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Environmental change and food production: consequences for human nutrition and health

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The debate about supplies of land, food, energy and water in relation to human needs is longstanding. Thomas Malthus is often viewed as having first noted, at the end of the eighteenth century, the mismatch between geometric population growth and arithmetic food production growth. In fact, the debate in general, and that particular observation, go back much further in time – as was pointed out in the 1970s by the pioneering Australian demographer, WD Borrie.

A more contemporary concern has to do with the worldwide degradation of arable land and depletion of fresh water supplies, as part of the constellation of “global environmental changes” that now endanger the stability and productivity of the biosphere. In addition to the manifest problems of erosion, salinisation and desertification, there are emerging concerns about ecosystem disruptions due to biodiversity losses, about the impact of a change in global climate, and about the latitude-dependent increase in exposure to ultraviolet radiation because of stratospheric ozone depletion. Importantly, various of these environmental changes will interact with one another, thereby amplifying the net impact on food yields.

Much of this is a familiar story: one that has afflicted local populations and regional civilizations, over the past 5,000 years or so. Indeed, the Canadian ecologist William Rees argues that, historically, the most rich and powerful societies have been the most likely to squander and destroy their environmental asset base. The distinctive feature today is that, first, this weakening of agroecosystem infrastructure is happening on a worldwide basis, and, second, there are several genuinely new human-induced “global” environmental changes of a kind not previously experienced by humankind – climate change, stratospheric ozone depletion and disruption of the nitrogen cycle being prime examples.

Biodiversity underpins the resilience of the ecosystems on which we depend. Human-induced biodiversity loss is now occurring at an unprecedented rate (faster than in the great prehistorical extinction events), driven by over-exploitation of productive ecosystems, land-use changes, climate change, trans-boundary migration of pollutants and hazardous substances, exotic species and biotechnology. Loss of biodiversity threatens vital ecosystem services, including yields of food, fuel and fibre, cleansed fresh water, nutrient cycling, flood protection, and climate stability.

Despite the great importance of ecosystem services for human health, links between biodiversity loss, nutrient status and human health are difficult to demonstrate epidemiologically. This is partly because biodiversity loss affects health via complex, indirect pathways. Further, local social-economic conditions can modulate, or defer, the nutritional effects of ecosystem disruption.

On the empirical front, international time series data for the past several decades shows that there has been an unusual, sustained, decline in per capita yields of cereal grain over the past six years. There are several contributory explanations, but it is increasingly likely that part of the problem is the decline in harvest yields from damaged or abandoned arable land.