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A meal to ameliorate the Anthropocene

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Despite (or perhaps because of) the staggering scale and pace of global change, the concept of the Anthropocene eludes discrete classification. There is widespread consensus that conditions associated with the Anthropocene, including rapid biodiversity loss and climate change, must be addressed if we are to enjoy ongoing and rich experiences. At the crux of human impacts is urban living – as of 2024 nearly 60% of people live in cities. Human societies are tightly interconnected with each other and surrounding ecosystems, but for city-dwellers, these connections may seem abstract. A failure to appreciate and foster such connections can have human and environmental health repercussions. We present a concept for a meal featuring local wild foods that could only be appropriately served under regionally ameliorated Anthropocene conditions. By presenting this hypothetical "solution", we seek a common ground that spans human (and non-human) cultures and behaviors, and a concept that can be extended to any community. The simplicity of the "Anthropocene meal" belies three primary challenges: improvements to urban design, maintenance of ecosystem health, and shifting cultural attitudes. However, these barriers are quantifiable and may be addressed within annual to decadal timelines, making the Anthropocene meal a broadly achievable goal, and thus a valid source of optimism in a time of great uncertainty.

KEYWORDS
Anthropocene, cuisine, urban, solutions, climate change, biodiversity

Introduction

> *Pour ce qui est de l'avenir, il ne s'agit pas de le prévoir, mais de le rendre possible.*
> – Antoine de Saint Exupéry

Human innovations including agriculture, fixed settlements, and the harnessing of machinery (Industrial Revolution) arose against the equable environmental background of the Holocene Epoch over the last 11,700 years. On the eve of the third millennium CE, however, Paul Crutzen recognized from his work on the atmosphere and its interaction with other subsystems that the Earth System was no longer behaving as it had since the large ice sheets withdrew from mid-latitudes at the end of the Pleistocene Epoch. He proposed that we were no longer in a Holocene world, insisting that human agency had so altered the planet that we were in a new epoch, which he suggested naming the "Anthropocene" for the agent responsible for the shift: *Anthropos* (Crutzen and Stoermer, 2000).

The term "Anthropocene" has since been broadly applied to microplastics (Alves et al., 2023), invasive species (McInerney et al., 2021; Leroy et al., 2023), biodiversity loss (Finn et al., 2023), and other Earth systems changes (Steffen et al., 2011, 2015). Efforts to formalize an Anthropocene epoch focused on global systems changes precipitated by human actions, identifying the varved sediments from Crawford Lake (Canada) as the candidate "golden spike" (AWG, 2023; McCarthy et al., 2023). Plutonium fallout from hydrogen bomb testing beginning in 1952 CE provides a chronostratigraphic marker for this unit, but it is fly ash from fossil fuel combustion and other markers of the mid-20th century "Great Acceleration" (Steffen et al., 2015; McNeill and Engelke, 2016) that record the drivers of the Earth system change beyond Holocene norms (AWG, 2023; McCarthy et al., 2023). That it had become apparent that we were no longer living in Holocene conditions within half a century of the Earth system shift (Waters et al., 2023) highlights the urgency of mitigating and adapting to this novel state.

While many changes associated with the Anthropocene, particularly biosphere changes such as species invasions and extinctions, are effectively irreversible, other elements of global change, such as eutrophication (Jeppesen et al., 2007), can be ameliorated. Lakes provide detailed records of environmental changes that demonstrate how restoration efforts may not result in a true return to prior ecological or biogeochemical conditions. For instance, decreased nutrient loading following abandonment of an agricultural settlement near Crawford Lake (~1500 CE) did not return the lake ecosystem to pre-impact conditions (McCarthy et al., 2018; Krueger and McCarthy, 2024). However, while changes may not be reversed, amelioration is possible. For instance, the eutrophication of Lake Amatitlán (Guatemala; ~550–1200 CE) improved following reduced nutrient loading, although post- and pre-impact conditions were not identical (Waters et al., 2021). Living in the Anthropocene must therefore encompass both improving systems and adapting to those that cannot be changed. Arguably, the most important locale for "Anthropocene living" is in urban areas.

Since the early 21st Century CE, more people live in urban than rural areas (UN Department of Economic and Social Affairs, 2018), and this urban fraction continues to increase (McDonnell and Macgregor-Fors, 2016; UN Department of Economic and Social Affairs, 2018). The future of human–planetary relations is therefore connected to urbanization. The negative impacts of urbanization on aquatic (Walsh et al., 2005) and terrestrial (Grimm et al., 2008) ecosystems are well documented. Cities feature outsized ecological footprints, exacting environmental tolls via deforestation (Jande et al., 2019) and greenhouse gas emissions (Minx et al., 2013; Pichler et al., 2017). Urban environments can impair human health through reduced air quality (Leh et al., 2010; Kura et al., 2013), noise pollution (Firdaus and Ahmad, 2010; Olayinka, 2012), light pollution (Cao et al., 2023; Rodrigo-Comino et al., 2023), water pollution (Halder and Islam, 2015), and reduced access to green and blue spaces (Smith et al., 2021; Serra and Feio, 2024). A symptom of urban impacts is thus degraded ecosystem health (land, air, and waters), often exacerbated by poor urban design (e.g., improper sewage treatment, roads) and reinforced by cultural attitudes that undervalue local environments. It is thus plausible that an increasingly urban future is damaging for humans, nature, and the planet. However, as urban communities are driving the Anthropocene, cities must also be at the heart of ameliorating the Anthropocene condition.

The Anthropocene meal

A major challenge comes from an inability to define a resolution to interconnected global stressors. We tackle this with a concept that we call the "Anthropocene meal." This meal could be prepared and consumed in any community, but its preconditions involve improvements in three key areas: infrastructure, ecosystem health, and cultural attitudes. The consumption of the Anthropocene meal would be a measure of success. Devising a pathway to enable it can help stakeholders identify key barriers to progress. Facilitating this meal would improve social, biodiversity, and climate conditions, thus broadly ameliorating the Anthropocene condition. We present a version of this meal that might occur in Toronto, less than 50 km from Crawford Lake, the Golden Spike candidate for the proposed Anthropocene epoch.

Toronto's metropolitan area holds over 6 million people within a temperate, humid continental climate adjacent to Lake Ontario. With ravines and valleys covering ~17% of its area (Oviedo et al., 2022), Toronto faces challenges of invasive species (Foster and Sandberg, 2004) and water quality (TRCA, 2024b). Toronto's Don River (Waasayishkodenayosh in Anishinaabemowin, once classified as Canada's most polluted river; Bonnell, 2014; Mansoor et al., 2018) drains a highly urbanized watershed (TRCA, 2024a), including high-speed roadways. In the context of Toronto's environmental situation, an Anthropocene meal might start with a peaceful descent on a warm autumn day into the Don Valley, to a cabin by the river with a thatched roof of *Phragmites australis*. One would sit at a table crafted from local trees, enjoy the autumn colors, aroma, and the sound of the river. The meal might consist of grilled Chinook salmon (*Oncorhynchus tshawytscha*) with a side of manoomin (wild rice, *Zizania palustris*) and garlic mustard (*Alliaria petiolata*) paired with a glass of sumac (*Rhus typhina*) tea brewed with Don River water. The salmon would be caught from the river, the manoomin harvested from coastal wetlands, and the garlic mustard and sumac berries would be harvested from the valley.

The first barrier to this meal is urban design. Despite the central location of Toronto's Don Valley, there are few access points for pedestrians, cyclists, or low-speed cars, and the sonic landscape is dominated by high-speed traffic. Much of the river is flanked by thick overgrowth and is relatively inaccessible, so the Don Valley requires expanded access to low-speed transportation options (walking paths, public transit accessibility). High-speed roads would require decommissioning or conversion into low-speed boulevards and/or dedicated streetcar routes, permitting the efficient transit of people without the sonic and land footprint of a highway, while also expanding access and enjoyment for people visiting the valley. This work would need to be accomplished by urban planners and engineers and supported by the public and their elected representatives.

The second barrier to this meal is ecosystem health. The river water would need to be safe for human consumption, as would the plants and animals. The migration of salmon necessitates that Lake Ontario water quality be considered. As the Don River watershed extends north of Toronto and is impacted by wastewater, a coordinated multijurisdictional effort would be necessary to make river water potable. Pollution from the tires and exhaust of automotive traffic constitutes a barrier to safe consumption of local terrestrial (Ndiokwere, 1984; Muthu et al., 2021) and aquatic (Werbowski et al., 2021) plants. Assessments of soils may identify areas requiring remediation before plants on those sites could be safely consumed. The work in overcoming this barrier would be carried out by biologists, geoscientists, chemists, and physicians (determining safe consumption guidelines), as well as industrial and agricultural stakeholders and urban engineers for improving the river's water quality.

The third barrier to this meal is cultural attitudes. It is possible to establish an enjoyable location and safe meal, but many people may remain deeply opposed to drinking river water and eating local wild foods. To overcome this, effective monitoring and communications systems may be needed to elevate and maintain public trust in the quality of wild foods, ideally in partnership with Indigenous communities whose longstanding local practices may guide future actions. An increased appreciation of natural wild foods, potentially stemming from youth and adult educational programs, would be necessary to re-establish cultures of reciprocity and trust with local environments. These initiatives would rest with government agencies (collecting and disseminating information on ecosystem health) as well as educators and cultural institutions (museums, zoos, etc.) to showcase and normalize improved behaviors towards natural environments.

Discussion

The three barriers considered to the Anthropocene meal – infrastructure, ecosystem health, and culture – are not exhaustive considerations of all possible barriers (e.g., local weather or political turmoil would also be impediments). However, these barriers were considered key areas for directing local progress that could be addressed by individual and collective actions. Furthermore, the Anthropocene meal is not presented as a solution to urban food supply or a replacement of agricultural systems, but as a symbolic or ceremonial act. Depending on geographic location and ecological considerations, only a few hundred people may annually enjoy such a meal. This does not, however, lessen the benefits that it could bring to the Anthropocene condition, locally and globally.

By meeting the conditions of the Anthropocene meal, cities undergo transformations benefitting net zero climate targets, including expanding alternative means of transportation. Rather than focusing on carbon budgets alone, this conceptual approach guides communities towards a more equitable, socially- and ecologically-just future with increased biodiversity and greater appreciation of ecosystem services provided by local environments. Replacing heavy automotive traffic with less intensive and potentially more efficient and affordable alternatives (Beaudoin et al., 2015; Ceder, 2021) reduces human and wildlife collisions (Forman et al., 2011; Morelle et al., 2013), improves air quality via reduced automotive exhaust (Twigg, 2007) and tire-related pollution (Horner, 1996), and reduces or eliminates road salt application, improving aquatic ecosystems (Arnott et al., 2020). Economic benefits stem from reduced road maintenance costs (Newman and Kenworthy, 1998) and reduced healthcare costs through improved air quality (Künzli et al., 2000) and access to green and blue spaces (Wolch et al., 2014; Grellier et al., 2017), particularly critical given forecast heat waves and the need for reprieve from urban heat islands (Dang et al., 2018; Liu et al., 2022). Broader benefits include diminished demand for critical mineral mining for electric vehicle batteries, and the hazards created by their disposal (Dou et al., 2023).

Regarding ecosystem health, urban areas are often crucial habitats for biodiversity conservation. Cities can harbor endangered species (Ives et al., 2016; Soanes and Lentini, 2019), and unprotected areas are often more likely to harbor endangered species than protected areas (Clancy et al., 2020). Ensuring the health of local plants and animals ensures the health of local food web connections for both humans and wildlife. Given that cities are often on bird and insect migratory routes, healthy urban environments can transform communities into valuable migration resource stops (Rudd et al., 2002), supporting regional and hemispheric ecological functions and biogeochemical cycling (Schmitz et al., 2018). Harvesting techniques may include traditional practices, potentially increasing plant productivity (Martínez-Ballesté et al., 2008) and protecting against variable climate conditions (Stigter et al., 2005). By harvesting invasive species, the Anthropocene meal suppresses their spread without costly and potentially harmful mechanical or chemical suppression techniques (Rinella et al., 2009; Nuñez et al., 2012; Seaman et al., 2024), establishing sanctuaries of heightened biodiversity relative to nearby rural areas.

The benefits of shifting public attitudes towards consuming wild foods are connected to broader benefits of decolonizing settler attitudes, particularly in communities built on colonial or extractive relationships with lands and waters. Witnessing friends or grandchildren drink local river waters could profoundly influence engagement of individuals with entrenched attitudes with maintaining the potability of those waters. Likewise, sharing the Anthropocene meal with neighbors could activate a joint community investment in keeping the land and waters clean. In the region encompassing Toronto and Crawford Lake, this ethic is echoed within a 1701 CE agreement between Haudenosaunee and Anishinaabeg nations, represented by the Dish With One Spoon wampum belt (Hall, 2003; Jacobs and Lytwyn, 2020), interpreted as dictating that lands and waters should be shared as by a meal contained in a dish containing one spoon. While recognizing the territorial sovereignty of each nation, those partaking in the meal should consume no more than they require for their sustenance, ensure that others at the dish have enough to eat, and keep the dish clean (Hill, 2020; Jacobs and Lytwyn, 2020). Establishing opportunities for urban populations to engage closely with natural systems can produce local and global positive societal impacts (Godinez and Fernandez, 2019; Greenwell et al., 2023). A broader awareness of and investment in local ecological health would likely link directly to a greater investment in maintaining healthy global systems.

The Anthropocene meal highlights pathways necessary for ameliorating the Anthropocene condition. Barriers at the individual (cultural attitudes) and the societal/structural scale (infrastructure upgrades and ecosystem health monitoring and dissemination), reflect the role that both individual and collective actions must play in addressing global change (Brownstein et al., 2022). At the local-to-regional scale, this exercise importantly provides stakeholders with a tool to identify key needs in their own community, based on which barriers are furthest from being achieved (Dilling and Berggren, 2015; Leitch et al., 2019). The Anthropocene meal addresses global change through a holistic lens integrating climate change, biodiversity conservation, and social wellness. Linking these elements throughout solutions planning is crucial, particularly as some climate change and biodiversity solutions may work against one another (Pörtner et al., 2023). This approach may also reveal overlooked areas in needs of improvement. For instance, in Toronto, the expansion of alternative modes of transportation including protected bike lane networks and public transit options is underway, yet to our knowledge there is no official consideration of upgrading highways in the Don Valley to more efficient/less impactful transport options such as dedicated streetcars or expanding public access options to this valuable green/blue space. Regarding ecosystem health, the multijurisdictional challenges associated with monitoring and ameliorating the Don River may be addressed by local Conservation Authorities whose boundaries are defined by watersheds rather than political boundaries. Major efforts are nearing completion to naturalize the mouth of the Don River (Bonnell, 2014), and Toronto is upgrading sewage overflow systems connecting to the river. Signs of improved ecosystem health include the recent reappearance of bald eagles and river otters within Toronto. Although the Government of Ontario releases fish consumption guidelines (Ontario, 2024a), these guidelines would need to include other wild foods (plants and animals). Education initiatives may be needed to assist the public in interpreting risk-based assessments of food safety. For instance, many may interpret a safety guideline of "one fish per year" as meaning that those fish are too dangerous to eat at all.

Another benefit of the Anthropocene meal concept is that it facilitates the development of a rough timeline over which barriers may be overcome. Plants and animals inhabiting the Don Valley may be fit for consumption within ten years given progress on improving local water quality and other restoration efforts. Public trust building efforts towards consuming wild foods may begin immediately, though a lag may exist from when wild foods are safe to eat to when most will be comfortable consuming them. Given the pace of changes in Toronto's urban infrastructure, municipal economic constraints, and the fact that transforming the Don Valley infrastructure is not a priority, this facet of the Anthropocene meal is likely furthest from completion. However, it may be reasonable to expect that within 15 years, public and political interests may garner support for such a plan, and that another 10 years would be required to carry it out. Within this very broad framework, we might therefore expect Toronto to enjoy its first Anthropocene meal by 2050, when the population of the Greater Toronto Area will have likely grown to over 10 million (Ontario, 2024b). This growing population underscores both the symbolic nature of the Anthropocene meal, and the potential challenges and opportunities that come with anticipated urban population growth.

Each of these considerations and timelines would be site-specific. For instance, while the primary identified barriers in Toronto were infrastructural and cultural, an Anthropocene meal in nearby Montreal incorporating the St. Lawrence River might instead feature ecosystem health as the greatest barrier to surpass. The St. Lawrence River faces similar challenges of cultural eutrophication as exist in many other urban waters (Hudon and Carignan, 2008; Wurtsbaugh et al., 2019), yet improving and safeguarding those waters from pollution sources would require international efforts as the river upstream is shared by the USA and Canada. In general, multijurisdictional waterways feature impaired water quality indices (Epperly et al., 2018), highlighting a potential challenge in such instances. In other cities such as Berlin (Germany), public attitudes may generally be amenable to the consumption of foods sourced within the city, with structural considerations (i.e., active support from municipal government) being the key barriers to broader adoption of such practices (Scharf et al., 2019).

The Anthropocene meal is presented as a small-scale practice with global repercussions. It does not "reverse" or "undo" Anthropocene conditions, but instead fits human behaviors more fruitfully within the Anthropocene (Bird and Nimmo, 2018; Heller et al., 2023). It does this by harnessing the inherent and often unexpressed *positive* potential of high-density human societies within existing ecosystems. These actions have potentially far-reaching beneficial repercussions to global biodiversity, climate, and social justice crises, and can be carried out by all communities. There may be no clear "solution", but the hypothetical Anthropocene meal would arguably guide us on the best path forward.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

SB: Conceptualization, Writing – original draft, Writing – review & editing. FM: Conceptualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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