Food environmental footprint: a bottom-top approach to reduce it

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Research Plan

Personal fascination

As a matter of fact, the beginning of human alterations to the Earth environment can be traced back to the beginning of farming - which compelled our nomadic ancestors to settle. Man was at that point starting to modify the natural environment to fulfill his basic necessities, altering a system which had been stable for millions of years. Together with human evolution, also agriculture evolved rapidly, and its consequences are now pointing out the necessity of rethink our food system in order to address the climate global challenges we will have to face in the coming decades.

Problem statement

With the world population increasing, the number of agricultural practices and lands devoted to crop-related practices are expanding, but also changing at incredible speed. As a result, the idyllic vistas of the rural landscapes are gone, replaced by infinite planes of high-tech greenhouses. The intensive production of food, necessary to feed a growing population following unsuitable diets, unfortunately results in monoculture and deforestation.

Hence, the central problem the research will address is the necessity to rethinking our food strategy, especially as the population is growing and the current linear food system will in the future be unable to feed everyone without using all the natural resources.

Reflection on the relevance of the theme

Population growth

The population is growing globally. In the coming decades, feeding people is going to become one of the biggest challenges of our society. The latest United Nations reports estimated that the global population is expected to increase by 3 million in the next 30 years, reaching 9.7 billion people in 2050¹. This means that we will have extra people to feed, a task completely impossible if we stick to the current linear food system. The biggest question in front of this growth pattern of population is: *how are we going to feed them?*

Unsuitability of the current food system

Our current food system is constituted by a sequence of linear steps that are becoming unsustainable. The evidence of the problem is underlined by several factors that present the impact of agriculture-related activities.

The first factor proving the necessity of rethink our food strategy is its overall carbon emission. Agriculture is responsible for a quarter of greenhouse gas emissions globally, making the agri-food industry is the global second-largest emitter of greenhouse gases¹. In terms of overall emissions, these activities are second only to the ones related to the building environment, underlining the responsibility that designers, architects and space planners have nowadays relating to find new solutions to safeguard the planet and its resources.

Secondly, this sector has a huge environmental footprint: is estimated that ap-

proximately 70% of global freshwater demand is used for agriculture² and its use of land is currently degrading the natural reserves in terms of biodiversity. The current world relies on just three crops for more than 50% of its plant-derived proteins³ contributing to a dramatic loss of biodiversity (over 60% in the last 40 years)⁴.

Finally, the cost of this system has to be considered. Overall, for every dollar spent on food, society pays two dollars in health, environmental, and economic costs. Half these costs - totaling USD 5.7 trillion each year globally are due to the way food is produced¹.

Research questions

What is the current environmental footprint of food system and how can we reduce it?

- What is the carbon footprint of food?
- What is the virtual water of food?
- What is the embodied land of food?
- How much food does a community requires?
- How can we calculate the environmental footprint of a community related to its food consumption? (status quo)
- How can we reduce the environmental footprint of food?
- Which future scenarios can we build?

The research verts on investigating the overall environmental footprint of food, defining its components and addressing strategies to reduce it in terms of emissions, virtual water and land accounting, proposing shifts in the current diet and the introduction of local food systems within cities.

Relation with the design

Given for proved global population is increasing, it is actually growing especially within cities. In 2009, for the first time, the amount of people living in cities overpassed the rural population, and its number is expected to grow to 68% by 2050⁵. Moreover, cities are the main responsible in terms of emissions and use of resources: they consume 75% of the global natural resources and 80% of the global energy supply⁶. Finally, cities as the main place where food is consumed: it is estimated that they will consume 80% of food in 2050¹, showing the pivotal role they can play in a food transition.

Rethinking our food strategy within cities can help realize the vision of a more sustainable consumption and generate significant environmental, economic, and health benefits within and beyond their boundaries.

To assess the problem statement, the research-based design will focus on moving the current linear food system towards the circular economy in order to reduce its environmental footprint and make it more sustainable.

In particular, the project will work on a neighborhood level proposing a local food system within the Brettenzone, Amsterdam. Since moving towards a sustainable circular economy for food is essential to face the growth of population, starting from involving citizens at a neighborhood level can be seen as the starting point for such a transition.

Research framework

How does the design of a local food system can reduce neighborhood environmental footprints?

Methodology

The research as well as the design start from exploring the boundary between two different ephistems: ecology - and the study of the natural environment and praxeology - observing humans behaviors. Although in the last 11.700 years, after the last glaciation, Earth is in the Holocene epoch, the majority of the scientific community believes man has already changed irreversibly the planet and that consequentially the new epoch we are living in should be called Anthropocene. This new term underlines the urgency of exploring and research the connections between humans behaviors and the surrounding nature, analyze our responsibilities and question our systems.

Embracing the philosophy of the Harvest graduation studio, the described research is focusing on the Flow domain, exploring the food systems and its related cycles of water, land and energy. To reach the needed amount of edible products, large quantities of resources are involved, often called inputs of the food system. Many of these inputs are from finite sources, and in multiple cases, food production is in competition with other human endeavours for their use. The Architectural Engineering chair questions indeed how we, as designers, can optimize the use of natural resources moving towards a circular economy contributing at the same time to enhance landscapes and urban communities. Within this context, designing a circular local food system means not only prevent food waste but also save precious resources including land, water, and energy.

Focusing on the food problem by underlining its environmental footprint, the research strives to create an innovative bottom-top approach. The quantitative analysis of humans diets and their ecological repercussion lead to a qualitative proposal of scenarios, proposing finally a research-based design for a local food system in the natural park of the Brettenzone, the selected case-study in Amsterdam.

Methods

The research strives to build a bottom-top strategy to face a food transition, starting from analyzing the current food consumption and its environmental repercussion, addressing possible changes and finally suggesting development principles based on local management toward a circular economy for food.

Using the described methodologies to define the spatial composition of the research, the exploration starts from a comprehensive analysis and literature review to debate the current concepts and methods related to the food system. The first step addressed is a rigorous knowledge synthesis of sources focused on the food problem and the urgent necessity to change our nutritional habits. Finding, evaluating, and synthesizing led in to collect data and information about the current status quo of the food system opening the field to questioning how we can improve it reducing our environmental impact.

To do that, the collected data are inserted into a simulation model (the FEWPrint⁷) used as a parametric tool able to analyze consumption patterns and their envi-

ronmental repercussion, linking the human behaviors to the ecological ephistem. Secondly, the model is used to simulate scenarios by shifting diet patterns and introducing new types of local production.

The elaborated focus scenario is then applied to the focus area, the Brettenzone, already interested by site researches and historical analysis providing information about the strong and controversial relationship the site has with agriculture. This rather unknown strip of land in the west of Amsterdam is finally used to elevate the public discussion about how reforming the food system bringing back to the city experiences of farming, local production and consumption and waste reuse.

The final part of the research is already leading towards the design of a local food system, where new methods such as analyzing similar case studies are implied. Moreover, the set contact with the Amsterdam Municipal Laboratory responsible for the development of the area (LaBGreen De Bretten - Stadsdeel Nieuw-West - Gemeente Amsterdam) and with the similar project proposed Flevo Food Campus in Almere, can bring to the implementation of new methods based participatory design principles.



Preliminary conclusions

The way we produce and consume food poses big challenges for the years to come. While the population is growing, agriculture is one of the human endeavors having a major impact on the environment, underlining the urgency of rethinking our food strategy.

Lots of resources are nowadays implied in food production. Those elements, often called input of agriculture, make part of our environmental footprint. In particular, a lot of water and land is used to provide each year the required quantity of edible product, while a lot of CO2 is emitted.

However, not all the components of our diets have the same influence: all the peaks related to virtual water, land accounting and carbon emission belong to meat. On the other hand, fruits and vegetables are less demanding in terms of natural resources. Moreover, those food groups are able to provide more calories and energy in relation to their weight.

Therefore, healthy diets should not only consider the caloric intake but also the environmental footprint the different food groups show. Thank to the analysed made with the FEWprint⁷, is been proved that with a vegan diet - that totally avoid animal-related products - displays a reduction of 76% in terms of CO2 emission, a drop by 84% of the land required and almost zeroed the necessity of water in comparison with the global average diet.

Given the impact people have on the planet in relation to their consumption patterns, awareness of the connection between diets and environmental footprint should be raised among common people. In particular, cities inhabitants should be more involved in urban policies that focus on food, since it is estimated that 80% of food will be consumed in cities in 2050¹.

The research proses a bottom-top approach to the food problem, pointing out the necessity of involving cities in agriculture-related activities. Bringing food practices back to urban environments can raise the awareness about food impact on both our lives and on the surroundings, creating healthy, green, livable and sustainable cities.

Within Amsterdam, the rather unknown strip of land called Brettenzone figures as the perfect scenario to showcase this approach. The area, already demanded for agriculture since the 11th century, is displaying today as a wild landscape collecting unfinished plans to bring back farming to the city. The municipality, together with the inhabitants, already questions possible uses of the area, pointing out the necessity of really putting the Bretten on the map for Amsterdam's inhabitants by inserting recreational functions⁸. A food-related program could be then proposed as the fil rouge linking the landscape to the development of more sustainable diets within the surrounding communities.

Can a grassroots, biodynamic and local food system be integrated in the city planning? Is it possible to change people's behavior towards more sustainable consumption patterns by proposing socially engaged projects? The challenge is to strike intervention between the small scale and the globalized one, discovering the shadows in between. This can be the opportunity to link city dwellers and their food sources, shortening the chain by closing local cycles. At the same time, those interventions will enhance food security and improve the self-resistance of urban communities. By proposing local food systems, food can become an interesting scope to look at cities, how they behave and which social themes they are facing.

Brettenzone: Urban amplifiers. Sketch.







Research Plan - Eleonora Farcomeni



Research and design: an iterative process

As displayed in the diagram, research and design are strictly connected. The design - focusing on the Brettezone as a perfect showcase for a bottom-top approach to the food problem - is being tested by the research in terms of final environmental footprint. On the opposite side, the FEWprint simulation model needs contextual data from the design in order to create different scenarios.

The main contact points are concerning the population and the local food production. The size of the community analyzed into the FEWprint is coming from the selected context: the number of inhabitants is the multiplying factor connecting consumption patterns and total food demand within the research. At the same time, the consumption patterns are influenced by food availability, which is obviously depending on food availability and therefore on the designed local food system.

In other words, the research is testing how the design of a local food systems can have an impact on the environmental footprint of a community, both changing their food habits towards more sustainable diets, and replacing the input of food and therefore the connected land, water and CO2 accounting. This connection aims to give the design space for experimentation, linking back to the research whenever is needed to test the proposed scenario.

The project presented strives to design a strategy to protect and improve both the health of the local communities and their environmental footprint, setting an encouraging vision in which local food management can play a central role in designing a fairer and more sustainable world.



Brettenzone: landscape sections. Sketch.

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