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Appetite-suppressing drugs and emerging implications for sustainability

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GLP-1 receptor agonists have transformed metabolic care, yet their influence extends far beyond direct human health. Appetite-suppressing drugs alter not only how people eat, but also how societies impact food production and resulting greenhouse gas emissions, land and water use, and nutrient pollution. We explore the potential environmental benefits of population uptake of these drugs and contend that planning a sustainable future requires accounting for the ecological outcomes driven by advances in medicine.

Appetite reduction and food demand changes

Appetite-suppressing pharmaceuticals such as Ozempic and Wegovy prolong satiety signals and convey a sense of nutritional sufficiency to the brain. Controlled studies show reductions in energy intake of 16–39% in individuals treated with GLP-1 agents[1]. One well controlled trial observed a 24% decline in daily energy intake during ad libitum meals compared with placebo[2]. This modulation of satiety circuits reduces the brain's need for calorie dense food and shifts the internal reward landscape. It is here, at the intersection of signalling peptides and behavioural choice, that the metabolic cascade begins.

The cascade does not end inside the body. Even before these drugs reach wide use, early market observations show that households with a GLP-1 receptor agonist (GLP-1RA) user reduce their grocery expenditure by around 5.5% within 6 months[3]. At the population level, early economic analyses suggest that current usage patterns may already have reduced total food and beverage consumption by an estimated 1–2% globally based on data from mature markets such as the United States between 2020 and 2025[4]. These are small aggregates produced by a minority of users, yet they illustrate that biological satiety signals, once pharmacologically modulated, can scale into measurable shifts in food demand.

The use of GLP-1RAs is increasing. Their prescriptions have risen sharply across many countries, and real-world data show that their use now extends far beyond classical diabetes care. Data from Japan, Europe, and the United States reveal steady growth in prescriptions and a widening of indications beyond type 2 diabetes[5–7]. For example, surveys in Great Britain show that 1.6 million adults used GLP-1RA therapy for weight loss in 2025, with 3.3 million adults expressing interest in doing so the next year[8]. J.P. Morgan Global Research estimates that approximately 25 million Americans will be on GLP-1 treatment by 2030, up from around 10 million in 2025, 6 million in 2024 and 5 million in 2023[9]. The World Health Organization now anticipates that fewer than 10% of eligible adults worldwide will use these therapies by 2030, yet this still corresponds to approximately 100 million users[10,11]. Together, these developments suggest that pharmacological appetite modulation will soon operate at a population level.

Population-level effects on food systems

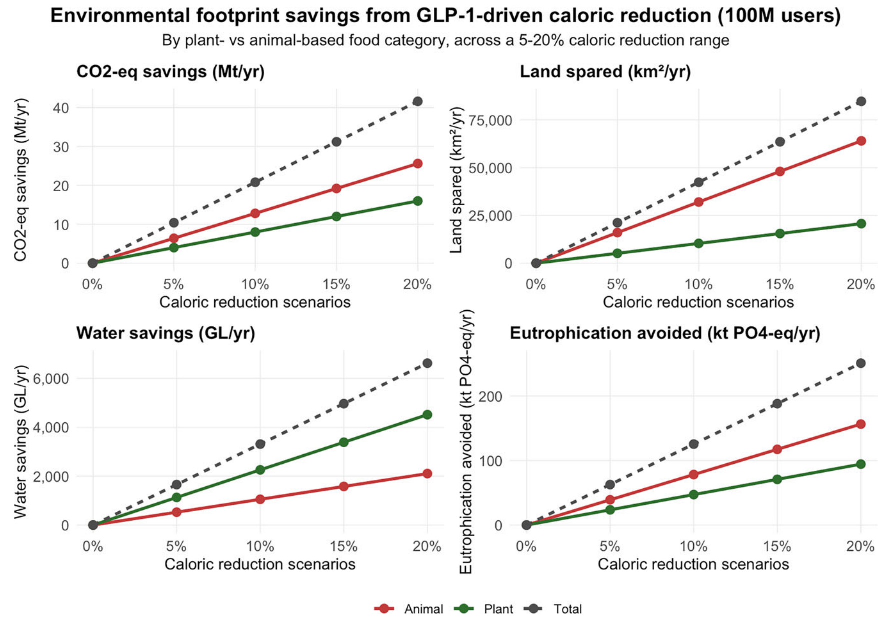
The reduction in caloric intake from GLP-1 therapy at the population level will have repercussions for food production and the environment (Fig. 1). To illustrate these implications, consider a conservative scenario in which 100 million adults worldwide use a GLP-1RA by 2030. If each of these individuals reduces their daily energy intake by 500 kcal (corresponding to the standard clinical energy-deficit target used in GLP-1 weight-management protocols[12] or 16.6% of daily energy intake[13]), then 100 million people will consume 50 billion kcal less per day, or approximately 1.8×10^{13} kcal less per year. The scenario becomes more concrete when translated across food groups. Assuming 17.8% of caloric reduction comes from animal-based products and 82.2% from plant-based products[13], then each GLP-1RA user would consume about 89 kcal less in animal and 411 kcal less in plant-based products. Across 100 million people, this equals 8.9 billion kcal per day (about 3.2×10^{12} kcal per year) for animal products and 41.1 billion kcal per day (about 15×10^{12} kcal per year) for plant products. For our analyses, total calorie supply (~3016 kcal/person/day) and the split between animal-based and plant-based foods are based on the most recent data available from FAO Food Balance sheets[13].

Reduced greenhouse gas emissions

An intervention that modulates appetite within the gastrointestinal tract can, when adopted by a small fraction of society, reduce pressure on croplands, livestock production, and associated greenhouse gas emissions. Using well-established estimates of environmental impacts from food production across meat, dairy, fruits, vegetables, and pulses[14], our scenario of a 16.6% reduction in daily caloric intake will subsequently reduce about 0.95 kg of CO_2-equivalent (eq) emissions for individual GLP-1RA users. Extending this across 100 million people corresponds to annual emissions savings of 34.5 megatons (Mt) CO_2-eq (Fig. 1), equivalent to removing about 7.5 million passenger vehicles from the road annually (assuming United States EPA estimates)[15]. About 62% of these savings are derived from reduced consumption of animal-based foods (21.3 Mt CO_2-eq), while 38% (13.3 Mt CO_2-eq) are from plant-based foods (Fig. 1).

Given uncertainty in the percentage caloric reduction from GLP-1 therapy, these overall emissions savings could range from about 10.4 to 41.6 Mt CO_2-eq (assuming 5% and 20% caloric reduction, respectively; Fig. 1). Assuming global food systems produce 18 Gt of CO_2-eq per year[16], our

Fig. 1 | Potential annual reductions in global carbon dioxide emissions, land use, water use, and excess nutrient runoff (eutrophication avoided) under varying levels of GLP-1 therapy associated caloric reduction (5–20% caloric reduction) across 100 million users. Estimates are organised by plant-based (green line), animal-based (red line), and total (black dotted line) caloric reduction. Estimates of per capita food calorie supply come from the FAO Food Balance Sheets 2010–2023[13] and associated environmental impacts per 1000 kcal from Poore and Nemecek (2018)[14]–processed by Our World In Data.



range corresponds to approximately 0.06% and 0.23% of the total annual food-related CO_2-eq emissions globally.

Land use implications

Agriculture is a dominant driver of biodiversity loss and soil degradation[17]. Land conversion for crops and livestock effectively removes habitat, simplifies ecological networks, and accelerates species decline[17,18]. Intensive cultivation decreases soil health through practices like monocropping, agrochemicals, and heavy machinery use[19]. When appetite-suppressing pharmaceuticals lower human caloric intake and food requirements at scale, even modestly, they reduce demand for land that may otherwise be important habitat for biodiversity. For example, using estimates of land area required to produce 1000 kcal of food per year[14], our conservative GLP-1RA scenario would result in 70,307 km^2 of global land spared (roughly the size of Ireland; Fig. 1), with 76% of this attributed to reduced caloric intake from animal-based foods (about 53,134 km^2) and 24% from plant-based foods (17,173 km^2; Fig. 1). The land area spared can vary depending on the percentage calorie reduction across the population; for example, 21,177 km^2 of land spared assuming five percent reduction in caloric intake and 84,708 km^2 assuming 20% reduction (Fig. 1). Assuming the world's total agricultural land is roughly 47.8 million km^2, then our range corresponds to 0.04% and 0.18% of global land for food production[20].

This example of the benefits of reduced food demand on land can have striking implications for biodiversity conservation. Given agricultural land use is one of the greatest threats to biodiversity[17], even moderate alleviation of this pressure may be critical for securing vulnerable species and ecosystems on the brink of extinction. Spatial planning policies could help maximise the potential benefit of agricultural land abandonment by ensuring that the abandonment occurs in areas of high biodiversity value.

Water savings and reduced nutrient runoff

Beyond land requirements, reduced demand for resource intensive foods such as meat, dairy, vegetables, sugars, and refined oils lowers the need for freshwater withdrawals and nutrient runoff that causes eutrophication[14]. For instance, when applying estimates of freshwater use per 1000 kcal of food consumption across commodities[14], our scenario results in a daily savings of 151 L of water per GLP-1RA user. Across 100 million people, this translates to 5496 gigalitres (GL) of water savings annually (Fig. 1), which is about two percent of the United States or 0.2% of global yearly water use for agriculture[21]. Our analysis suggests that 68% (3748 GL) of the global water savings in our scenario is attributed to reduced plant-based food consumption. This is largely driven by water-demanding crops like rice and wheat that provide over 10-fold higher per capita daily caloric supply compared to beef products[13,14].

When assessing savings in nutrient runoff per 1000 kcal[14] from reduced caloric demand[13], our set of assumptions results in 208 kilotons (kt) less phosphate equivalent (PO_4-eq) runoff into surrounding environments and waterways annually (Fig. 1). Over 62% (130 kt PO_4-eq) of this reduced nutrient pollution is attributed to animal-based foods, compared to 38% (78 kt PO_4-eq) for plant-based foods (Fig. 1). However, this can vary depending on our underlying assumptions. For example, if GLP-1RA users experience just a five percent reduction in caloric intake, then this would translate to about 62 kt less yearly phosphate runoff globally, while a 20% calorie reduction would result in 251 kt less phosphate pollution (Fig. 1). Regardless, if GLP-1-associated appetite shifts reduce food consumption, even marginally, the ecological consequences could be substantial. This is not speculation about individual behaviour but an extension of the well-documented mechanisms by which dietary patterns shape human impacts on the environment.

Caveats and implications for planetary health science

There are additional mechanistic layers not explored in our analysis. Lower food consumption reduces packaging, transport, cooling, and processing, each of which has quantifiable impacts on habitat degradation and material extraction. Waste streams shrink when meals become smaller and cravings for calorie-dense products diminish. These changes may seem trivial at the level of an individual household, but aggregated over millions of people they can affect economies that translate to benefits for biodiversity.

Yet the benefits we explore here are conditional rather than guaranteed. Land released from food production could be converted to biofuel crops or industrial uses that harm biodiversity in different ways. Producers may respond to declining domestic demand by intensifying production for export rather than reducing overall output[22]. The environmental footprint of GLP-1 drug production itself remains small compared with that of global agriculture, but it is not zero. Also, there are potential ethical, social, and economic implications from focusing purely on the environmental benefits from widespread GLP-1RA uptake. And these medicines alone are not a panacea for achieving sustainable food production, nor for addressing the overshoot of planetary boundaries. It is therefore critical to account for trade-offs among environmental, social, and economic objectives to ensure sustainable outcomes from appetite-suppressing pharmaceuticals.

Still, the conceptual shift is profound. A receptor agonist that quiets hunger may also quiet, through a chain of mechanistic pathways, the ecological pressures that erode ecosystems and biodiversity. It reminds us that the human metabolic state is not isolated from the state of the planet. When a society eats less, ecosystems ranging from the microbial scale to the landscape scale feel the effects. This highlights, with renewed clarity, that human health and ecosystem health are inseparably linked; changes in our physiology can reshape ecological systems, just as degraded ecosystems ultimately reshape human health. This interdependence carries the potential for beneficial synergies as well as unintended harms. Recognising this connection between metabolism and ecosystems should also be at the heart of planetary health thinking. In this sense, GLP-1RAs reveal an overlooked axis in sustainability and planetary health science: the link between metabolic modulation and ecological resilience. This invites us to view the future of biodiversity not only as the product of climate and conventional human impacts but as something also influenced by the collective appetite of humanity.

Data availability

No new datasets were generated during the current study. Estimates of per capita food calorie supply come from the most recent FAO Food Balance Sheets 2010-2023[13] and associated environmental impacts per 1000 kcal from Poore and Nemecek (2018)[14] – processed by Our World In Data.

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C.J.O. and M.S. conceived the idea of the manuscript. P.d.V. and C.J.O. wrote the initial draft with input from M.S., P.M., and J.W.H.Y. All authors contributed to writing and editing of the manuscript.

Competing interests

The authors declare no competing interests.

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