Prospects for the Third Horseman in an environmentally stressed biosphere

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Human numbers will reach an estimated 8–9 billion by 2050. This along with continued economic development in today's low-income countries, means that the total global demand for food will increase by around threefold over the coming half-century. Will a combination of high-tech precision farming, enlightened practices (such as low-till and mixed-crop farming), equitable land tenure and socially-attuned use of GM technology suffice to keep St. John the Divine's 'Third Horseman' at bay? Opinions vary (1,2).

Against this background of social changes and technical possibilities, today's emerging global environmental changes, such as climate change, will also affect food production. Other incipient large-scale environmental changes that are affecting, or will affect, food production include stratospheric ozone depletion, biodiversity losses (with knock-on effects on crop and livestock pest species), and the perturbation of several of the great elemental cycles of nitrogen, sulphur and phosphorus (3). Further, current agricultural practices are increasingly damaging to the biosphere at large, and entail deforestation, chemical pollution of soils and waterways, destruction of habitat and increased risks of infectious diseases in livestock – and their passage into human populations (4,5).

These various environmental changes will affect the production of crops and livestock on land and wild and cultivated fisheries in various and complex ways. The modelling of how global climate change is likely to affect world and regional food production is illustrative. On balance, recent modelling-based estimates indicate that, in the medium-to-longer term, if not over the next several decades, climate change will affect crop yields adversely, especially in food-insecure regions (6). An increase in climatic variability will amplify the risks to future food production.

Our capacity to maintain food supplies for an expanding and increasingly expectant world population will depend on maximising the efficiency and sustainability of production methods, using genetic biotechnologies wisely, and minimising ecologically damaging environmental changes. Resolution of the longstanding disparity between the world's rich and poor, with widespread chronic deficits in 'food entitlements' (7) alongside an unprecedentedly well-fed privileged minority, should also be part of any future sustainable solution.

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