

Review

# Who Cares? The Importance of Emotional Connections with Nature to Ensure Food Security and Wellbeing in Cities

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**Abstract:** To be “connected” is “to care”, because how and what we care about is influenced, and influences, what we are connected with. Emotional connection predicts environmental concern and children exposed to green environments take this appreciation of nature with them into adulthood. However, the majority of the human population is now living within urban areas, where opportunities for people to interact and bond with nature are greatly diminished, thereby potentially threatening the liveability of cities into the future. Connection with nature has been shown repeatedly to benefit human wellbeing and predict pro-environmental behaviours. By definition “nature” includes urban agriculture, which is also an integral component of a city’s foodscape, thereby providing opportunities to improve the wellbeing of city inhabitants as well as help ensure food security. This will only be attainable if the next generation has an emotional connection to nature, and the necessary life skills to help them enter adult life as informed food citizens who make healthy and sustainable decisions for themselves as well as others. This paper reviews existing literature on foodscape (or one’s food environment) and biophilia (the love of life or living systems) to highlight the need for inter-disciplinary research that combines urban agriculture and food literacy to ensure future food security and wellbeing of urban inhabitants.

**Keywords:** biophilia; foodscape; wellbeing; urban agriculture

## 1. Introduction

Humans are socially oriented beings, that need healthy inter- and intrapersonal connections to experience psychological wellbeing. A sense of belonging and connectedness is a requirement to experience an overarching meaning in life [1]. To belong implies experiencing relatedness and connections with people, society, and nature. But generally cities are comparatively nature-poor and with inhabitants living busy lives, there are fears that people are increasingly disconnected through an extinction of experience (first termed by Pyle [2]) from the natural world in both quality and quantity [3–7]. As David Attenborough argues, this “means that people are getting out of touch with the realities of the natural world, of which we are in fact a part” [5] (p. 1).

This connection to the natural world is studied in the biophilia literature [8,9] (as well as many other disciplines) and includes measures for gauging people’s levels of pro-environmental behaviours. Biophilia literally means “love of life or living systems” [10], and encapsulates the connection sought with other life forms and nature by humans [9]. This paper collates evidence that food production is in fact part of “nature” and that a similar disconnect to that argued for nature, exists between

people and their food system. Thus, a loss in one's connection to nature may have implications in one's relationship with and knowledge of food. In many contemporary cities, spaces and skills related to food are rapidly vanishing, where we are now experiencing a global generational "amnesia" about how to grow food [11]. For most urban inhabitants the growing of food is no longer a part of their relationship with food. This shift has also been recorded in literature on foodscapes and urban agriculture [12], however implications for human health and wellbeing are often absent (except in research on food choices). Food is vital to human health and wellbeing, and is therefore considered "the ultimate index of our capacity to care for ourselves and for others" [13] (p. 1852).

Historically, studies have focused on impacts of nature relatedness and foodscape (including agriculture and food production) on wellbeing as completely separate fields of research, when in fact there are many overlaps and commonalities between the two areas. This paper aims to explore concepts within existing literature on biophilia and foodscapes to highlight opportunities for inter-disciplinary research that could help ensure food security and wellbeing of city inhabitants. Education (food literacy) and urban agriculture are proposed as having a unique role in addressing both the quality of life and subsistence concerns of cities.

## 2. Biophilia and the Definition of Nature

The term biophilia was first coined by Fromm [10] and has since spread from the field of psychology to health, architecture, evolutionary history and environmental science to name a few. Wilson [9], and then Kellert and Wilson [8], introduced the "biophilia hypothesis" attempting to explain the human desire to relate to the natural environment. Wilson [9] argues that we have an innate need to connect with all other life because humans evolved in nature (relying on it for survival), so that nature forms part of our ancestral identity [14].

The theory behind the biophilia hypothesis asserts that people are hardwired and driven biologically to seek out (requiring "individual will") and/or enjoy nature for our survival [8,9]. However, there are people who genuinely dislike being in nature, due to conditioning (such as fear campaigns of media, peers, parents and schools) or personal negative experiences in nature [15]. But these differing opinions on nature necessitate the clarification of what "nature" is. Is it pristine wildland including a diverse range of ecosystems, biodiversity and ecological processes subjected to climatic variability, or is it a manicured parkland? Buettel and Brook [7] argue that as nature is a sociocultural construct, the definition and view of nature is constantly changing and evolving, and therefore one should not expect everyone to appreciate and care about nature in the same way [16]. One might therefore argue that a rural perspective of nature would be vastly different to that of a city dweller and even amongst different sociocultural or socio-economic groups within the same region. However, research on nature-human interactions has generally used a broad definition of nature [17] and included indoor (foliage plants), urban (public green spaces, gardens and roadside vegetation), fringe (peri-urban nature reserves), production landscape (agricultural land), and wilderness (beach/ocean, river, mountains, forest/woodland, national parks) [18]. According to this definition, food production and agriculture within and outside cities are considered to be an integral part of "nature".

Positive past and present nature experiences create emotions such as affinity, interest and indignation which can result in nature-protective or pro-environmental behaviour [19]. Therefore, the biophilia hypothesis has been used to help understand why people do, or do not, feel the desire to conserve the environment. "Personality and attitudes, as well as knowledge and skills, predict pro-environmental behaviour" [19] (p. 716). Existing measures of biophilia or environmentalism and ecological worldview include the new ecological paradigm [20], the new ecological consciousness scale [21], the connection to nature scale [22], the environmental identity scale [23], and the inclusion of nature in self [24]. Nisbet et al. [19] created the nature relatedness scale which aims to combine the strengths of the measures mentioned above to assess "the affective, cognitive, and experiential aspects of individuals' connection to nature" (p. 715). However, none of these measures specifically

ask questions about food production or agriculture. The nature relatedness scale includes a question about getting one's hands dirty, and the environmental identity scale asks a question about gardening, however neither of these activities are necessarily food related. Furthermore, it would be fair to assume that when answering these nature experience or ecological worldview questions, food production may not be what the respondents are thinking about.

It is important to keep in mind that just because people do not behave in environmentally conscious ways, does not mean that they are not concerned or aware about the environment [19,24,25]. However, people with high nature relatedness have been found to spend more time outside in the natural environment, be more environmentally concerned and endorse pro-environmental attitudes and behaviours [19]. There is no research to clarify if people with strong connections to nature are concerned about food security, spend more time at farmers markets, produce any food, or make more ethical or sustainable food choices.

Existing research on nature relatedness is currently biased toward high latitude, western, developed nations, which may lead to overlooking cultural as well as socio-economic influence on responses to interactions with nature [6,18,26]. This may be because "studies in western societies tend to focus on human quality of life and wellbeing, and maintaining the biological quality of the urban landscape, while those in non-western societies frequently emphasise subsistence, economic gain and developmental potential of interactions between people and nature" [6] (p. 160). This point would be especially true for food related nature perspectives given the vastly different personal experiences and cultural orientations associated with food (this is discussed further later in the paper).

Even within western cities there are socio-economic disparities in access to nature and quality of the nature which is accessible. Suburbs of higher socio-economic advantage have significantly more overall vegetation cover, more private green cover (but slightly less public green cover), more street trees, higher plant species richness and vegetation abundance than areas of greater disadvantage [6,17,27–29]. Hoffmann et al. [30] found that green spaces in lower socio-economic areas raise more safety concerns, have more signs of damage, less equipment and fewer amenities (such as seating, toilets, cafes). It is unclear from the literature whether the green cover recorded in these studies includes urban agriculture or food production; however, given the definition of nature and the methodologies used (usually aerial surveys) it can be assumed that it is. This is of importance, as lower socio-economic areas often experience inequities in the availability, quality and accessibility of food [31,32].

In the food choice literature similar inequities to those of nature availability have been demonstrated and have been referred to as "food deserts". Food deserts are "those areas of inner cities where cheap, nutritious food is virtually unobtainable and large geographical areas without access to healthy and affordable foods" [33] (p. 213). Food deserts are more prevalent in lower socio-economic areas and result in higher levels of food insecurity [34–37]. As an example, in Australia somewhere between 5–11% of the population is food insecure, with certain groups (e.g., unemployed people, single parent households, low-income earners, rental households, young people, indigenous, culturally and linguistically diverse and socially isolated people) being more susceptible [35,38,39]. This is partially explained by limited financial resources, as production of food in cities is limited, and purchasing is the key method of obtaining food for urban populations [40]. Kettings et al. [41] demonstrated that following the public health recommendations (2 serves of fruit and 5 serves of breads/cereals and vegetables per day) was often not feasible for those on welfare or for low-income earners as it required at least 33% of their weekly income. People with less money eat less, eat less nutritious food and/or eat food of inferior quality, thereby endangering their health as well as leaving less money available for other costs such as health and education [40]. For this reason, government and community groups are trying to encourage urban farming initiatives in lower socio-economic areas, however Santo et al. [42] point out that urban farms located in lower-income communities may not necessarily be feeding these urban populations.

Urban agriculture is unlikely to be the answer to feeding the future city's population, but its greatest merit is the combination of social, economic, landscape and leisure benefits that contribute to a system of healthy food production and a liveable environment [40,42,43]. "Urban agriculture is considered as a means to manage open spaces within the city and to achieve a liveable city with green spaces and recreation areas close by" [40] (p. 725). Studies have shown that simply by looking at a plant people can feel less stressed, fearful, or angry, and doing so can lower blood pressure and muscle tension [44]. Community gardens have been shown to be reassuring places [45] and "enhance nutrition and physical activity and promote the role of public health in improving quality of life" [46] (p. 1435). Public health advantages could be enhanced by incorporating urban agriculture into a city's plan for "green spaces" (e.g., parks and wildlife corridors) [44].

### 3. Food Related Wellbeing

Feeling connected to nature can trigger feelings of care and responsibility for animals and the natural environment of which humans are an integral part [47]. "Care for nature, therefore, also means to care for one's physical and mental health, as well as striving for vitality and overall wellbeing" [47] (p. 447). Health, as defined by the World Health Organization is the complete state of physical, mental and social wellbeing in people [48]. However, the literature on wellbeing includes aspects of physical, psychological, mental, emotional, economic, environmental, social as well as spiritual health [1,49]. So generally speaking wellbeing "is a good, satisfactory, and desirable state of personal existence or life" [1] (p. 4752).

Increasingly, research is finding that biophilic tendencies are significant contributors to reaching emotional and psychological wellbeing [6,18,29,50]. Interacting with nature can result in a range of human benefits including physical health, mental health, psychological health, psychological wellbeing, life meaning, cognitive ability and social cohesion, and provide spaces for physical and social activities to take place [3,14,18,19,25,28,50–54]. Shanahan et al. [17] identify three main pathways of nature benefitting wellbeing: direct pathway to physical health (e.g., a tree reflecting light and thereby managing temperature extremes); indirect pathway to physical health (e.g., a tree providing more shade promoting and encouraging physical activity); and an indirect pathway to mental health (e.g., the experience of viewing nature having restorative impacts on the brain).

Numerous studies within the disciplines of health, education, sociology, planning and psychology have looked at the wellbeing benefits of gardening, which is arguably the easiest nature-based activity in cities to measure. Given the definition of nature, it is unsurprising that Kiesling and Manning [55] found that a strong environmental connection significantly predicts increased engagement in gardening behaviour. Gardening participants were more concerned about the future of the environment and tried to conserve resources [56]. Reasons for participating in gardening include aesthetics, connecting with nature, achievement and physical and mental activity [54,55,57]. Most literature, however, does not distinguish clearly between gardening activities and food production, which results in an apparent divide between urban agriculture and biophilia research. The multitude of benefits of urban agriculture within communities have been well established, and include fostering social interactions, educational opportunities, health and ecosystems services as well as community and economic development [40,42,44–46,58–64]. All of these apply to green spaces as well. Assuming therefore that urban agriculture is considered part of nature, does our "connection" with urban agriculture (the cultivation, processing and distribution of food) therefore also influence our wellbeing? And if so, how do we measure this? As with the definition of nature, Mougeot [65] argues that the definition of urban agriculture is not a fixed definition but rather changes over time and varies between socio economic and cultural groups.

Jacobsen [16] explains that food in western societies is often viewed through three different lenses that are not mutually exclusive: as part of nature, plants, animals, raw material or nutrition to the human body; as a commodity for sale and purchase; and as culture (food is embedded culturally and associated with norms). Regardless of what perspective is taken, food is an essential part of living

that occupies a considerable part of a person's daily life (in relation to time and resources), meaning it can be seen as both a source of satisfaction as well as potential dissatisfaction [66]. Health policies have drawn attention to the fact that food is an aspect of life that influences subjective wellbeing. "The influence of foods on perceived wellbeing can be explained by its influence on different aspects of life, including body functioning and physical health, mood and emotions, as well as global life judgement and social relationships" [67] (p. 63).

Food provides sustenance for all humans, yet food production, preparation and consumption methods vary among differing communities and cultures. In addition to providing sustenance, food is also a symbol of personal and group identity, thereby playing an essential role within most cultures [68]. Vaqué-Crusellas et al. [69] state that food "includes aspects of the physical environment (where the eating takes place, the furniture, the cutlery used, sound and environmental temperature, among others), the psychosocial environment (interpersonal relationships with meal companions) and also beliefs and values held with regard to food in each socio-cultural context" (p. 964) (similar points are made by Johansson [70] and Jacobsen [16]). Cantarero et al. found that people prefer to consume food that they associate symbolically with their own culture, as it reinforces their sense of belonging [71]. A multi-national study by Prescott et al. [72] concluded that geographical location can be less important than common cultural values in determining food choice. Food is ingested individually but it is often grown, processed and prepared by a group (or in this globalised world, multiple groups) [73]. Food binds people together and is therefore a primary indicator of individual and group identity [73]. It is important to note that ethnicity is a "process of creating and reproducing classificatory distinctions between in-groups and out-groups by people who perceive themselves as distinct from others" [73] (p. 3). These distinctions can include tangible elements (such as dress, mannerisms and bodily features) as well as immaterial elements (such as language, cultural knowledge, worldviews, values, religion, shared history, symbolic practices, and other traditions) and will vary between individuals [73]. Food often plays an important role in facilitating such categorization of "belonging" and "non-belonging", often through discussions about heritage, nation building and tradition [68,73]. Eating and food are strongly embedded in history, identity, community, place and culture, so will always involve interactions between the social and natural world [32,70]. Research is limited however, on how a seemingly stable part of one's cultural identity can also be fluid and changeable, given that diets and cuisines are in constant state of flux (which is significantly amplified by globalisation) [68]. Therefore, to improve the inhabitants' food-related wellbeing in cities (which are culturally diverse) it is important that cultural drivers and group identities are understood.

The majority of food related wellbeing literature focuses on developed nations and specifically the consumption of food, except for Grunert et al. [66] who added procurement and preparation of food. However, food-related wellbeing research ignores food production altogether and has yet to establish what role this plays in healthy eating, especially in developing countries. It is important to note that "there is a two-way link between eating and psychological wellbeing . . . in as much that not only do psychological factors affect food choices, but that food choices affect psychological balance [wellbeing]" [74] (p. 211).

#### 4. Food Choices and Foodscapes

Lautenschlager and Smith [56] found that youth garden program participants were more likely to try new foods and were more willing to eat nutritious food. Does this mean that connection to nature translates into people making better food choices? Food choice has long been "recognized as a process that involved psychological, social, cultural, economic, and biological forces . . . over a lifetime, these forces interact with a person's life course events and experiences to result in individual preferences (such as taste) and other considerations (such as convenience or monetary considerations), which shape food behaviour" [75] (p. 128). There are many influences on food choice including ideals, personal factors, resources, social context and the food context [71,76–78]. Considerations that weigh into food choices can also be labelled as food related values, with the most common being



health (physical wellbeing), taste (sensory perceptions), cost (monetary considerations), convenience (time and effort), and managing relationships (inter-personal interactions) [78]. Story et al. [79] compiled a model of influences on food choices based on an ecological framework that highlights the nature of food decisions in terms of multiple levels, the relationships between multiple factors within these levels, as well as connections between the factors and levels.

Food choices are driven by a combination of individual factors, social influences (networks of family and peers), physical environments (home, school, after-school programs, and neighbourhood) and macro-level environment (cultural, economic and political factors) [35,71,74,77,80–84]. The term “foodscapes”, originally used in geography, encapsulates these interactions well. Foodscapes are seen to encompass the places and spaces where food is acquired, prepared, talked about, or some form of meaning is gathered from food [31,33,85]. Foodscapes incorporate elements of community (type and location of food outlets), consumer (availability, price, nutritional information), organization (home, school or workplace) and information (media and advertising) [33,37]. Mikkelsen [33] defines foodscapes as “the physical, organizational and sociocultural space in which clients/guests encounter meals, food and food-related issues, including health messages” (p. 215). The term foodscape aims to incorporate all components of the relationship such as the planning and purchase, the preparation and cooking as well as the consumption of food and health messages. It is important to note that food production and distribution are not explicitly mentioned in the definition of foodscape but are arguably the foundation for the shaping of foodscapes and hence should be included.

When considering the ecological framework of influences on food choices by Story et al. [79], it is important to remember that to make healthy food choices individuals need a supportive environment with access to affordable healthy food [37,79]. But views on food can vary significantly from individual to individual based on their own experiences, family and cultural histories, belief systems, education and socio-economic position. In other words, foodscapes can influence food choices [31,33,35,37,86,87], but food choices can also influence foodscapes [31]. This is mainly achieved by way of economics (customer purchasing power) and to a lesser extent food politics (such as ethical, fair trade, sustainable growing, health messaging and food regulations).

As with defining nature and urban agriculture, it is important to note that the foodscape is never fixed [31] and that food is not a thing (a noun) but a process (a verb) [88]. “Food and how/what we feel about “it” and the feelings of care we attribute to “it” cannot be divorced from the embodied practices, socio-institutional arrangements and cultural conventions whence it came” [88] (p. 319). It makes sense that these feelings therefore underpin food preferences and dietary decisions [89]. This would suggest that the way we feel or connect with our food influences our overall sense of wellbeing and that we need an integrated approach in studying foodscape and connections with nature. It is not enough to know what sustainable and healthy foodscapes are, but we need to “feel” them [13,88]. To date, literature on foodscapes has primarily focused on the structure or composition rather than values associated with creating foodscapes. Given the similarities established earlier, a possible starting point would be to look at the literature on values associated with biophilia [8] and food choice related values [78].

## 5. Urban Agriculture’s Role in Food Security

The United Nations forecasts that 70–80% of the world population will live in cities by 2050 [17]. Currently more than half the human population is living in or close to cities [3,40] and in Australia this is closer to 89% [90]. In low-income countries approximately 28% of the total population lives in cities, however these countries currently have the fastest rates of urban population growth which is putting increasing pressure onto their food systems [43,85,91]. Worldwide around 15% of food is grown in urban areas [40]. Food production in cities can include but is not limited to home gardens, community gardens, market gardens, vacant lots and parks, school gardens, rooftop gardens, balconies, windowsill gardens, livestock grazing, aquaculture and urban farms [40,61,91]. More agricultural technologies such as vertical, rooftop, underground and floating farms have been established recently, however

it is uncertain if these technology-driven agricultural initiatives will be economically successful and accepted socially in the long-term [92]. Even though there has been an increased interest in food production in cities, food policy and plans in most westernized countries primarily support commercial agricultural sectors in urban centers outside capitals i.e., regional cities because the majority of food-related jobs are located there [59].

Urban agriculture is primarily undertaken for subsistence purposes, but also for financial benefits (albeit usually with low returns), agricultural traditions, access and affordable dietary diversity and quality in low-income countries [43,91]. In comparison, urban agriculture in developed countries is undertaken for subsistence purposes (cost saving) but more commonly for psychological and personal factors such as the desire for high-quality food (fresh, convenient, organic, better tasting), previous exposure, health reasons (mental and physical), as well as political and environmental convictions (such as sustainability issues) [43,93–95]. This discrepancy in motivations is partially driven by differing perspectives and experiences of nature, foodscapes and food security. Extensive research into developing countries (especially their fast-growing cities) is necessary to further understand the role that urban agriculture should play in ensuring wellbeing and food security.

The food consumed by a city's population rarely can be met by the city's urban ecosystems, hence cities seldom have the capacity to satisfy their own food supply [43,61,62,91,96]. Large cities mainly feed themselves via global food systems. This reliance on global connectivity, however, can increase a city's vulnerability to food shortages and severe crises by severances of supply lines [11]. Not only could this pose a major threat to urban food security, this dependence on others for materials, products, capital and waste disposal can result in fragmented, passive and unhealthy communities [11,97]. Globalisation results in a power imbalance between consumers who have lost control over basic needs, such as food and energy, and multinational corporations that have little appreciation for the local social and economic culture of the community [61]. Local food can help give back communities that ability to control, understand and influence the food they eat [63]. This awareness is resulting in an influx of food sovereignty research and movements worldwide [36,93,98], which could have significant implications for the wider food system and political governance in the future. Learning from developed countries, preventative policy should be made a priority in low-income countries that are currently undergoing urban population influx and transitioning away from local food production (with shorter supply chains) towards a more globalised food system. Evidence-based research on sustainable production practices and development should be adapted into appropriate location-specific mechanisms of governance and institutional support for improving food system resilience [43,99–101].

A sustainable foodscape promotes community health by encouraging socio-ecological sustainability as well as sustainable food security (via a resilient food system) [33]. "It is highly unlikely that the major cities . . . will ever become completely self-sufficient in food, but through greater support for urban (and peri-urban) agriculture, they could become more food secure" [58] (p. 62). The Food and Agriculture Organization of the United Nations defines being food secure as when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [102]. Urban "agriculture presents a holistic approach to food security that is more directly connected to the economic, environmental and social factors that affect diet and health" [64] (p. 14).

Food security is considered to be a significant public health issue as it is a key social determinant of health [38]. Food insecurity has been linked with the obesity epidemic (due to the tendency to buy "cheaper" food) and general poor health (e.g., higher mortality rate, malnutrition, coronary heart disease, type-2 diabetes, some cancers and lower birth rates) [38,43,103]. Obesity levels in lower-income and transitional countries are increasingly as high, or even higher than in developed countries, leading experts to conclude that the obesity epidemic is a worldwide phenomenon [104]. For urban agriculture to achieve its full potential, Hamilton et al. [43] recognized that the role of urban agriculture in abating malnutrition and obesity requires further attention.

As an indication of future health habits, a 2016 Health report from Australia found that 97% of children did not eat the recommended daily servings of vegetables and 30% did not eat the recommended daily servings of fruit [103]. Furthermore, 26% of children (aged 5–14) and 37% of young people (aged 15–24) were overweight or obese [103]. Most alarmingly, discretionary foods (often energy rich food and drinks high in saturated fats, sugars and/or salt) contributed 39% of energy intake for children and young people during 2011–2012 [103]. It is commonly accepted that diet plays a crucial role in chronic disease and obesity prevention and has been linked with environmental factors (e.g., distance to parks and markets) [79,105]. Due to lifestyle choices and the limitations of the current food system, obesity and chronic diseases will increasingly be a burden on the medical system and challenge the sustainability of cities.

Urban agriculture (in close proximity to residents) can help secure food during harvest failures, regional political turmoil or other reasons for cuts on imports from distant supply chains [11]. As with the pro-environmental attitudes discussed in the biophilia research, it is assumed that urban residents have the foresight to want and be willing to participate actively (including potential changes to diet habits due to restricted seasonal availability) or encourage food self-reliance and food security into the future [42]. However, an increased pace of life and modern living distractions have diminished most people's interest and capacity to grow food or indeed cook a balanced meal [106]. Could this lack of sustainable and proactive thinking be a direct consequence of a reduced connection with nature and food?

## 6. Implications for Future Generations

Childhood has changed dramatically in the last three decades due to a shift in indoor based play (often including the use of electronics) and changes to parenting attitudes [107,108]. Stressful work schedules and bombardment of negative media stories (such as child abductions) result in parents being too anxious to allow their children free play outdoors [107]. For these and other reasons, a British study showed a 90% reduction of the radius that children roam freely around their homes since the 1970s [107]. Similarly in a school setting, sports fields have more frequently been sold off or developed and the use of outdoors as a “natural classroom” has diminished due to rigid curricula, parental expectations and fear of repercussions such as accidents and lawsuits [107]. Children today are suffering from “nature deficit” [107]. This also applies to food, with children increasingly becoming disconnected from the land and communities that produce their food [109,110].

Hillman and Buckley [109] explored the disconnect many students have with the very industries that feed them. Their survey found that rarely did students have a deep knowledge of farming practices [109]. Similarly Shaw and Martin [111] established that 77% of city teenagers know little or nothing about farming and food production and 68% know little about how food gets from farm to plate. Surprisingly, both teenagers and teachers (53%) had positive associations with, and perceived farming and food production as very important to their country and for young adults; however only 7% indicated an interest in an agricultural career [109,111].

Adolescence is signified by a physical and psychosocial transition, including: changes in cognitive processing; increased autonomy in decision-making and independence; more responsibilities and experimentation; as well as developing a personal identity with different interpersonal influences and support systems [82–84,112–114]. This period can often come with heightened stress and anxiety levels. Research has shown that nature experiences (including gardening) increase empathy for the natural world in children, as well as their perceptual skills, self-esteem, self-acceptance and self-efficacy [6,52,115], thereby bolstering their resilience so they can cope better with adversity [116]. In other words, nature buffers the negative effects produced by stressful situations by providing psychological restoration [116].

Simple interventions such as encouraging people to notice positive things in and about nature have been found to increase the connection with nature [4]. In response, a variety of programs have been developed and trialed within developed urban communities, including but not limited to: Work with



Nature (The Nature Conservancy); 30 × 30 Nature Challenge (David Suzuki Foundation); The Wild Network; 30 Days Wild (The Wildlife Trusts); and the Children and Nature Network. Analyses of such programs have found that in addition to wellbeing benefits, “connection to nature may provide people with resilience to meet the challenges of everyday life, while also facilitating exercise, social contact and a sense of purpose” [4] (p. 9) (also supported by Morris [50]). It has been found that camps exposing children to nature have increased their emotional affinity to nature, their ecological beliefs and willingness to display ecological behaviour [117,118]. However, longer environmental programs and “direct” experiences (such as camps) generally have greater impact on environmental behaviour than environmental education alone [117]. Interestingly, a suggested activity aimed at encouraging a strong connectivity with nature is to eat something wild (e.g., a fresh blackberry), but besides this, food is never prioritized in any of these programs.

Childhood is a crucial period of socialization when young people learn and develop many of the consumption values, habits, attitudes, preferences and behaviours that they will carry into adulthood [82,83,112,119,120]. With increasing age these views and habits become increasingly less flexible, so it is an opportune time to cement healthy perspectives on nature and food. There are two theories on how children learn and acquire knowledge: their relationship with nature is all learnt; or children are born with an innate nature relatedness [115]. Assuming children are born with a sense of connection to nature, a child’s experiences and discovery of the world can still shape their sense of self in relation to the natural world (or their ecopsychological self) [115]. This means that education can either erode or facilitate children’s connection or view that they are part of the natural world [115,121].

Food literacy captures food and nutritional education, and is recognized as being critical for individual empowerment within the food system [35,122]. It consists of these interrelated domains: food, nutrition and health (including wellbeing); agriculture (as part of the food system), environment and ecology; social development and equity (including economic, cultural and political factors); and the skills and ability for planning, managing, selecting, preparing and eating food [110,122,123]. Research to date has often studied these individually (e.g., nutrition literacy and agricultural literacy) rather than collectively [123]. Due to the multi or cross disciplinary nature of food literacy, educating children and society at large poses a real challenge. But food literacy programs at schools are of paramount importance due to the low levels of food and nutritional knowledge and skills amongst consumers as well as the inadequate family support for adolescents to develop healthier food habits [110]. Food literacy concepts should be started in primary school, and the broader aspects of the food system continued into secondary school, when young people are mentally, emotionally and intellectually able to critically analyse them [110,124–126].

With mounting evidence of an obesity epidemic in children, farm to school education programs have gained momentum worldwide as a possible countermeasure. These programs aim to improve children’s exposure to food, raise awareness, support local food production (such as the farm-to-school initiative in the U.S.), incorporate healthy food into school canteens, as well as integrate health and nutrition education opportunities [43,127,128]. By far the most common type of agricultural program for primary and secondary schools is to participate in vegetable gardening (82% and 58% respectively) [109], with the focus most often being on prompting nutritional changes in children. Some programs have resulted in reduced health risk behaviours (including antisocial behaviour and willingness to try new foods), increased nutritional and eco-literacy, improved eating habits, increased satisfaction with life, increased emotional wellbeing, increased student resilience, better learning outcomes [129,130]. Mixed results from these programs have been documented in the literature, however studies did frequently find that the most effective program uptake was at schools where a whole-school and committed approach (with enthusiastic role modelling) was taken [33,126–131]. It is important to note that significant constraints in study design and methodology limit comparative analysis and hence program design. Successful implementation and longevity of such programs (with schools often finding them hard to maintain and costly) are extremely difficult to measure, so have only started being conducted widely [127]. Generally, however, researchers agree that these

programs often make a difference for the least food literate children and therefore where there is greatest need [128,131].

Research shows that adolescents are well-informed about good health and nutrition practices, but that adolescents do not translate this knowledge into good food behaviour [70,74,113]. O'Dea [132] clearly found that “adolescents are looking to their parents and teachers to encourage, support, and enable them to be involved in more healthful behaviours” (p. 500), to the extent where several student groups held their parents completely responsible for meal preparation and blaming them for their poor eating habits [56,84,113]. And Sloan et al. [74] found that children eat healthier foods when nutritional education is combined with environmental support (schools, parents and local communities). It can be argued that young people have limited control over their foodscape and are therefore strongly influenced by the foodscape in which they spend the majority of their time i.e., at home and the wider community (including their school) [32,70,133].

Gradually education programs are incorporating the understanding that good eating practices require more than learning about healthy food, but are about building a positive relationship with food [70]. There is an opportunity to merge nature and food focused programs to reinforce this connection. Interestingly, these programs are often in line with food sovereignty movements to “re-connect the social and business links between gardens, communities, and restaurants, emphasizing the importance of building social relationships through multiple actors” [36] (p. 174). Unsurprisingly, as the urban agriculture literature has shown, these programs can build strong informal networks of social support, trust and cohesion which have been shown to mitigate food insecurity [134]. These programs create potential new markets for farmers and therefore aid in creating a more resilient food system [126]. “When it comes to food, resiliency is lost when our connections to the land, and each other, are lost; when we forget that eating is an agricultural act” [135] (p. 7).

Urban children and adolescents are the next generation to inherit the food system and so are pertinent to food security concerns in increasingly high-density cities. Food habits developed during childhood and adolescence prevail into adulthood, however studies have highlighted a clear gap in knowledge of health behaviour patterns in the emerging adulthood life stage and the role their connection to nature plays [128,136].

## 7. Conclusions and Future Opportunities

The reduction of natural areas in cities not only influences the urban living experience and wellbeing of inhabitants but could also lead to urban food security concerns. There is a wealth of knowledge on the process of how people make food choices, but no existing research on how human connections with nature influence food choices. Urban agriculture or food production is the commonality between foodscapes (that are known to influence food choices) and biophilia (that can impact on wellbeing). Urban agriculture thereby provides an opportunity for both improving food security and wellbeing of urban inhabitants. To achieve this, urban populations will require increased education (food literacy) and more nature experiences (including food production) to encourage a stronger emotional connection with nature.

More than ever, urban inhabitants are disconnected from food production and processes associated with food moving from farm to plate, as well as associated health and environmental impacts. This could be a significant risk in creating future liveable cities and therefore there is a level of urgency in understanding these concepts and connections more fully. Urban agriculture is not just about the provision of food, but also the social fabric of communities [43]. With trends in developed societies increasingly seen in urban areas of developing countries too, more research needs to be allocated to devising effective preventative measures using a transdisciplinary approach that is multi-level, multi-directional and coordinated [85,104]. Researchers will “require understanding of the actions of multiple inter-related stakeholders within an interdependent, interconnected, complex system, that is constantly changing, and therefore may take a long time to stabilise” [35] (p. 388).

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