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Nemo's Garden

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SUMMARY

With the increase in global population by 2025 the demand for food also increases and the place for cultivation of crops has been decreasing in order to meet this demand Ocean Reef Group developed the Nemo's Garden Project, looking at new branches of green and blue economy. The installation, known as Nemo's Garden, is an experiment meant to test the viability of underwater greenhouses. The submerged "biospheres" consist of plastic domes rigged up with hydroponic equipment, plant seeds, and air-circulating fans.

INTRODUCTION

The changes in temperature, precipitation, and carbon dioxide, as well as climate variability and surface water draining are already challenging for agriculture, and they are expected to affect it even more in the future, both in the Southern and Northern. Nemo's Garden has the main goal of not harming the planet, consequently it was designed to be: self-sustainable, using mainly renewable energy from natural resources such as the sun and having the ability of reutilizing the freshwater it produces, eco-friendly, not harming the surrounding environment and its natural marine ecosystem that is heterogeneous, has an oligotrophic nature, a high diversity in marine species, and a high rate of endemism and ecological, not producing any pollution.

Nemo's Garden might serve as an example of an alternate agricultural system, particularly beneficial for growing herbal crops and geared toward regions where the climate, economics, or geomorphology pose significant challenges to plant growth. Nemo's Garden is situated in the bay of Noli in a tiny cove. The underwater farm is situated between the cliffs of Capo Noli and Punta Vescovato, about 40 meters (130 feet) from Letizia Beach, and between 32 and 40 feet (9.8 and 12.2 meters) below sea level.

The technology created as part of the Nemo's Garden Project comprises of "biospheres," or underwater greenhouses. These are translucent acrylic domes filled with air, holding about 2000 liters of air, and floating in front of the Noli town seashore near Savona, Italy. They are fastened to the seabed by several chains and are positioned between 5 and 10 meters below the surface. As these air-filled pods function as sealed environments, sunlight causes the water inside of them to warm up, making the inside of the pods warmer than the outside. Additionally, this desalinates the seawater, which drips down and provides fresh water to the plants as it evaporates and condenses on the pod's roof. After vast research, they developed a wide range of more than thirty

herbs, salads, vegetables, and flowers. They also discovered that, even in cases where the crops didn't quite thrive, the plants grew more quickly underwater than they would have on land.

Design

Nemo's Garden is constructed from six biospheres. They consist of an internal metallic scaffold that ties the structure to the seafloor using 24 chains and specialty screws, and a vinyl-plastic dome that lets light reach the plants within. Each semi-sphere has a diameter of two meters (6 feet 7 inches), 2,000 liters of air volume that is periodically replenished, and a step grid at the bottom where divers can stand to perform their duties.

The Garden was originally in the shape of a pentagon with five biospheres, but a sixth one was added in 2021. The Tree of Life is a 3.5 metres (11 ft) high and 3 m (9.8 ft) large structure placed in the middle. It hides cables going into the biospheres, provides illumination for the habitat, and has webcams monitoring the Garden from the top.

The "agrinauts" (divers working in the biospheres) use the shoreline Control Tower to connect with their colleagues working on land, as well as to monitor and oversee all activities within Nemo's Garden. A spiral tube, 10 meters (33 feet) long, with holes spaced every 15 centimeters (5.9 inches) to serve as seedbeds is installed inside the plastic domes. Each biosphere has 60 holes total, supporting 150–200 plants.

Every semi-sphere is equipped with monitoring sensors that detect and record physical and chemical data such as: air temperature, Humidity rate (controlled through solar powered fans) levels of oxygen and carbon dioxide. The Garden is provided with an irrigation system situated in a tank in the lowest part of the spiral tube. The irrigation water is obtained by condensation caused by the difference between the air temperature inside of the biospheres and the surrounding water temperature. The water obtained is stored in the tanks and mixed with fertilizers and redistributed to the plants through solar powered pump that pushes the water from the bottom to the top of the spiral tube. The water then falls by gravity reaching the plants. The main renewable energy source is solar energy and fresh water is obtained through the process of desalination of water. In absence of solar energy, LED lights are employed to provide light.

Plants grown under nemos garden:

Stevia rebaudiana, Salvia elegans, *Eschscholzia californica*, Vinca, Calendula, Pansy, Small Tomatoes, Lemon balm, Basil, Thyme, Orchids, Sophora, Goji, Oregano, Mentha and Beans

Benefits

- Self-sustainable:
- Eco friendly
- Improved yield, flavor, and nutritional qualities

Challenges That Could Occur in the Nemo's Garden

1. Very expensive to set up, vulnerable to power and internet system failure and requires constant monitoring and maintenance, demands technical expertise
2. Production is limited compared to field conditions
3. Vulnerable to possible major natural disasters such as storm damage, tsunami, etc.

CONCLUSION

The underwater system represents an innovative approach to marine agriculture that addresses environmental concerns and promotes sustainable practices. If effectively implemented, it could serve as a blueprint for responsible food production in underwater environments.

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Nemo's Garden- the world's first-and only sub terranean greenhouse

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