Beerling, D.J. (2020) Increased yield and CO₂ sequestration potential with the C₄ cereal *Sorghum bicolor* cultivated in basaltic rock dust-amended agricultural soil. *Global Change Biology*, **26**, 3658–3676.

Paper #24 reports the first evidence from mesocosm experiments that amendment of a UK agricultural soil with crushed basalt increased yields of the C₄ crop Sorghum and introduced a detailed 1-D soil profile PhreeqC reactive transport model for simulating rock grain weathering and carbon capture.

23) Pidgeon, N. (2021) Engaging publics about environmental and technology risks: frames, values and deliberation. *Journal of Risk Research*, **24**, 28-46.

22) Cox, E., Spence, E. & Pidgeon, N. (2020) Incumbency, trust, and the Monsanto effect: stakeholder discourses on greenhouse gas removal. *Environmental Values*, **29**, 197-220.

2019

21) Cox, E., Royston, S. & Selby, J. (2019) From exports to exercise: how non-energy policies affect energy systems. *Energy Research and Social Science*, **55**, 179-188.

20) Beerling, D.J. (2019) Can plants help us avoid seeding a human-made climate catastrophe? *Plants, People, Planet*, **1**, 310-314.

19) Andrews, M.G. & Taylor, L.L. (2019) Combating climate change through enhanced weathering of agricultural soils. *Elements*, **15**, 253-258.

18) Cox, E. & Edwards, N.R. (2019) Beyond carbon pricing: policy levers for negative emissions technologies. *Climate Policy*, **19**, 1144-1156.

17) Smith, P., Adams, J., Beerling, D.J., Beringer, T., Calvin, K.V., Fuss, S., Griscom, B., Hagemann, N., Kammann, C., Kraxner, F., Minx, J.C., Popp, A., Renforth, P., Vicente-Vicente, J.L. & Keesstra, S. (2019) Land-management options for greenhouse gas removal and their impacts on ecosystem services and the sustainable development goals. *Annual Review of Environment and Resources*, **44**, 255-286.

16) Lawrence, D. M. et al (including Val Martin, M). (2019) The Community Land Model version 5: Description of new features, benchmarking, and impact of forcing uncertainty. *Journal of Advances in Modeling Earth Systems*, **11**, 4245-4287.

2018

15) Arnold, S.R., Lombardozzi, D., J-F Lamarque, T. Richardson, L.K. Emmons, S. Tilmes, S.A. Sitch, G. Folberth, M.J. Hollaway, M. Val Martin (2018) Simulated global climate response to tropospheric ozone-induced changes in plant transpiration, *Geophysical Research Letters*, **45**. <https://doi.org/10.1029/2018GL079938>

14) Eufrazio-Espinosa, R.M. & Koh, L.S.C. (2019) The UK Path and the Role of NETs to Achieve Decarbonisation. In: Shurpali N., Agarwal A., Srivastava V. (eds) Greenhouse Gas Emissions. Energy, Environment, and Sustainability. *Springer, Singapore*. pp. 87-109.

13) Spence, E., Pidgeon, N. & Pearson, P. (2018) UK public perceptions of Ocean Acidification – The importance of place and environmental identity. *Marine Policy*, **97**, 287-293.

- 12) Cox, E., Pidgeon, N., Spence, E. & Thomas, G. (2018) Blurred lines: the ethics and policy of greenhouse gas removal at scale. *Frontiers in Environmental Science*, **6**, 1-7.
- 11) Beerling, D.J., Leake, J.R., Long, S.P., Scholes, J.D., Ton, J., Nelson, P.N., Bird, M.I., Kantzas, E., Taylor, L.L., Sarkar, B., Kelland, M., DeLucia, E., Kantola, I., Müller, C., Rau, G. & Hansen, J. (2018) Farming with crops and rocks to address global climate, food and soil security. *Nature Plants*, **4**, 138-147.
Paper #11 reported the first detailed evidenced-based synthesis advancing our understanding of how enhanced rock weathering could operate with agricultural systems to sequester carbon and promote food and soil security
[Commentary on #11: Editorial *Nature* **554**, 404-405, 2018]
- 10) Singh, M., Sarkar, B., Sarkar, S., Churchman, J., Bolan, N., Mandal, S., Menon, M., Purakayastha, J. & Beerling, D.J. (2018) Stabilization of soil carbon as influenced by clay mineralogy. *Advances in Agronomy*, **148**, 33-52.
- 9) Mercure, J.-F., Pollitt, H., Viñuales, J.E., Edwards, N.R., Holden, P.B., Chewpreecha, U., Salas, P., Sognnaes, I., Lam, A. & Knobloch, F. (2018) Macroeconomic impact of stranded fossil fuel assets. *Nature Climate Change*, **8**, 588-593.
- 8) Shaw, C., Hurth, V., Capstick, S. & Cox, E. (2018) Intermediaries' perspectives on the public's role in the energy transitions needed to deliver UK climate change policy goals. *Energy Policy*, **116**, 267-276

2017

- 7) Hansen, J., Sato, M., Kharecha, P., von Schuckmann, K., Beerling, D.J., Cao, J., Marcott, S., Masson-Delmotte, V., Prather, M.J., Rohling, E.J., Shakun, J., Smith, P., Lacis, A., Russell, G. & Ruedy, R. (2017) Young people's burden: requirement of negative CO₂ emissions. *Earth System Dynamics*, **8**, 577-616.
- 6) Beerling, D.J. (2017) Enhanced rock weathering: biological climate change mitigation with co-benefits for food security? *Biology Letters*, **13**, 20170149.
- 5) Kantola, I.B., Masters, M.D., Beerling, D.J., Long, S.P. & DeLucia, D.H. (2017) Potential of global croplands and bioenergy crops for climate change mitigation through deployment for enhanced weathering. *Biology Letters*, **13**, 20160714.
- 4) Edwards, D.P., Lim, F., James, R.H., Pearce, C.R., Scholes, J., Freckleton, R.P. & Beerling, D.J. (2017) Climate change mitigation: potential benefits and pitfalls of enhanced rock weathering in tropical agriculture. *Biology Letters*, **13**, 20160715.
- 3) Lawford-Smith, H. & Currie, A. (2017) Accelerating the carbon cycle: the ethics of enhanced weathering. *Biology Letters*, **13**, 20160859.
- 2) Taylor, L.L., Beerling, D.J., Quegan, S. & Banwart, S.A. (2017) Simulating carbon capture by enhanced weathering in croplands: an overview of key processes highlighting areas of future model development. *Biology Letters*, **13**, 20160868.
- 1) Pidgeon, N.F. & Spence, E. (2017) Perceptions of enhanced weathering as a biological negative emissions option. *Biology Letters*, **13**, 20170024.