# Weathering the 'perfect storm': transforming cities into water catchments and urban farms

Marc Noyce
Biofilta Pty Ltd

**Abstract**

This paper outlines the work of Biofilta in advancing a soil-based urban farming method that is scalable from household to community-scale food production. Biofilta was selected from a global search of 280 applications across 74 countries in 2017 by LAUNCH Food, funded by DFAT and USAid. All products are made in Australia and the new Foodcube system is made from recycled food-grade plastic that was destined for landfill. Biofilta has demonstrated that the sealed food growing system works in Tuvalu where water availability, space constraints and robust technology are issues facing many similar communities. DFAT has now issued a contract to implement larger-scaled community gardens using the Foodcube to create a circular economy, close nutrient loops and showcase to the world how appropriate the technology is for urban agriculture. Statistics of other gardens being grown in urban car parks showcase how little space it takes to grow the yearly recommended amount of vegetables for an adult according to the World Health Organization. Biofilta is a small private business based in Melbourne. The owners want to expand and partner with organisations across the world to deploy urban agriculture and help smallholders make an income and raise nutrition levels within the community.

At Biofilta we demonstrate how to grow food in difficult places and small spaces, using recycled plastic growing-units; we also clean stormwater through biofilters, to a standard sufficient for irrigating.

Figure 1 (overleaf) shows an example in Fitzroy Gardens in Melbourne where we suck in stormwater and by treating it with a vegetated sand filter we provide a million litres-worth of water for irrigation overnight. This system produces 70 million litres-worth of potable water offset per annum, with a 15-year payback. We can do that in a very small area: this system takes up one-tenth of what a wetland would take up, which is ideal for cities which lack spare land.

Figure 2 shows another example in Melbourne; this channel up until the 1960s was conveying sewage out to the water treatment farm at Werribee. We now collect the stormwater from the nearby developments and filter that inside what used to be the open sewer, and the product is water for landscapes.

About five years ago we decided to combine our expertise in water and in food-growing systems. We were concerned about the way people were less and less growing food in urban areas, generally because they said they lacked the time, or lacked the space, or lacked the expertise; and they found supermarkets so convenient. We wanted to do something about that.

This paper has been prepared from a transcript and the illustrative slides of the presentation.

**Figures 1, 2.** Groundwork (left) and final appearance (right) of the system in Fitzroy Gardens; and (below) the channel leading to Werribee water treatment works, south-west of Melbourne.

Traditional garden beds have kept humans alive for the last 10,000 years, with water being applied from the top of the soil and gradually leaching out. The system is labour intensive, conducive to weeds, and a water-intensive way of growing food. By contrast, the wicking bed system of horticulture provides water from bottom up instead of top down (Figure 3). That keeps the soil nutrients and water in check and available. Nothing is lost; it is a sealed system, though there are some drawbacks.

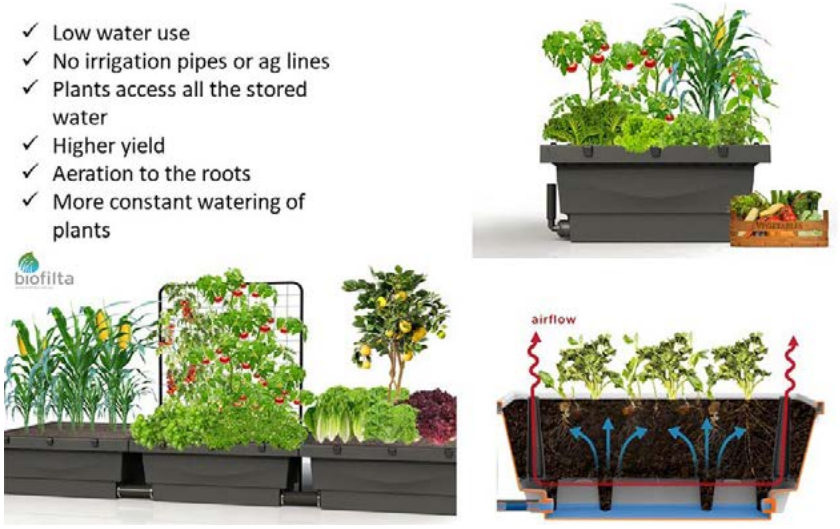


**Figure 3.** Advances in wicking gardens.

In Biofilta we have re-engineered the wicking garden bed system to overcome some of the drawbacks, and in 2017 the LAUNCH Food challenge, run by the Department of Foreign Affairs and Trade's innovationXchange and USAid, chose our system as a winner.

We were already growing vegetables in very modular, very spatially efficient wicking garden beds. Then in 2018 we set ourselves the target of growing 150 kg of food – enough for one person over a year, according to the World Health Organization – in a single car parking space. We tested the idea using two car spaces (in case one was too small) and in six months we achieved our target yield (Figure 4). Since November 2018 we have harvested over 350 kg-worth of food out of that small area.

**Figure 4.** Growing one (or two) years' supply of vegetables in one (or two) car park spaces.

## Tuvalu

In Tuvalu, on the low-lying atoll Funafuti (capital of Tuvalu), where saltwater comes out of the ground, we have now showcased wicking self-watering modular technology using our 'Foodwall', a raised sealed food-growing system. Here we thought the biggest challenge would be water supply, but it turned out to be soil because the area has 3000 mm annual rainfall (collected in rainwater tanks) but the soil is coral scree, very saline and with a high pH, unsuited to vegetables. Green waste either goes to the pigs or is mixed with other waste in low-lying dumps often inundated by seawater. Traditionally vegetables in Tuvalu are grown in whatever medium you can collect, including coconut husks.

In mid-2018 we set up our Foodwall (Figures 5, 6), using local compost as growing medium, in two stages – July and September – and every four weeks we were able to harvest vegetables out of a space that could not grow vegetables beforehand. That has been affecting a lot of lives over there, which is very satisfying.

Tuvalu, in fact, has a lot of resources in plant and animal materials, and ACIAR will help set up a viable system for using those resources to grow food. Once people have a 'recipe' that can be reproduced and they get something out of it, they will maintain it. There is certainly demand for vegetables grown at home-scale; we had people lining up to get their allocation from the Foodwalls.


**Figure 5.** 200 Foodwall Step units (100 $m^2$ in total) growing vegetables in Tuvalu.


**Figure 6.**

We learnt a lot out of this trial: that sometimes the beds need to be shaded during hot periods, and that heat build-up in the planter boxes can be an issue; that compost supply is critical to provide nutrients; that education and good partners on the ground are very important; that perception is also very important.

In summary, sustainable food-growing needs on an island are: (i) access to water; (ii) growing medium such as compost; (iii) replenishable nutrients for plants; (iv) seedlings; (v) a closed nutrient loop; (vi) land area; and (vii) education.

## Foodcubes

To scale-up our growing system we have developed the Foodcube, which we make from recycled food-grade chip-packet film that was going to go landfill. Two local companies in Melbourne have invested $6 million in tooling and construction to create the Foodcube. Figure 7 shows Foodcubes bound for Tuvalu, with no packaging or waste.


**Figure 7.** Foodcubes , deconstructed (left), and loaded in a container for Tuvalu.


**Figure 8.**

The photos in Figure 8 show where we plan to deploy Foodcubes: schools, homes, city rooftops and urban farms. The sky farm pictured will be on a 2000 m² roof top on a Melbourne carpark, and we also plan to set up an education centre for urban agriculture. We want schools to grow food and reconnect the community with food-growing, because in one generation we are losing understanding about where our food comes from. Closed-loop urban farms in urban communities are the way to go.

Marc has over 20 years of experience in the water industry and is the Chief Executive Officer of Biofilta Pty Ltd, a Melbourne based water sensitive urban design and urban food product supply company. With a mission to 'turn our cities into water catchments and urban farms', Marc is passionate about combining engineering and horticultural skills to solve urban sustainability challenges. Marc grew up on a working market farm and likes to encourage everyone to grow their own food in a sustainable manner.