Nature-based Solution protocols

City Adapt
RECONNECTING CITIES WITH NATURE
LATINAMERICA AND THE CARIBBEAN

UN environment programme

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Hydroponics

Hydroponics is a method of growing plants without soil, using water-based mineral nutrient solutions. In this system, plants may have their roots directly exposed to the nutrient solution or supported by an inert medium such as perlite or gravel.

This technique allows for precise control over the nutrients plants receive and can be used to grow a wide range of plants, including crops, medicinal plants, and ornamentals. Hydroponics is known for its efficiency in water usage, making it an attractive option for sustainable agriculture. It can be implemented in various settings, including greenhouses and urban environments, offering advantages such as reduced water usage compared to traditional farming methods and the ability to grow plants in areas with unsuitable soil conditions.

Estimated number of beneficiaries[1]: 300 persons

[1] The total yield expected from your system annually and divide it by the average consumption rate of your target crop per person

Integration with international agreements

SDG 6, 11, 13

Duration

Medium-scale Systems: For larger systems, such as those used in schools, community projects, or small businesses, the setup time can range from a few days to several weeks. This includes planning, sourcing materials, system assembly, testing, and initial planting. Depending on the level of maintenance, these systems can last 5-10 years.

Place of Implementation

Hydroponics can be implemented in various locations, offering flexibility and adaptability to different settings. They are particularly important in regions facing water scarcity, because of their water conservation features. Hydroponics' flexibility and efficiency make it suitable for a variety of applications, from small personal projects to large commercial ventures, and even in challenging environments where traditional agriculture would be difficult or impossible. Hydroponics are also suitable for places where soil is of poor quality; where planting is limited due to space or other constraints or in dry regions with little rainfall.

Threats Addressed

- High Temperature
- Changes in rainfall patterns
- Heavy Rainfall
- Drought
- Food scarcity

Social, eco-systemic and economic benefits

1. **Enhanced Food Security:** Hydroponics can increase local food production, especially in urban areas or regions with harsh climates or poor soil quality.
2. **Community Development and Education:** Hydroponic systems can be used as educational tools in schools and community centers, teaching people about sustainable agriculture, nutrition, and science.
3. **Improved Nutrition and Health:** By providing access to fresh, locally grown fruits and vegetables, hydroponics can play a crucial role in improving nutrition, particularly in urban food deserts where access to affordable fresh produce is limited.
4. **Soil Preservation:** Since hydroponics does not use soil, it eliminates the issue of soil degradation and erosion, which are significant problems in traditional agriculture. Healthy soil is crucial for carbon sequestration, and its preservation is essential for combating climate change.

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Main Climate Impacts & Threats Addressed

Water scarcity: Hydroponics is highly efficient in terms of water usage. It uses significantly less water than traditional soil-based agriculture because water in hydroponic systems is recirculated and reused.

Pests & diseases management: Since hydroponics does not use soil, many soil-borne pests and diseases are naturally avoided. This reduces the need for pesticides and fungicides, making hydroponic systems more sustainable and safer for growing food.

Urban heat island effect: Hydroponics can contribute to reducing the Urban Heat Island (UHI) effect, especially when implemented on a large scale in urban areas.

Implementation Stages

Decide on the type of hydroponic system that best suits your needs. Common types include:

- **Deep Water Culture (DWC):** Plants are suspended in a nutrient solution with their roots submerged. An air pump oxygenates the solution to prevent root rot.
- **Nutrient Film Technique (NFT):** A continuous flow of nutrient solution runs over the roots of plants placed in channels, allowing the upper part of the roots to remain exposed to air.
- **Ebb and Flow (Flood and Drain):** Plants grow in a grow bed filled with an inert medium. The bed is periodically flooded with nutrient solution, then drained back into the reservoir.
- **Drip System:** A slow feed of nutrient solution is dripped directly onto the base of each plant.
- **Aeroponics:** Plant roots hang in the air and are misted with nutrient solution at regular intervals.

1 Site Selection

Choose a location with enough space for your system and good light exposure. If natural light is insufficient, you'll need artificial grow lights.

2 Gather Supplies

Depending on your system, you'll need:

- A reservoir to hold the nutrient solution.
- A water pump (for systems that require active water movement).
- An air pump and air stones (for oxygenating the solution, essential in DWC).
- Grow trays or channels (for NFT or ebb and flow systems).
- Growing medium (if not using a water-only system), such as rockwool, clay pebbles, or coco coir.
- Hydroponic nutrients.
- pH and EC meters to monitor nutrient solution strength and acidity.
- Grow lights (if using indoors or in low-light conditions).
- Timer for lights and pumps (to automate the system).

3 Set Up the System

- **Reservoir:** Place your reservoir at a lower elevation than your grow beds or channels to facilitate water movement.
- **Pump and Irrigation:** Install the water pump in the reservoir, connecting it to the grow beds or channels to circulate the nutrient solution. Use a timer to control the flow in ebb and flow or drip systems.
- **Air Pump:** In DWC, place the air stones in the reservoir and connect them to the air pump outside the reservoir to oxygenate the water.
- **Grow Lights:** Install grow lights above the plants, ensuring they're at the correct distance to provide enough light without overheating the plants.

References

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4 Prepare the Nutrient Solution

Mix water with hydroponic nutrients according to the instructions for your specific crops. Use the pH meter to adjust the solution to the appropriate pH level, typically between 5.5 and 6.5.

5 Plant Your Crops

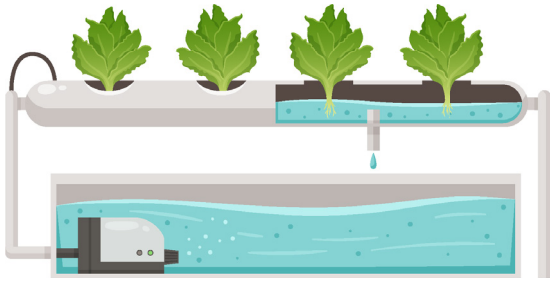
- For systems using grow media, plant seeds or seedlings directly into the media.
- For water-only systems like DWC, place seedlings in net pots with their roots suspended in the nutrient solution.

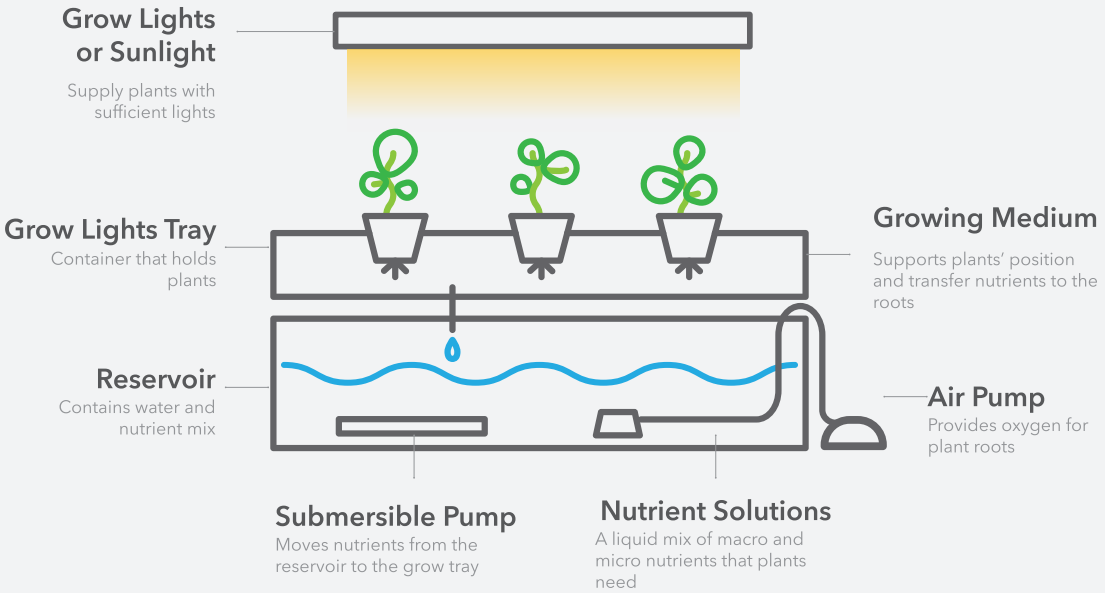
6 Monitor and Maintain

- Regularly check the pH and nutrient strength (EC/ppm) of your solution, adjusting as necessary.
- Top up the water level in the reservoir to replace what's absorbed by plants or evaporated.
- Keep an eye on plant health and watch for signs of pests or diseases.
- Clean and sterilize the system between growing cycles to prevent the buildup of pathogens.

7 Harvest

- Once your plants have matured, harvest your crops. Many hydroponic systems allow for continuous harvesting, especially for leafy greens and herbs.





Indicators

Implementation	Number of hydroponics units installed
	Number of direct beneficiaries (disaggregated by gender and age)
Quantitative	Percent of Jamaica 4H-Clubs school members participating in collective NbS actions (Disaggregated by sex and age)
	Crop (fruits/vegetables) yield (weight)
	Cost savings of fruits/vegetables used in the school for school/community feeding program
Qualitative	Level of awareness and knowledge about nutrition and healthy eating habits

Costs and inputs

School Hydroponics 1500 sq feet	Cost in USD
Labour:	1,300.00
Equipment & Tools	3,500.00
Total	**4,800.00**