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RETHINKING HOW CITY DWELLERS GET THEIR FOOD

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YOUNG REVIEWERS:

COLEGIO ALTOS DEL CERRO GRANDE

AGES: 11–12

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AGE: 12

Do you perhaps live in a city, or have you visited one? Cities are exciting places where there is often a lot going on. They offer a variety of job opportunities and many leisure activities, like movie theaters, shopping malls, parks, and museums. Currently, Earth's greatest population growth is happening within cities. Even though cities cover only 2–3% of the land, they consume approximately 75% of the world's energy and they produce 80% of the carbon dioxide that is released into the atmosphere. Until now, cities have not needed to grow their own food, but this makes them dependent on food sources that can be quite far away. This article will describe how urban agriculture can help cities to better deal with climate change and other environmental problems, and how this food-growing method can improve the living environments for the people in cities at the same time.

CLIMATE CHANGE ENDANGERS CITY LIFE

As you know from school and from the news, Earth's climate is changing due to human activities. Global temperatures are warming, and severe weather events are happening more frequently. Cities are especially vulnerable to the impacts of climate change, which can negatively affect the health of the people who live there. For example, most of the land in cities is covered by buildings, roads, and pedestrian pathways, mostly made of asphalt and concrete. These surfaces cause what scientists call an **urban heat island effect**. Have you ever put your hand on the asphalt at the end of a hot summer day? Even when the sun goes down and the air temperature drops, the surface still feels warm. In fact, in contrast to forests or other vegetation, these human-made materials often absorb the sun's heat and release it at night, when the air is cooler. This keeps the temperatures within cities higher than the temperatures in the countryside.

URBAN HEAT ISLAND EFFECT

When the air temperatures in the city are hotter than in the surrounding countryside, because the pavement and buildings retain heat, which makes all the surfaces very warm.

There are even more serious effects of climate change for city residents. Although rainfall is becoming less frequent, the risk of severe weather is increasing, and heavy rainfall events are on the rise. Ground that is sealed by asphalt and other human-made materials cannot take up the water the way soil can, so flooding can result. Another big problem faced by cities is how to manage the enormous amount of waste produced every single day. This waste must be taken away and, at the same time, the many goods that city residents need must be transported into the cities. All this transport in and out of cities produces a lot of greenhouse gases, including carbon dioxide [1].

The foods that city dwellers eat are produced all over the world. Before foods (or any goods that we need) find their way to a city's supermarket shelfs, they may have traveled hundreds or even thousands of miles across the globe by plane or boat, often through several countries. On the one hand, this means that we can find our favorite foods all year long. But on the other hand, cities are highly dependent on trouble-free food delivery to feed their residents. Is there anything cities can do to protect Earth's climate while also improving the lives of city dwellers? **Urban agriculture** may be the answer! [2, 3].

URBAN AGRICULTURE

The production of food within cities, to feed city residents. Includes growing of vegetables in backyard gardens and in greenhouses on rooftops. Also called urban farming.

FOOD SUPPLY CHAIN (FSC)

The path of a food product from its production, through processing, to our plates. The more stops a product makes, the longer the chain.

THE SOLUTION IS RIGHT OUTSIDE THE DOOR

One way that cities can adapt to face the challenges of the future is to shorten **food supply chains (FSCs)**. The food supply chain describes the path of a food product, from production through processing to our plates. Urban agriculture shortens FSCs by creating locations for food production within, or very close to, cities. Access to locally grown food can also be improved by encouraging farmers from the outskirts of the city to sell their goods (such as vegetables, fruits, milk, and meat) to city residents. This can both shorten FSCs and reconnect the city with its surrounding countryside. Moreover, the

farmers often receive only little money for their products, when selling it on the global food market. This puts a lot of pressure on the agricultural production and food system, especially in countries where the production requirements are high. Farmers have to produce very efficiently to be able to offer their products to low prices. Large farms are more likely to cope with the price pressure, while small family farms are more at risk to give up.

Often, there is not much land available within cities for urban agriculture—but urban agriculture can still succeed, even in the largest metropolitan areas. Smart scientists and architects can integrate agriculture into city buildings, to save space and reuse resources [4, 5]. Typical examples are rooftop gardens, where plants are grown high above the city (Figure 1). Urban agriculture tries to reuse resources like water and energy. In some cases, rooftop gardens contain greenhouses that use the heat from the building; or plants can be watered using rainwater, if there is a way to collect it.

Figure 1

Urban agriculture includes food produced in or on city buildings, including in rooftop gardens, on the walls of buildings, and even in climate-controlled spaces within buildings, where all of a plant's needs are met.

Urban agriculture can take place *inside* buildings, too. As you may know, plants have unique demands: some like a lot of sun and high temperatures, while others prefer cool and even wet weather conditions. Inside a building, the conditions are fully controllable, so that plants get the right amounts of light and **nutrients** and can grow in their preferred temperature ranges. In these controlled environments, outside weather, sunlight, and city pollution do not affect the plants. To save space, plants can be stacked on shelves, one above the other. This is called **vertical farming**. A high-rise building with many levels of vertical farming uses space very efficiently and can produce fruits and vegetables throughout the whole year, even in winter. Another option is to integrate plants into a building's walls (called edible walls) [6].

NUTRIENTS

Essential substances that a plant needs to grow.

VERTICAL FARMING

A farming method in which plants or animal products are produced on various levels, like shelves, arranged one above the other to save space.

SOIL ALTERNATIVES?

Every plant needs something for its roots to grow in, so that it can get the water and nutrients needed for its growth and development. School gardens, community gardens, family gardens, traditional farms on the outskirts of cities, and people growing a few plants on their balconies all use the most common growing substance—soil! However, the quality of city soils is often not very good and does not support the healthy growth of food plants. Soils near roads are especially poor, due to potential contamination by the pollution released by cars and trucks [7].

Soil can be replaced by other substances, such as compost, sand, or gravel. The selection of a soil replacement depends on what the type of plant being grown needs. One of the most important physical properties of a soil-replacement substance is the particle size (Figure 2). Imagine you have two bowls filled with balls—one with golf balls and the other with tennis balls. The tennis balls are obviously larger, so the bowl contains fewer of them, and the airspace between the tennis balls is greater. With soil and other growing substances, it's the same—the larger the particles, the more airspace there is in the substance. However, the water-holding capacity is reduced when the particle size is large, because water can move through the particles faster and seep into the deeper parts of the ground, where the plants cannot reach it.

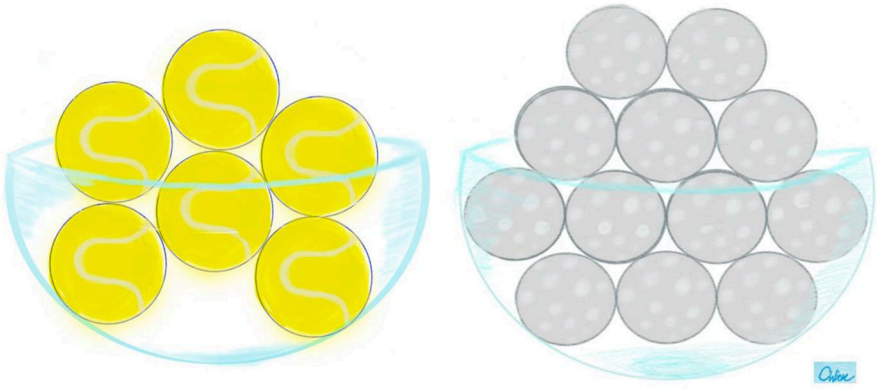

Figure 2

Figure 2

The particle size affects the properties of the soil and other substances in which plants can grow. The right cup contains tennis balls while the left cup contains golf balls. The left bowl can hold more balls and the air space between the golf balls is smaller. For this reason, the water seeps into deeper soil layers more slowly. Plants that grow on sandy soil (large particles) need to be watered more frequently in summer than those that grow in loamy soil or even clay soil (smaller particles).

HYDROPONICS

A soil-free growing method for plants. The plants receive the nutrients necessary for their growth from nutrient-enriched water.

It is even possible to produce plants without any soil-replacement substance! New technologies enable us to grow plants in water that has been enriched with nutrients. This system is called **hydroponics**. Hydroponics can also be combined with fish production, in a technique called **aquaponics**. Although aquaponics is difficult, the idea behind it is relatively simple. The fish are kept in basins, where they eat and grow. The water the fish swim in must be cleaned and exchanged occasionally. The wastewater is collected and used in hydroponics, because the fish droppings in the water are good fertilizer for plants.

The plants take up the nutrients from the water and, in doing so, clean the water. The water can then be reused for the fish (Figure 3).

Figure 3

Aquaponics is a type of agriculture in which fish and plants are farmed together. The plants receive their water from the fish, which live in a separate basin below them. A pump moves the water from the aquarium to the plants. The fish droppings contained in the water serve as fertilizer for the plants. The plants also clean the water, which can then be returned to the fish via a drain.

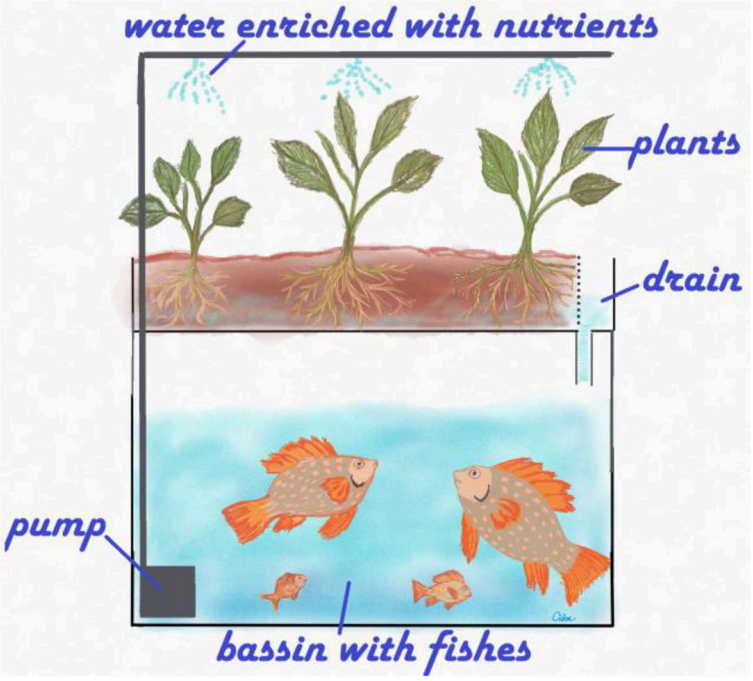

Figure 3

SUMMARY

AQUAPONICS

A technique in which fish and plants are farmed together. Water containing fish droppings is used to feed plants. Plants remove the nutrients and purify the water for the fish.

In summary, producing food within cities and establishing relationships between cities and nearby farmers has many advantages—for both farmers and city residents. Even small farms that are close to cities can find a way to make money selling their products to city dwellers. Growing food within or close to cities eliminates long transportation routes and the harmful emissions that they cause. One important way to support urban agriculture is to rethink your (or your family's) food-buying behavior. Urban agriculture will only be successful if people care about locally produced food and buy it instead of buying food that was produced far away. Change begins with this slogan: Think global, eat local!

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ORIGINAL SOURCE ARTICLE

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YOUNG REVIEWERS

COLEGIO ALTOS DEL CERRO GRANDE, AGES: 11–12

We are 11 and 12 year old school children who despite being native speakers of Spanish also enjoy knowing English. And above all we like to learn about new thing! We are a highly dynamic, cheerful and unruly group that seeks new challenges.

COLÉGIO MAXI - MIZZOU ACADEMY, AGE: 12

For this review a small group of Middle School students within the Mizzou Academy program at Colégio Maxi worked together to complete the review. Our program is an opportunity for students to experience an American classroom experience without leaving Brazil. We had lots of fun learning about climate, weather and how the scientific process works.

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