

A PRODUCTIVE PERMACULTURE CAMPUS IN THE DESERT. VISIONS FOR QATAR UNIVERSITY

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Abstract: In Qatar food and water security are high on the agenda of safe and sustainable development. At the same time, rapid urbanisation which is not integrated with ecological landscape design is contributing urban sprawl, fragmented landscapes and to the loss of biodiversity. At Qatar University, the architecture department has been working for several years on the concept of regenerative cities to develop an integrated approach to planning and design and to increase resource efficiency and quality of life. This has led to research and projects on edible landscapes at the campus to contribute to food supply to the University, while at the same time promoting biodiversity on the campus. Using examples from Edible Campuses worldwide, as well as literature on Permaculture, Food Urbanism and Edible landscapes, students and faculty identified strategies and best practices for implementing this vision for Qatar University. An analysis of the campus and existing and future buildings and landscapes was undertaken, to identify the types of interventions – retrofitting of existing buildings with green roofs and green walls and biodiversity habitats, transformation of existing landscapes, use of empty lands for food production, and modification of the urban design of future buildings with integrated food gardens. The Permaculture approach includes the concept of systems thinking and maximum resource efficiency and is used as the philosophy and framework for all the interventions proposed. This includes water recycling and treatment, organic waste recycling, clean and renewable energy producing. The project also includes awareness campaigns, citizen participation and the collection of quantitative data on the concept of Food Miles, that is the amount of miles food travels until it reaches our plate.

1. Introduction

Qatar imports over 90% of its food and obtains 99% of fresh water from desalination. This implies that food and water security are high on the agenda of sustainable development. Organic waste is not recycled systematically at a large or individual scale, resulting in wasted resources. Rapid urbanisation which is not integrated with ecological landscape design is contributing to the loss of biodiversity. As University Campuses worldwide are striving to become more sustainable and resource efficient, some are beginning to also develop the concept of the Edible Campus, which includes implementing spaces to grow food within the University Grounds. These initiatives are first and foremost to provide the users with healthy and sustainable food, but also to educate the University population about the production of food and the resources involved. Producing food on a campus not only reduces the food print, that is the energy that is required to bring the food from distant fields to the plate, but also allows more efficient resource use and recycling, for example the recycling of organic waste as compost and the use of grey water in irrigation. Dormant lands – green fields – can be used to produce crops, and decorative landscapes can be converted into productive landscapes with food and medicinal plants. Edible boulevards are constructed with fruit bearing trees, and can still have urban and climatic functions of providing shade. A permaculture approach to food production can also contribute to increasing biodiversity on the campus, with careful combinations of plants that repel harmful insects but attracts multiple species. (Grichting & Awwad, 2015)

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1.1 Research Questions

Universities, being key institutions in processes of social change and development, play explicit role in spreading knowledge and producing highly skilled personnel to meet perceived economic needs (Brennan, King, and Lebeau, 2004). This role helps in encouraging and facilitating new social and cultural values supported by the students who assume the major change of their societies. That is why, the issue of food and water security can be addressed through universities, with the aim to encourage students to grow their food in campus. At Qatar University, the architecture department has been working for several years on researching and implementing edible landscapes in the campus to contribute to food supply to the University, which at the same time promoting biodiversity on the campus. This research looks at how can the concept of Edible Campus can be applied in Qatar and the Gulf Region, in a dry land climate? How does this project relate to other Master Plans for University Campus' and initiatives for Edible Campus Designs and Master Plans worldwide ? What is Urban Permaculture and how can it contribute to a Sustainable Campus and City? This research looks at the different practices and modes of producing food in dry lands and proposes an application at Qatar University campus. It builds on previous research on Food Urbanism in Doha, and on a prototype Edible Boulevard and Edible Rooftop Garden being implemented at the College of Engineering.

1.2 Purpose

The purpose of this work and research is to create an overall vision of an edible and biodiverse campus in the form of a Master Plan, as well as to implement experimental permaculture gardens on the campus. This paper presents the work with students to envision an overall master plan for the campus.

As architects and planners of urban landscapes, we hold a vital tool in the growth of a sustainable community. Food is both a local and global issue. The lack of productive urban land, food insecurity, uncontrolled urban growth, and a general lack of societal knowledge of food growing and preparation are the main drivers to conduct this research and implement its prototype at Qatar University campus.

2. Approach and Methods

This research was carried out as part of an undergraduate course in Urban Planning and Design, building on the student work of the previous year and also projects produced by graduate students in Urban Planning and Design. The work also integrates projects and research carried out on an Edible Garden at the Female College of Engineering and workshops and exhibitions on Landscapes for Food Security Biodiversity and a student workshop on Green Roofs held in the department design studios.

2.1 Approach to the Research

An analysis of the campus and existing and future buildings and landscapes was undertaken, to identify the types of interventions – retrofitting of existing buildings with green roofs and green walls and biodiversity habitats, transformation of existing landscapes, use of empty lands for food production, and modification of the urban design of future buildings with integrated food gardens. The Permaculture approach includes the concept of systems thinking and maximum resource efficiency and is used as the philosophy and framework for all the interventions proposed.

The Permaculture approach was introduced to the students as an efficient way to address the questions of growing healthy food with scarce resources at the same time promoting biodiversity. Permaculture is a sustainable and a conscious approach to agriculture, and a creative design system based on ecology for designing integrated systems of food production, housing appropriate technology and community development. Permanent agriculture offers many solutions for the problems of dimensioning resources in a campus or in a city. It provides space with shelters, food and water, income, community and aesthetic and spiritual fulfillment, and other material and non-material needs in a sustainable way. It works with (not against) nature, so, permaculture can be more concerned about the neglected parts in cities and campuses. Permaculture contributes in making them sustainable by providing them with clean and safe air and water, clean and renewable energy, healthy biodiversity, healthy and accessible food, and an access by proximity.

From the previous research undertaken by students and faculty on Food Urbanism in Qatar (Grichting, Ball, Awwaad, 2014), and in particular the study of Paige Tantillo's permaculture laboratory garden, we can confirm that permaculture can and is being implemented in Qatar, and can have significant benefits to both food security and biodiversity, as well as consuming less scarce resources (water, soil) and recycling organic waste and water. We can make the following assumptions:

- Permaculture techniques can help increase food security in Qatar
- The implementation of Permaculture practices helps to increase and benefit soil structure by use of compost, manure, straw, diversity of plants
- Natural pest management practices can be used instead of harsh chemicals
- Bio-diversity can be increased with a mix of vegetables, herbs, fruit trees, and beneficial plants – which can also decrease pests and bring beneficial insects to site
- The basic elements of the Permaculture approach are :
 - Soil building (compost and manure)
 - Trees for wind breaks
 - Companion planting
 - Grey water recycling
 - Crop rotation
 - Composting
 - Chickens for soil turning
 - Planting nitrogen-fixing trees
 - Creating a food forest
 - Mulching with straw to decrease water usage and add nutrients to soil
 - Test beds are prepared to ensure a full utilization of the organic wastes

2.2 Methodologies of the Research

Case studies of Edible Campuses worldwide were studied, as well as literature on Permaculture, Food Urbanism and Edible landscapes, to identify strategies and best practices for implementing the plan. The research also looked at systems to maximise resource efficiency, including water recycling and treatment, organic waste recycling, clean and renewable energy producing. The project also includes awareness campaigns, citizen participation and the collection of quantitative data on the concept of Food Miles, that is the amount of miles food travels until it reaches our plate. The aim of the students research was to produce an Edible Campus Master Plan. To achieve this, students worked in groups to address specific components and themes or layers of the Master Plan including

Productive Landscapes in Green Fields, Productive Green Roofs, Transforming Decorative Landscapes into Edible Landscapes, and a Central Park and Biodiversity Reserve. (See Table 1.)

Table 1. Outline of the Framework for the Edible Campus Project

<p>1. Master Plan</p>	<ul style="list-style-type: none"> • Work on master plan, land use, functions and future scenarios. • Integrating the other projects into one vision and master plan. • Look at the overall network of green and productive spaces created by the Food Urbanism Master Plan. • Study other Master Plans for Edible Campus' worldwide. 	
<p>2. Productive landscapes in green field.</p>	<ul style="list-style-type: none"> • How to use and propose planting food in the undeveloped land within the University campus. • Can be temporary – for sites with future projects, or permanent. • Can include greenhouses or open crop as well as livestock and fruit trees, dates, etc. 	
<p>3. Productive Green roofs.</p>	<ul style="list-style-type: none"> • Mapping the potential for Green Roofs at Qatar University. • Identifying different Land Uses – Crops – for the roofs. • Explaining the systems – Water recycling, organic waste recycling, etc 	
<p>4. Transforming Decorative Landscapes into Edible Landscapes.</p>	<ul style="list-style-type: none"> • Divide the campus into sectors and work on transforming Existing Landscapes into • Edible Landscapes. See the example of the CENG Edible Garden by the UREP team. • Identify areas and landscapes that can be transformed from decorative landscapes to Edible Landscapes and propose plantings. 	
<p>5. Central Park and Biodiversity Reserve</p>	<ul style="list-style-type: none"> • Develop the concept of the Central Park • Develop the Wadi as the backbone of a biodiversity corridor • Connect these Green Spaces as a network of green spaces with the surrounding areas. 	

Students were asked to respond to a series of questions in order to verify that they could integrate the concept of the edible permaculture campus into larger idea of sustainable urbanism(s) and food urbanism and also relate it to similar projects worldwide.

- How does this project relate to other Master Plans for University Campus' and initiatives for Edible Campus Designs and Master Plans?
- What is Urban Permaculture and how can it contribute to a Sustainable Campus and City?
- Which types of Urbanisms / Urban Design Principles did you integrate into your design
- Outline the main steps you went through in your research and design process?

3. Results

The result of the research and the student work was a proposal for a Master Plan for an Edible Campus at Qatar University. It is intended as a tool and vision to initiate interdisciplinary and multi-stakeholder involvement in a strategy and plan to promote food production and biodiversity on the campus. It also includes the optimal use of scarce resources such as water and energy, and recycling of waste, in particular organic waste.

The students produced a series of posters and an integrated Master Plan containing all the parts of the projects.

3.1 Master Plan

The first step in our part (The Master Plan) was to have a clear vision and mission for QU edible campus, and relate it to Qatar National Vision 2030. The second step was to analyze the food cycle process and show its aim in addressing local food security. The third step was studying a case - McGill University's School of Architecture, to understand and see what strategies and methods it has implemented to have an edible campus. The result was master plan of Qatar University campus showing the land uses and functions, supported by different types of charts showing the existing and the proposed design for the future.

The last and the most important step was to compile and arrange all the layers of the other students into one master plan to produce the overall vision. The final master plan combines the existing plan in addition to the future plans, covering all types of buildings, roof tops, productive and edible landscapes and the central park.



Figure 1. The Master Plan for the Edible Campus at Qatar University

3.2 Transforming Decorative Landscapes into Edible Landscapes.

The main steps of the design process to transform the existing landscapes at Qatar University into Edible Landscapes are listed below.

- Identifying the areas where the existing landscapes were located:
- Studying the existing landscapes and the surrounding public spaces (if any)
- Studying the existing landscapes and the surrounding buildings and facilities
- Categorizing existing landscapes into similar surrounding facilities (zoning phase 1)
- Generating a strategy that will help identify the types of edible landscape that will be incorporated into the campus
- Identifying the edible landscape typologies from the strategy that will be used for each category of existing landscape (final zoning phase)
- Selecting one area within each typology to be transformed and be used as an example for each typology
- Generating plans, sections and photo montages for each area to visualize the proposal



Figure 1. Transforming Decorative Landscapes into Edible Landscapes

3.3 Productive Green roofs

Students started researching about green roofs, how they could be applied on different types of buildings, what systems could be implemented and what types of crops could be grown, or biodiversity encouraged.

The students visited existing buildings on the campus, and also looked at the designs of new buildings to see where Green roofs could be implemented. They then mapped the green roofs that were identified as suitable on the master plan layer, as well as those that were accessible to the public and/or to different users.

The student attended a seminar on Green roofs and biodiversity and learned about different systems for green roofs and how to encourage biodiversity.



Figure 2. Productive Green Roofs

3.4 Productive landscapes in Green Field

The approach for the Green Fields included identifying the reserve land in the University campus that was not yet developed – to proposed temporary agricultural uses that would also create a green infrastructure for the future urban and landscape designs for the campus development.

First, students located the unused and unproductive fields on the master plan of the campus. They also located the new metro station and incorporated it into their design with a building that can grow food inside. So when the people arrive at the station they will have a new kind of experience inside the station where they can select fresh fruits and vegetables to consume.

Subsequently, students started to locate the different typologies of food production into the new gardens and fields (green house, fruits garden, medicinal garden, crop fields, etc.) and categorized the different kinds of fruits and vegetables that can be grown in the different types of structures and landscapes.

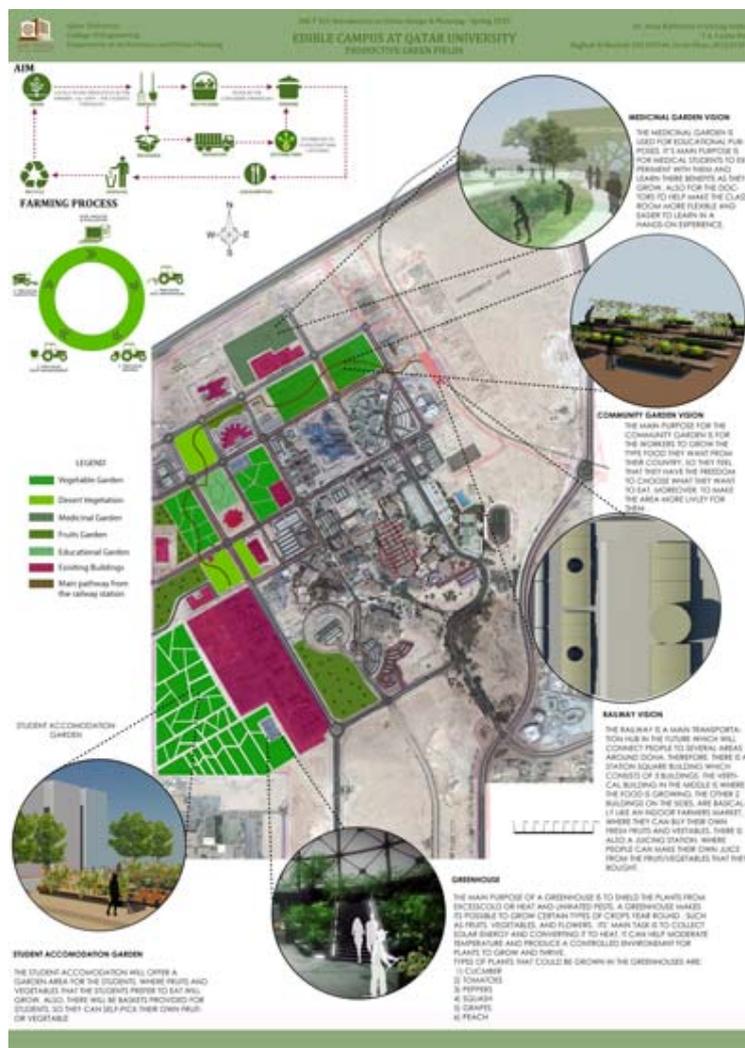


Figure 3. Productive Landscapes in Green Fields

3.5 Central Park and Biodiversity Reserve

University edible campus. In case of Qatar University campus, there might be challenging urban and climatic settings. This project successfully shows ways and offers solutions for how to weave productive planting in urban spaces without diminishing their utility or functionality. The master plan of this project can be also a leading step to more future edible campuses in the country and in the region.

It takes into consideration the needs of the campus in terms of food security and biodiversity. In addition to this, it acknowledges the importance of the social and community aspect within the campus. Also, it looks at different ways to integrate edible landscaping in both the existent and the non-existent landscapes. Finally, it uses ways such as permaculture to create a sustainable edible landscape for the campus which will be beneficial not only for the occupants of the campus but also to nature as it follows natural processes.

This research and design project developed with architecture and urban design students shows how they envision the future of their campus - one where the students, faculty and all the workers will be proud of a sustainable and green environment and they will all benefit from it. The green roofs will create a place for informal recreations and provide less crowded, less polluted and less noisy spaces. Therefore, it will increase the interactions in the community and the activities in the campus. Moreover, it will improve the air quality by filtering airborne particles in the leaves and branches.

Through all the case studies students learned many things to apply to their campus and they worked on landscaping the whole master plan to include edible areas, green roofs, a central park, green network connections and biodiversity corridors, as well as social spaces with informative digital hubs to educate the campus users on the systems, foods and species of the campus.

Next steps include brining the vision to the University Presidency and creating an interdisciplinary and inter-departmental group to develop the project and implement it with the Building Services and University Administration. A research grant has been submitted to further the research and project work and the researchers, faculty and students are all convinced that this idea needs to be pursued at Qatar University and in the Gulf Region.

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