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Phosphorus transfer from land to oceans accelerating under climate change

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The devastating hurricanes that have occurred recently in an around the Caribbean and Gulf of Mexico remind us of the great dynamics and power in our weather and climate. As well as the immediate flood and human hazards, such events can have implications for the earth's biogeochemical cycles too. My team has been studying the extent to which phosphorus losses from land to water will be impacted by climate change and land management, with detrimental impacts on aquatic ecosystems and food production. There is a great challenge in determining this, with all the complexities, controversies and uncertainties that surround it. I will describe work from my team that uses a combination of methods to evaluate the impact of projected climate change on future phosphorus transfers, and to assess what scale of agricultural change might be needed to mitigate these transfers in the UK. We combined novel high-frequency phosphorus flux data from three representative catchments across the UK, a new high-spatial resolution climate model, uncertainty estimates from an ensemble of future climate simulations, two phosphorus transfer models of contrasting complexity and a simplified representation of the potential intensification of agriculture based on expert elicitation from land managers. We show that the effect of climate change on average winter phosphorus loads (predicted increase up to 30% by 2050s) will be limited only by large-scale agricultural changes (e.g., 20–80% reduction in phosphorus inputs). Perhaps the global phosphorus cycle is now starting to accelerate with climate change, with implications for long term biogeochemical transfers to oceans.

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