Ocean biogeochemical cycles, agricultural revolutions and food system transformations

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Abstract

Current global food systems, based on key nutrients that are produced from fossil fuels or mined, are widely regarded as unsustainable, inequitable and unhealthy. Global food and nutrition policy forums therefore increasingly look to regenerative, agroecological, nature-based and circular-economy models as ways to transform global food systems. Ocean-based food production has many of the characteristics called for in such transformations: capture fisheries depend directly on functional ecosystems for sustainable harvests, while coastal and marine aquaculture has varying levels of dependence on water quality, natural habitats and wild populations. Such systems are therefore largely 'nature-based'. The extent to which nature-based or regenerative approaches can nourish the human population sufficiently, healthily and equitably is a subject of much debate. At the roots of this debate are researchable gaps in understanding of biogeochemical cycles – particularly those between oceans and land. In particular, the role of oceans in key nutrient cycles – phosphorus, potassium, nitrogen, and bioavailable forms of minerals such as iron, zinc, magnesium and selenium – is poorly understood and not incorporated in global food systems and 'planetary health' policies.

In this presentation, I outline a potential major research programme for the IMBER community to

help fill these vital knowledge-for-policy gaps. The presentation first outlines the premise of regenerative agriculture, then uses historical data to show the importance of large-scale nutrient transfers – including reciprocal land-ocean transfers, in supporting previous 'agricultural revolutions'. I then argue that a combination of urbanization, coastward-migration of human populations and nutrient mismanagement have led to consumption being largely 'downstream' of food production, while nutrients accumulate 'downstream' to cause pollution concerns. The research programme I will outline asks questions on how this situation might be reversed. It asks how IMBER's expertise in biogeochemical cycles and social-ecological systems thinking can be brought to bear on one of the central issues of our time: how to nourish the human population fairly and sustainably.