Agricultural & Rural Studies

Commentary

It Is Not What We Eat, It's How We Produce It

Jaime Martínez-Valderrama

Estación Experimental de Zonas Áridas, Consejo Superior de Investigaciones Científicas, 04120 Almería, Spain; jaimonides@eeza.csic.es

1. Exceeding Critical Thresholds in Food Production

The current food system is one of the main contributors to the environmental degradation of our planet (FAO, 2021). The disruption of phosphorus and nitrogen cycles, the release of greenhouse gases (GHGs), and the degradation of vital resources like water and soil serve as compelling examples and explain the overtaking of six planet boundaries (Rockström & Gupta, 2023) that a decade ago appeared distant and abstract.

Despite this prevailing consensus, there is a substantial divergence in the range of measures and proposals. Many focus on product analyses, emphasizing their water and carbon footprint (Mekonnen & Hoekstra, 2012; Petterson et al., 2021), as well as their relationship with health (Willett et al., 2019) often overlook the significance of production systems and our lifestyle. In an era marked by short-termism and the incessant flow of information, short and flashy messages are imposed, leaving aside essential nuances of the food system, such as the externalities of each form of production, the demand for very cheap food at any time, or the final form in which these products are delivered to us (ultra-processed, with a huge associated consumption of plastic and energy, or with working conditions that are in many cases appalling).

It is imperative to expand our perspective and take into account the diverse impacts—both positive and negative—across social, environmental, and economic dimensions of food systems. This is crucial as the same product can be cultivated and produced through various methods, each carrying distinct implications.

This viewpoint can be illustrated with two examples. One concerns the call to drastically reduce red meat consumption, and the other promotes so-called superfoods (Magrach & Sanz, 2020), such as quinoa. Initially, several data points indeed underpin the sustainability of this dietary shift. Beef production accounts for an average water consumption of 15,415 m^3 t^{-1} (Mekonnen & Hoekstra, 2012). 98% of this water footprint is due to the massive use of animal feed, the production of which requires the cultivation of cereals and legumes. The cultivation of these crops involves the deforestation of valuable primary forests (Martínez-Valderrama et al., 2021) and the depletion of aquifers, which are also affected by the discharge of animal slurry from large-scale farms. Another harmful effect associated with livestock farming is the emission of GHGs, mainly methane and nitrous oxide. It is estimated that this production sector is responsible for between 8 and 18% of total emissions (Herrero & Thornton, 2013); on average, meat carbon footprint is 41 kg CO_2eq kg^{-1} (Herrero et al., 2013). In addition, there are other undesirable effects of meat production and consumption, such as the conditions in which many of these animals live and the diseases associated with excessive consumption. Quinoa enjoys a favorable reputation. It's a food with deep roots in ancient cultures, which imparts a sense of exoticism in Western markets. Often hailed as a "superfood", quinoa is highly compatible with vegetarian diets, offering a rich blend of essential amino acids, micronutrients, vitamins, and is naturally gluten-free.

2. The Need for a More Integrated Vision of Food Systems

Is this always the case? It depends, we can argue the opposite. Let us first look at meat. There are many livestock production systems that are examples of sustainability, i.e., stocking rates are adjusted to the availability of pasture. Pastoralism is the most widespread land use around the world and has proven to be a secure livelihood for many societies for millennia (Manzano et al., 2021). In these livestock grazing systems, the ruminants graze in the open air, eating various types of vegetation that would otherwise not be utilized. In doing so, they achieve something unique: they convert lignin and cellulose into protein. No machine is capable of this process. In addition, they rid the landscape of flammable materials, reducing the risk of forest fires. As they move, they fertilize the countryside with their excrement, in line with the precepts of the circular economy: that the waste of one becomes the food of the other. The richness of breeds is the result of their adaptability to different environments and conditions, which translates into great agrobiodiversity

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and resilience of the territory. Finally, products derived from this type of livestock farming have nutritional and organoleptic properties far superior to those of processed products from industrial livestock farming (Wilkinson & Lee, 2018).

What are the downsides of quinoa's popularity? Its soaring demand has pushed it into large supermarket chains where competitive pricing is the standard. As a result, the traditional Andean production system has undergone significant alterations. Peru and Bolivia, the primary quinoa producers, have increased their production by 252% and 612%, respectively, over the last four decades, along with a 124% and 440% expansion in their cultivation areas (Magrach & Sanz, 2020). These changes have brought about noteworthy environmental and social consequences. In the high-altitude deserts where quinoa thrives, the conditions are harsh: minimal rainfall coupled with frigid and windy weather. For centuries, local communities sustained themselves on quinoa, cultivating it without the use of mechanical equipment and meticulously considering weather conditions to allow the soil to rest and regenerate with water and nutrients. The quinoa boom, which drove prices to unprecedented levels (sometimes reaching up to 60 times that of wheat), triggered the intensification and expansion of quinoa farming.

The use of heavy machinery, fertilizers and pesticides, the elimination of livestock that fertilized the soil, the invasion of pastures and the reduction of fallow have triggered soil erosion and deterioration. The selection of the most productive varieties (4 of which account for 90% of production) is leading to the loss of a rich gene bank. The local population, far from getting richer from this business, has lost its main sources of protein: Quinoa has prohibitive prices and most of it is exported -Peru went from exporting 60 t in 1995 to 36,000 in 2014 (Bedoya-Perales et al., 2018) and the llamas have less space to graze. To make matters worse, much of the land that was in the hands of local communities is now private property.

As evident, a plate of quinoa can have an environmental impact comparable to that of a hamburger. Concentrating solely on the product type, neglecting the social and environmental repercussions of its production system, may result in the formulation of policies that exacerbate rather than resolve issues. Therefore, adopting a more holistic perspective on food systems can empower stakeholders to devise more sustainable land-use plans.

3. Final Remarks

These two instances illustrate that consumption should be guided not solely by the type of food but also by the methods of its production. The main problem is related to large-scale production, which seeks to minimize production costs at the expense of social and environmental externalities (Martínez-Valderrama et al., 2023). This phenomenon of "Uberization" has permeated a significant portion of food systems, and this is where attention should be directed.

Quinoa can maintain its sustainability if cultivation respects local ecosystems and traditional production systems, such as fallowing, and refrains from encroaching upon marginal areas traditionally designated for grazing. On the other hand, livestock production requires substantial reforms, which may include the following guidelines: (i) By reducing animal protein demand for the nutritional reasons outlined above; (ii) By favoring pasture-based livestock systems, within the limits of adequate stocking rates; or (iii) by further technifying intensive production systems (i.e., macrofarms) through cultured meat and precision fermentation (Singh et al., 2022), which will reduce the environmental footprint and animal suffering.

Finally, it is necessary to understand that the elimination of negative externalities and the establishment of socially equitable food systems will result in higher food costs (Baker et al., 2020). The impact on society can be mitigated by redistributing these costs or by narrowing the profit margins of major distributors.

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