Chapter 13

Cyber-Gardening and Biophilic Design in Future Cities

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ABSTRACT

Today, in line with nature's integrated habitats and environments, the scope of biophilic architecture emerges as an essential issue for society wellbeing. When evaluating the possibilities of enhancing access to healthy food, the necessity of including every scale of living—from the smallest individual living space to collective living areas—should be discussed. In this study, cyber-gardening practices are evaluated from critical perspectives in terms of dystopia. Cyber-gardening, systems of self-organization, and self-sufficiency concepts are crucial to envisaging a sustainable city, food, and agriculture ecosystem. Biology, architecture, and urban design-oriented approaches have emerged in the works of design groups such as EcoLogic Studio. Emerging as a kind of bio-architectural hybrid, these new physical and digital interactive garden prototypes create augmented biospheres. In these new urban-food-agriculture scenarios composed of designed virtual interfaces, visitors are transformed into urban cyber-gardeners.

INTRODUCTION

More than half of the world's ever-increasing population today lives in cities and metropolises (United Nations, 2014). While 55% of the world population resided in urban areas in 2018, it is estimated that 68% will live in cities by 2050 (United Nations, 2018). Although the world population was 5 billion in 1987, it reached 6 billion in 1999. According to current estimates, the world population is expected to reach 9.7 billion by 2050 and approximately 11 billion by 2100 (United Nations, n.d.).

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In parallel with this increase in both the global and urban populations respectively, traditionally agricultural areas are being transformed into urban areas as part of expanding urbanization and meeting the need for shelter; this expansion is creating pressure on agricultural areas. Therefore, existing agricultural lands in many geographies are disappearing, and "chemical and physical problems such as salinization, alkalization, acidification, mineral nutrient deficiency, pollution, erosion, compression, and organic matter loss in soils" are being observed (Tübitak, 2003, p. 15). According to the estimates made, about 38% of 1.47 billion hectares of land for plant production is under degradation (Tübitak, 2003, p. 15). This process, which includes "burning tropical rainforests to open up agricultural land and [the] pollution of water resources" (Tübitak, 2003, p. 15), is compounding the effects of the global environmental crisis.

Among the environmental problems that we face on a global scale today are "climate change, ozone depletion" and "desertification" (Crist & Rinker, 2010, p. 13). As stated in the World Economic Forum's 2017 Global Risks Report, the five greatest global risks in terms of impact were listed as "weapons of mass destruction, extreme weather events, water crises, major natural disasters, failure of climate-change mitigation and adaptation" (World Economic Forum, 2017). According to the FAO (Food and Agriculture Organization of the United Nations), "climate change is having profound consequences on our planet's diversity of life and on people's lives" through the warming of the oceans and rising sea levels (FAO, (n.d.), p. 16). Other effects of climate change include melting glaciers—which has "increased flows in some river systems for the next two to three decades"—increased flooding, and the overall "disruption of water resources" (Parry et al., 2007, p. 49). Due to climate change and human pressure on the environment, oceans—which comprise a large part of the globe—are also becoming more polluted and affecting the air and food efficiency required by living beings (Crist, and Rinker, 2010, p.13). Globally-prevalent "ecological crisis phenomena"—namely, the loss of soil and soil fertility, the climate crisis, GMOs, deforestation, "decreases in biodiversity", "species extinction", and an "increase in the number of extreme climatic events"—have brought "natural thresholds to an irreversible point" (Benlisoy, 2010, p. 35). This situation is making it harder to access healthy food, which is one of our most basic physiological needs (Benlisoy, 2010, p. 35).

In order to meet the food requirements of the increasing global population, at least a doubling of production is required in the near future. This increase has to take place in existing areas since there will not be any space for expansion in production areas (Tübitak, 2003, p. 14). If the negative effects of the aforementioned crisis phenomena continue on a global scale, the search for "alternative" agricultural production will become crucial due to factors such as soil loss, the destruction of agricultural land, water crises, and pollution. These quests range from soilless agriculture to cyber-gardening.

Soilless agriculture was first used in Egypt in 2000 BCE (Raviv & Lieth, 2007, p. 1). In the 1960s, the commercial use of soilless agriculture began. Soilless agriculture means "water working or growing plants in a nutrient solution without soil" (Sheikh, 2006, p. 53). There are three types of soilless agriculture such as "hydroponics", "solid media culture", and "aeroponics" (Atzori, Mancuso, & Masi, 2019, p. 200). Hydroponics (hydro: water, ponos: labor) as one of soilless agriculture's techniques, was coined by W.E. Gericke in 1930 (Sheikh, 2006, p. 53; Sengupta & Banerjee, 2012, p. 103). This type of agriculture especially has "potential application in providing food in areas having vast regions of non-arable land, such as deserts and dry coastal belts" (Sheikh, 2006, p. 53). Another method is "aeroponics" that enables supplying nutrients to the plant with roots suspended in air. Solid media culture enables supporting plants with substrates such as perlite and vermiculite (Atzori, Mancuso, & Masi, 2019, p. 200).

Today, besides soilless agriculture, new techniques are being developed to meet the growing population's increasing food needs amidst the qualitative and quantitative decrease of agricultural land. According to

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