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Wojciech Lara, Szymon ORCID: <https://orcid.org/0000-0002-1120-2092>, Tsiami, Amalia ORCID: <https://orcid.org/0000-0002-1122-4814> and Ryan, Phillipa (2023) Forgotten crops. Food Science and Technology, 37 (3). pp. 18-21. ISSN Institute of Food Science and Technology

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Forgotten crops

Szymon Lara emphasizes forgotten crops for diverse, resilient food systems, citing economic, nutritional benefits, suggesting how they could enhance global food security.

Background

Biodiversity measures the abundance of life in a specified area, considering the species and varieties of all life forms. The United Kingdom is believed to still hold around 50% of its original biodiversity levels from the pre-industrial state. There has been a steady 13% decline in the abundance of life since early 1940s^[1]. The United Kingdom (UK) has implemented various policies and frameworks for the promotion and

protection of the endangered habitats, for example, the Environmental Bill (2020-2022), Convention on Biological Diversity (2010 – 2020) and various reformations in the Agriculture and Fisheries Acts (2000-2022). Nevertheless, the UK remains in the top 12% countries in the world with lowest levels of biodiversity, exceeded by far by other developed nations like France, Italy, or Canada^[2].

The main causes of biodiversity loss include the broadly understood

climatic changes, urban developments, introduction of invasive species, transport infrastructure and the intensified agricultural practices. Agri-biodiversity is a term that relates to the measurable abundance of species within an agricultural scope, like a field or farm, with considerations towards the level of intactness of the natural reservoir of life. The growing attention for sustainably produced food, from farm to fork perspective, has stimulated the investors,



producers, but also the consumers and other actors from along the food value chains, to promote feasible introduction of regenerative practices to agriculture. Some of which include decreasing the use of chemicals, limiting excessive soil disturbance and promotion of intercropping, and some less drastic measures such as the maintenance of natural field margins and hedges for wildlife, insects and weeds^[2-3].

Organisations like the the Food and

Agriculture Organization (FAO) and the United Nations (UN), and national governments, including parliament in the UK in the recently published State of the World's Biodiversity for Food and Agriculture and the National Food Strategy, respectively, have highlighted the importance of agrobiodiversity and outlined some tools for its maintenance and growth. One of which, is the reintroduction of forgotten crops into the wider food systems^[2].

Forgotten crops are crop species and varieties that have become the victim of global food systems homogenisation, where commercial cultivars including maize, wheat and rice, which are the staple for 4bn people, and further 12 crops which together constitute 90% of the global human energy intake, six of which contribute 80% of global biofuels production, have outcompeted the remaining edible plants^[4]. To put these figures into a better perspective,

there are at least 7,039 edible plant species, but only around 417 are considered food crops and the 15 above have become commoditised. These figures should demonstrate the potential fragility of the world's food and nutrition security is and how, at least, an elementary diversification could help to build more sustainable and resilient food systems^[4–5].

Definitions

Across academic and grey literature on forgotten crops, there are ample terminologies with overlapping meanings and built-in predispositions. The term 'underutilised' and 'neglected' is popular as it encompasses crops and potentially cultivable wild species that lack attention and investments. Other terms of similar meaning, focusing mainly on cultivars that have been displaced from wider agriculture, include: 'minor', 'orphan', 'heritage', 'heirloom', 'indigenous' and 'traditional'.

These terms have variable socio-economic and cultural connotations and associations. 'Ancient' is another popular term used. It is nowadays widely adopted across the baking industry, describing certain grains and flours; however, the meaning is often not historically and botanically accurate. 'Landraces' is, in contrast, a more botanically orientated and technical term for 'farmers varieties', the locally adapted, geographically limited varieties that evolve through time, but which are rare today in the UK. Using terms such as 'forgotten crops' is better as it is a good, overarching category that summarises the group's distinctiveness from the commodity crops^[6].

The economic potential of diversified food systems

A recent meta-analysis compared the profitability potential of farming practices that include forgotten crops and non-intensive methods like inter-cropping, with those of simplified/intensified farms that lack agrobiodiversity practices. The results revealed significantly higher benefit-cost ratio, gross margin, net returns, gross income, and total cost assessment metrics for diversified farms when compared with the simplified/intensified farms, where poor agrobiodiversity practices are prominent^[7].

Despite higher financial inputs for some of these crops, the profit margins could also be elevated as a



result of growing market demand for sustainably-produced foods, where some British-based businesses have started to take advantage of this phenomenon, and popularised forgotten British varieties of peas, beans and other legumes. Consumers are likely to be attracted to these crops for a variety of reasons that all add up to the broadly understood perception of higher value, through elements like the sensory characteristics of the crop, novelty, sustainability including seasonality and locality, historical contexts, and nutritional benefits. This consumer demand has somehow been diminished across the UK over the past century as opposed to other European nations that still value their local food markets and greater dietary biodiversity^[8].

Nutritional benefits of forgotten crops

Enhanced post-harvest nutrient fortification has resulted in concepts like biofortification, which has many benefits for the food industry. Many of these so-called forgotten crops have a tendency to be good sources of nutrients, especially in areas effected by nutrition insecurity^[9]. For example, the once widely present cactuses (Cactaceae) across Mexican cuisines, such as *Carnegiea tetetzo* L., *Cereus chiotilla* L. or the introduced legume – pigeon pea; *Cajanus cajan* L. as an alternative protein and fibre source, used to be household staples, providing essential minerals

Above: Some of the different varieties of peas, upon harvest, that were analysed for their sensory characteristics using subjective and objective methods.

Above right: Objective textural analysis of one pea variety using a textural analyser and a pea probe

Right: Different forgotten pea varieties.

Below: Stenner runner bean, a heritage Welsh variety.



and vitamins, dietary fibre and water, especially important for peoples living in water insecure areas. These food sources have been diminished for commercial crops like wheat and corn, where these modern varieties have been commoditised^[10]. In Africa, there are many Leguminoaeae – Papilionoideae species like *Argyrolobium andrewsianum* Steud. or other Fabaceae like the Bambara groundnut (*Vigna subterranea* L.) which have the potential to become new staples in times of food and nutrition insecurity. As mentioned earlier, the argument also circulates around the profitability of diversification with forgotten varieties and does not have to be species-based^[7, 10].

Studies have shown that forgotten and landrace varieties of crops such as wheat (*Triticum aestivum* L.), lettuce (*Lactuca sativa* L.), tomato (*Solanum lycopersicum* L.), chickpea (*Cicer arietinum* L.) and many others, have showed elevated nutritional density as opposed to their commercial relatives^[11–12]. For





example, according to a recent study, wild and forgotten varieties of lettuce had 21% and 8% higher ascorbic acid content, respectively, in comparison to their commercial relatives^[13]. The superiority of some of these forgotten crops comes not just from their nutritional composition and bioactive compounds but from the resistances to things like abiotic and biotic stresses, weeds, and disease, where the highly productive commercial cultivars might not be able to cope with, especially if some were to be undertaken for further, *ex situ* crop development.

Sensory Characteristics

Commercial cultivars are grown specifically for yield purposes where uniformity is a crucial requirement for harvesting and processing stages. The forgotten varieties of common crops are often underdeveloped by agriscience and resemble a wilder relative, with greater variations in size, maturity time, shelf life and various sensory characteristics, including flavour and off-flavours, texture and colour^[14].

A good example of this is the case of the Spanish melons (*Cucumis melo* L.), where the landrace cultivars have outcompeted the commercial cultivars for flavour and texture characteristics, such as sweetness, fibrosity and firmness^[15]. Swedish horticultural landraces, including apple, pear, and pea varieties, have demonstrated superior flavour and texture profiles. This makes them highly promising for potential use in gastronomy to enhance dietary biodiversity^[16].

In the study we are carrying out on the diversification of food systems with forgotten crops, we have tested nine forgotten UK varieties of peas (*Pisum sativum* L.), with the genetic material being sourced from various seed banks and compared the results with their most popular, UK commercial cultivars. The preliminary results show a higher consumer

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acceptance for the forgotten varieties, which could mean that even within the UK, partial diversification with underutilised species and varieties could have an economic potential.

Value chains

Fonio, (*Digitaria exilis* (L.) Staph) is a great example of an ancient, neglected crop that has been revitalised recently, by creative chef-entrepreneur Pierre Thiam. The grain, an African cereal, has been put through the modern value chain and used as a basis for a modern crisp-like product, now widely available in the USA and Europe.

The supply chain of fonio relies on smallholder-indigenous farmers, giving the local communities prosperity and investments. This brings attention to the neglected and underutilised edible plants, that may have survived in some indigenous food systems but have been lost in the global battle for calories^[17]. Another case, this time in the UK, is showing the potential of genetic editing and the genetic reservoir that these forgotten varieties held.

The UK imports around 4m tonnes of soya annually, with 0.5 tonnes being utilised for animal protein analogues, and other vegan and vegetarian foods^[18]. Agriscience has developed new pea cultivars that are free from pea-off flavour and suitable for cultivation in the UK. These 'flavour-less' peas can serve as a viable alternative to soya in various processed food products, especially when avoiding pea off-flavours is essential. This adoption of flavour-less peas contributes to reducing food miles and building resilience in Britain^[18].

Provenance

Sourcing of forgotten foods for research and product development is rather difficult, as those mainly exist in small and informal reservoirs.

In the case of Scotland, there are a lot of interesting landrace varieties of cabbage, bere barley and oats that are being cultivated on a small scale by local growers, however, they have also been put under supervision by organisations like the Scottish Agricultural Science Agency (SASA). In England and Wales, the forgotten cultivars and species are dispersed around the country, often catalogued and monitored through various initiatives by the John Innes Centre (JIC), Heritage Seed Library and the Millennium Seed Bank^[19].

Sourcing genetic material from

overseas, for crop development poses obstacles in the form of legislation, such as the national listing for agricultural varieties/species and Food Standards Agency (FSA) regulations on novelty ingredients. Nevertheless, as shown through the case of Shropshire quinoa, feasible diversification of food production even with foreign, once neglected crops, is possible.

Conclusions

The decline in biodiversity and specifically agrobiodiversity, as shown at the beginning of the article, could be mitigated, at least to some extent, through a successful diversification of the food supply with forgotten foods.

In Africa and Central America, this could be achieved via popularisation of indigenous crops such as Fonio, while simultaneously increasing resilient-crop development, for which the neglected cultivars and wild edibles provided good genetic reservoirs.

Further exploration and attention for the forgotten varieties and crops across the developed nations, could also be a crucial step in elevating food and nutrition security and tackling genetic erosion across the scope.

Reintroducing forgotten foods into the food systems, driven by economic justifications, higher nutritional density, and enhanced sensory characteristics, as well as historical and social connections (e.g., British-Grown or ethnically distinct landraces), can significantly boost dietary diversity.

Moreover, these foods offer intriguing possibilities for gastronomy and present new qualities that the food industry can explore. It is important to mention that proper attention and investment are required to explore the potential and reintroduce these crops to markets, via diversified food value chain and through a systems approach. ■

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Szymon Wojciech Lara, Lecturer, Dr Amalia Tsiami, Associate Professor

London Geller College of Hospitality and Tourism, University of West London, St Mary's Road, Ealing, London W5 5RF, UK

Dr Philippa Ryan, Research Leader

Royal Botanic Gardens, Kew, Richmond, London, TW9 3AE

email Szymon.Lara@uwl.ac.uk