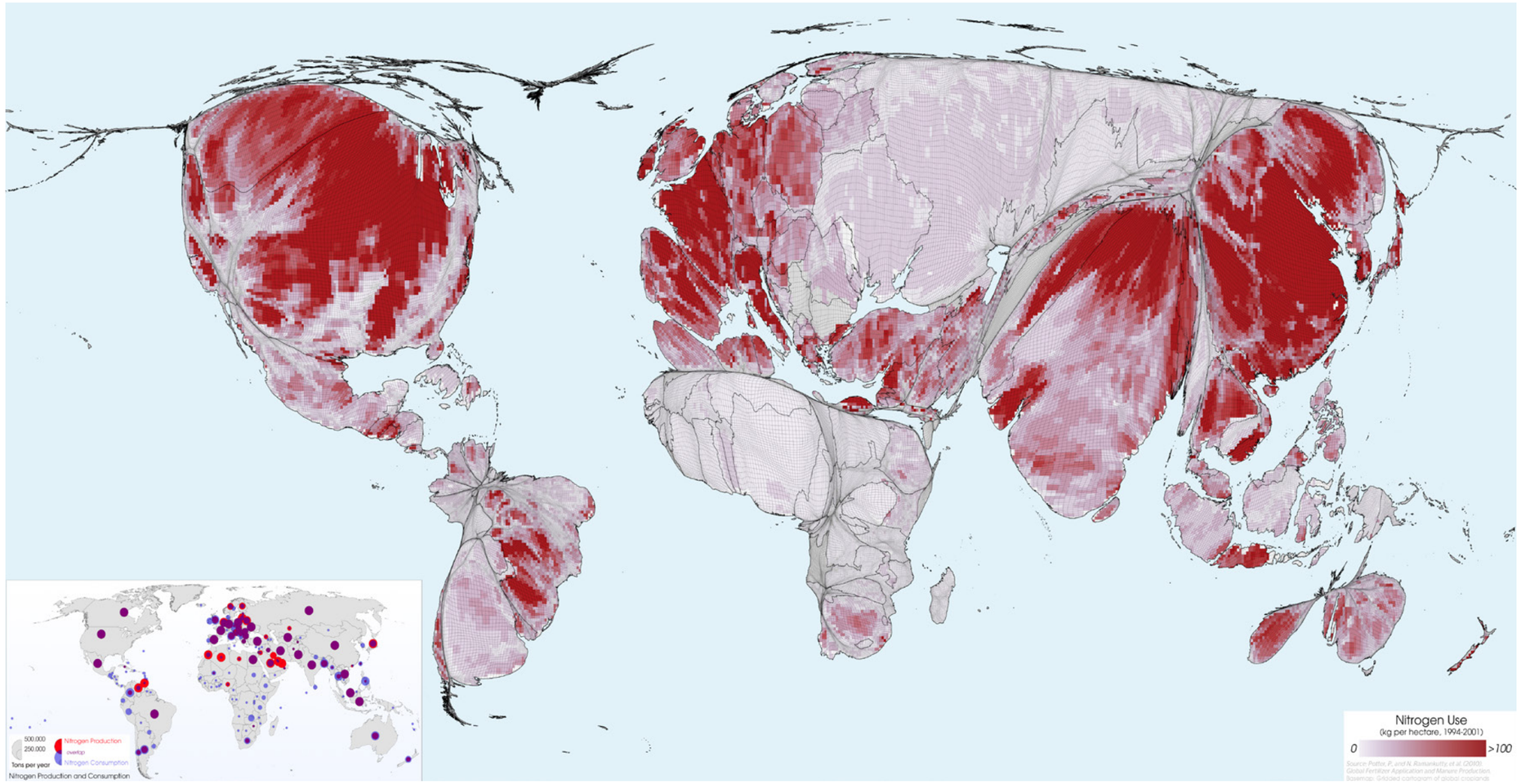
THE NITROGEN DILEMMA

Excessive use of nitrogen-based fertilisers is contributing to numerous environmental problems, but a more balanced approach is necessary if the world's growing population is to be fed



CARTOGRAM: BEN HENNIG

More than any other aspect of the climate crisis, it is the over-production of carbon dioxide that has been demonised – and rightly so. But nitrogen, and its abundant use in commercial fertiliser, also leads to air pollution and climate change.

The problems are numerous. When nitrogen-based fertiliser runs into water systems it can result in toxic algae blooms, leading to oxygen depletion and vast oceanic 'dead zones'. Evidence suggests their use also contributes to air pollution, increased rates of cancer and reduced biodiversity, as well as emitting nitrous oxide – an extremely potent greenhouse gas.

But nitrogen has another side. As a component of fertiliser, nitrogen helps feed around half the world's population and looks set to remain essential for the foreseeable future. With prices of fertiliser now rising, many developing countries don't have access to it, with resulting threats to food security. The global nitrogen challenge therefore involves both reducing fertiliser use, and getting it to where it's needed most.

A team of scientists, led by the University of California, Davis, has come up with a five-step plan to tackle this two-sided problem. Lead author, Benjamin Houlton, explains that only by undertaking a holistic approach and combining solutions can the problem be solved on both levels. 'While we bring nitrogen efficiencies up and continue to work on that challenge, we also have to bring nitrogen to those communities that don't have any access to it,' he says.

The five steps identified involve changing agricultural practices (Houlton points to the use of slow-release fertiliser and other practices which help precisely deliver nutrients in proportion to crop demands), getting fertiliser to the places it's needed (which Houlton says will require intergovernmental cooperation and policies to incentivise the private sector), reducing nitrogen pollution (restoring flood plains which can absorb nitrogen pollution from fertiliser run-off is key) and finally, both reducing food waste and promoting a change in diet. The latter two are essential because approximately one-quarter of all global food produced is wasted along the supply chain. This means that a large portion of the nitrogen fertiliser applied to crops is ultimately wasted.

Houlton admits that adding nitrogen to the list of existing climate woes might elicit a sense of exhaustion. Nevertheless, he has an encouraging message. 'The truth is, nitrogen is a blessing and a curse,' he says. 'But if you can reduce the spill-overs of nitrogen you can quickly get systems to return to a more pristine state. That makes it very different from CO_2. We lock in 30 to 50 years of climate impacts every time we emit a molecule of CO_2 into the air. But with nitrogen you can get immediate returns on investment.'

As a result of both the challenge and these opportunities, Houlton and his colleagues are now calling for the implementation of a formal research mandate – similar to the United Nations' Intergovernmental Panel on Climate Change – a move that could kick-start the 'nitrogen revolution', necessary for planetary health, climate mitigation, and food security. ●

Nitrogen-based fertilisers are something of a double-edged sword

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