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Desert Garden: How scientists and refugees have turned the desert green

Through co-creation scientists and refugees have turned two problems – that food doesn't grow in the desert and foam mattresses can't be recycled – into a humanitarian solution.

Zaatari refugee camp in Jordan is a UNHCR safe haven for 80,000 refugees from the Syrian war. It's full of former farmers, so you would expect it to be green – but it's not. Poor soil with little low organic matter, water restrictions and local rules that disallow permanent structures (including planting in the ground) make desert based Za'atari a tough place to grow plants.

The camp is very resource-efficient, having the most effective plastics recycling scheme in Jordan, but there was a hidden waste problem. Used polyurethane foam mattresses, piling up in a warehouse, which couldn't be recycled. These held the solution to the planting problem.

Scientists at the University of Sheffield working on soil-free, hydroponic food production were growing plants in special polyurethane foam [Wright, HC., Zhu, J., Cameron, DD. and Ryan AJ. (in press). Flexible polyurethane foam with sodium bentonite: Improving the properties of foams for use as a synthetic growing media. *Acta Hort.*2020] and recognised that repurposing the waste mattresses could allow refugees to grow their own fresh food. We developed low-tech hydroponic systems for herbs, vegetables, fruits and leafy greens using chunks of recycled mattresses in drain pipes and yoghurt pots and refugees were trained in hydroponic techniques. As conventional toilers of the soil, they couldn't believe it at first – but now they've transformed the desert into a garden.

Stepping up the project and working with the UNHCR, we have now trained more than 1,000 refugees, including over 400 women, in hydroponic techniques. Initially the University of Sheffield staff did the training – but now we have trained refugee trainers, the diffusion of this knowledge is self-sustaining.

The benefits of the project has been gauged by interviewing over 500 of the participants asking about the utility of the training and whether they can, and will, use what they have learned to produce fresh fruit and vegetables. The co-creation approach also means that scientists have learned from the refugees how to use PU foam in real-world conditions and in harsh environments. There are other benefits too. Training for young people, who would otherwise have no access to further education, provides future employment opportunities.

Skills in hydroponics not only enable food production, but also provide food of cultural significance and connections to their homeland. But our most enduring collective achievement is boosting mental health by delivering the colour green.

After starting in Zaatari, we are now rolling out the project in Azraq camp and urban areas, including Mafraq and Ruwaished. This brings benefits to Jordanians as well as refugees, as urban hydroponic systems [<https://doi.org/10.1038/s43016-020-0045-6>] are designed to overcome challenges of limited natural and financial resources. This work is about using science to improve people's lives, empowering refugees with new skills that they can apply in innovative ways, and doing things that scientists might never have considered. To find out more and make a contribution, visit sheffield.ac.uk/desert-garden.

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