URBAN AGRICULTURAL TERRACES

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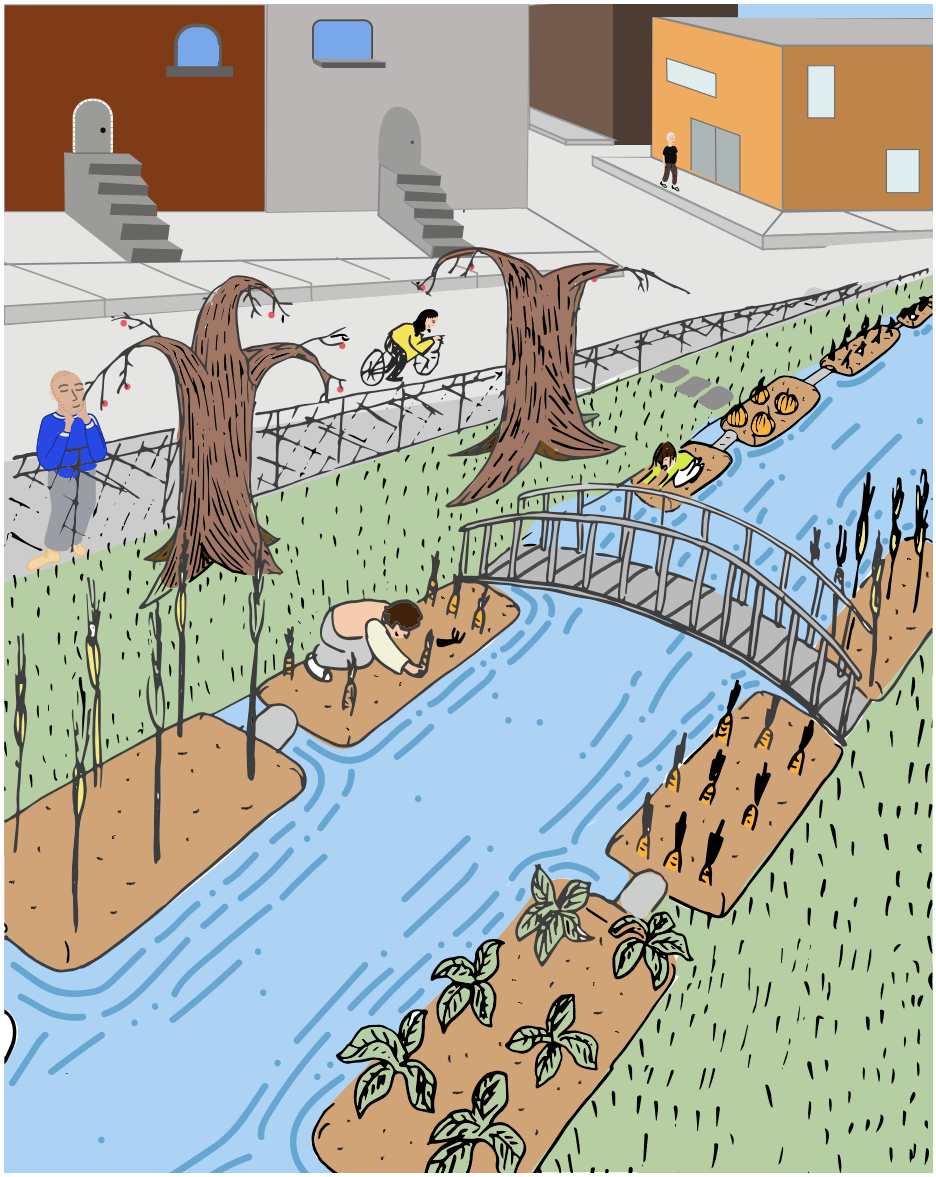
Urban agricultural terraces (UATs) address food shortages and the climate crisis by repurposing city river systems to grow crops. The UAT will provide food to city-dwellers and increase ecological knowledge within communities.



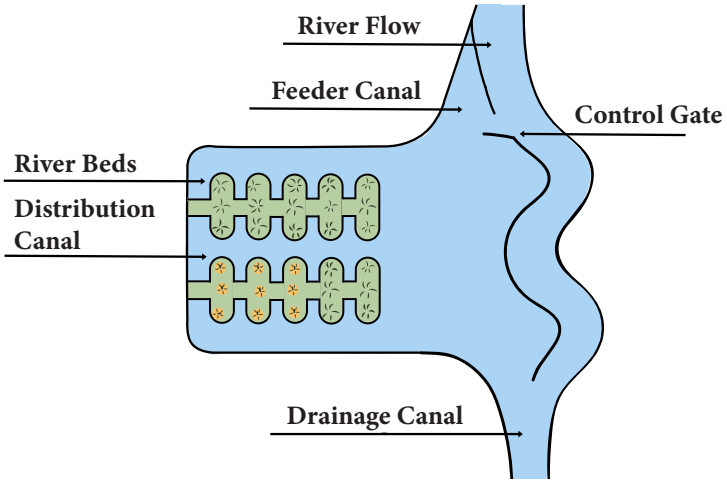
UATs offer city dwellers the opportunity to cultivate crops

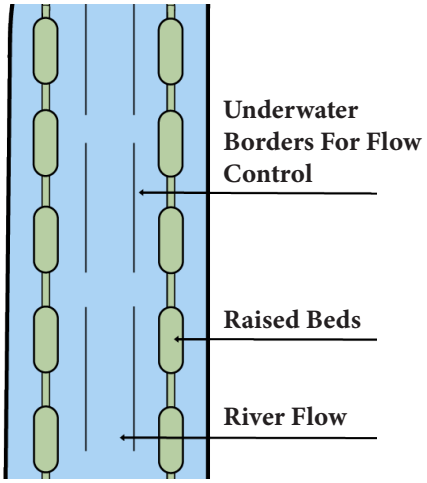
The decreasing availability of arable land (land capable of being used to grow crops) is a pressing global concern. Arable land is lost by overusing soil, decreasing biodiversity, and using land for inefficient practices such as raising livestock. These problems, while posing a looming threat to the environment, pose an even more immediate food crisis.

Another global agricultural challenge facing our planet is the high demand and low supply of fresh water. Importing water from abroad is common for cities with a low or non-existent natural supply of water. Limited space available for food production leads us to look for radical and immediate solutions to this problem. The UATs address these issues by using an otherwise unused space for growing food. What makes it different from the majority of contemporary agricultural methods is its use of city river systems.

The UATs are modeled on the Waru Waru agricultural system, which was developed by the Inca peoples of Peru around 1,800 BCE. Since this time, many indigenous communities (such as the Aymara and Quechua) have evolved and perpetuated the technology.

The basic principle of the UATs and Waru Waru systems is the same: to create a renewable food supply using local waterways. Julia Watson describes the potential for the Waru Waru system in her book *Lo-Tek: Design By Radical Indigenism*: "this ancient agricultural system has positive localized environmental effects and represents a scalable and sustainable model for contemporary agriculture." (31) Building off of the ecological knowledge of the Inca people, I created a revised design that's suitable for cities.



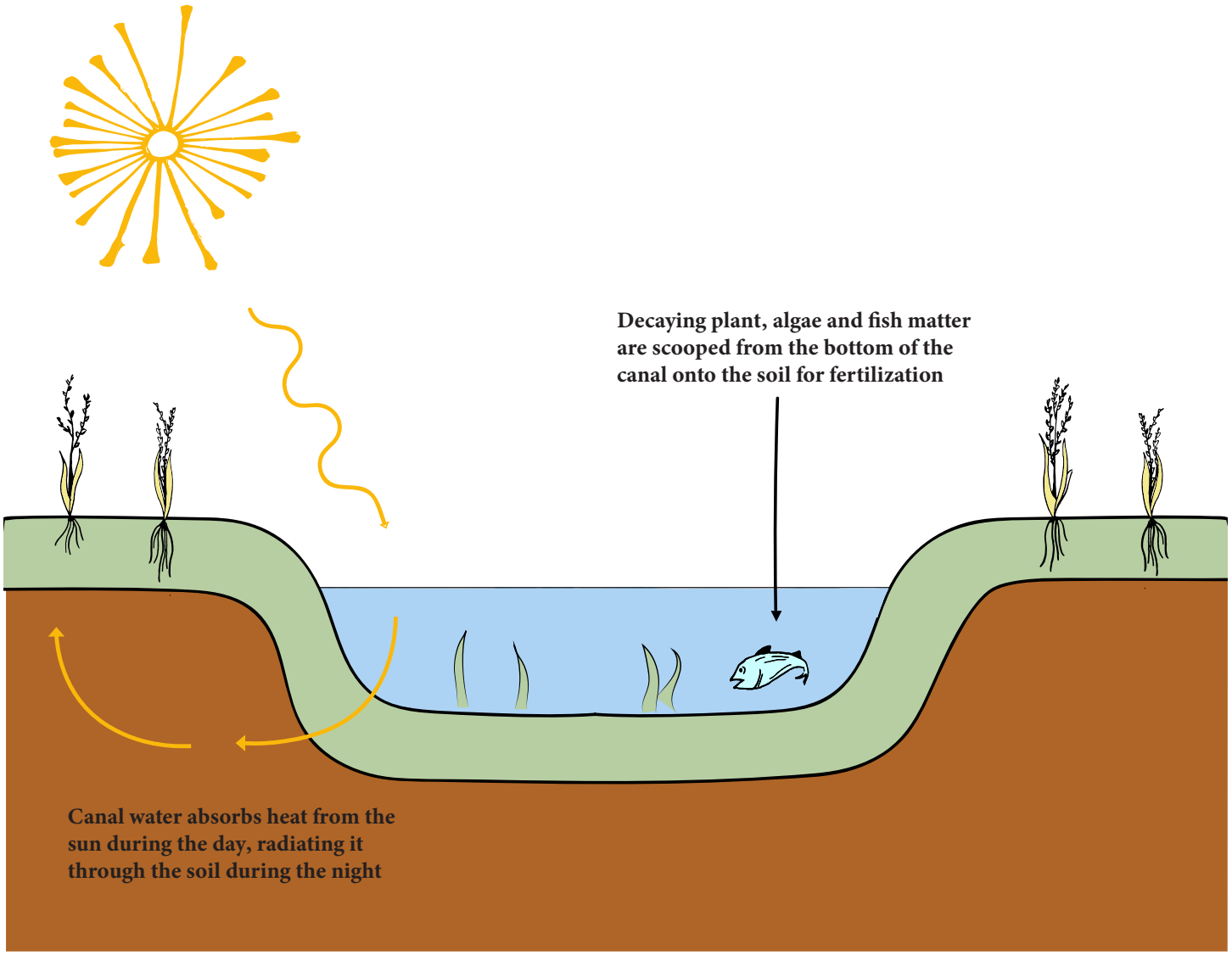


The Waru Waru system involves a series of platforms made of riverbed soil that protrude from the water and provide space for cultivation. Its resistance to drought and flood makes it a reliable food source year-round. The Waru Waru is created by altering a river's course into a maze-like formation, making more arable land.

What makes the UAT different is that it can be built on existing river systems without the need to reroute or modify the river, as is the case with the Waru Waru. Underwater borders were added so the water flow could be controlled as is done with the Waru Waru.

The UAT system has a very simple design, and can be implemented in any city with clean water running over a soil riverbed. With the COVID-19 virus in mind, the terraces are spaced 2 metres apart to ensure social distancing measures can be followed.

Raised soil platforms are built atop riverbeds, with a pathway connecting them. The soil is fertilized by placing the decaying matter from the rivers (decomposing fish and algae) on the soil. Using these resources as fertilizer allows the soil to be reused indefinitely. This cycle is illustrated below.



While designing the urban architectural terraces, I kept three of the United Nations' Sustainable Development Goals in mind: SDG2: Zero Hunger, SDG 11: Sustainable Cities and Communities, and SDG 12: Responsible Consumption and Production. While these goals aren't mutually exclusive, it's important to clarify what the motivations were for each of the goals, and how they were achieved.

SDG 2: Zero Hunger

As stated earlier in this project, the main goal of the UAT is to address hunger and food shortages. According to a report by the United Nations, an additional 2 billion people will inhabit the earth by 2050. This calls for solutions to feed this new population (Goal 2: Zero Hunger). In particular, SDG 2.3 and 2.4 were addressed in this project. These targets address community-led agriculture, increased and sustainable food production, and a high capacity to adapt to droughts, flooding and the effects of climate change. With these objectives in mind, it was necessary to look at the resources that are most accessible and available to cities, and design a system from there.

SDG 11: Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable

The UATs address SDG 11.4, which is to protect the world's cultural and natural heritage. The UATs do this by repurposing an indigenous tradition and giving it a new life. The design includes plaques and lessons on the history of the Inca peoples who built the Waru Waru. Implementing these will honour the generations of people who engineered this system.

The UAT also addresses the broader goals of SDG 11 by making the project community-led: it provides citizens with opportunities to benefit from an inclusive ecological education that can create jobs and supply food to city dwellers. A commons framework or community-garden approach are just two ways cities can use UATs.

SDG 12: Ensure Sustainable Consumption & Production Patterns

There have already been many approaches to addressing global food shortages. Some, such as GMOs and a persistent plant-and-harvest cycle, have been proven to have a damaging impact on the environment (The Environmental Impact of GMOs, 2). When considering how to address food shortages, the UN understood that it had to be done in a sustainable manner and specified the targets for this in SDG 12.4 and SDG 12.5

SDG 12.4 addresses the need for the reduction of chemicals in our air, water and soil. While the UAT isn't a model that could be applied to any landscape or city, it's use of natural materials and it's regenerative fertilizer system allows for an alternative to chemical fertilizers and pesticides in cases where the UAT can be built.

SDG 12.5 aims to reduce waste via recycling and reusing materials. The UAT model produces zero waste. Once the initial soil is brought in (in some cases it can be dug from the riverbed), the process of cultivating with the UAT reuses the natural sediments in the river as fertilizer, and what is grown can be directly transported to the consumer's home.

If we want to find creative ways to solve the issue of food shortages, it has to be in a way that encourages long lifecycles and sustainable consumption and production. The UATs use of local materials (soil, clean river water), and a regenerative lifecycle make it a design that could have a positive and lasting impact on agriculture and food availability.

The UATs are to initially be implemented in one or two cities. From here, the results can be studied and the design can be tweaked if need be. Once a successful model has been established, it will set a precedent for other cities to follow.

Thank you to Julia Watson and her team for the incredible research done on the Waru Waru system, Dr. Carmela Cucuzzella for her advice and encouragement on this project, and the Inca peoples for their ingenious creations and dedication to sustainable agriculture.

Sources

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