



# Land, water and bees – don't take us for granted:

## Hydroponics and vertical farming

### Student activity sheet

#### Wigan University Technical College farm

By 2050 world population is expected to have grown by an extra three billion people. Our current agricultural methods are not producing enough to feed this huge population. Land is an increasingly scarce resource, with many people wanting to use it for different purposes. The idea behind vertical farming is to provide space for plants to grow in layers on top of each other, instead of expanding outwards into more and more land.

Wigan University Technical College (UTC) has a vertical hydroponics farm attached to its historic warehouse buildings. It is the first educational vertical farm and one of only a few vertical farms in the world. The farm has glass-framed rooms full of equipment for growing plants. Students get involved by growing crops that they can then turn into meals in a full-scale production kitchen or sell to local restaurants as fresh food with zero food miles and a minimised carbon footprint.

Watch the video 'Hydroponics and vertical farming' (available on The Crunch website, [thecrunch.wellcome.ac.uk/schools](http://thecrunch.wellcome.ac.uk/schools)), an interview with the students who run the vertical farm at Wigan UTC. Then answer the following questions.

#### Questions

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1. In traditional farming it is impossible to guarantee that plants will always get the particular conditions they need to grow well. Make a list of the conditions that plants require for growth.
2. What factors might cause a crop to fail when growing on a traditional farm?
3. (a) How does a hydroponic farm supply the things that a plant requires to grow well?  
(b) Plants grow very well in hydroponic systems because the risk of failure from the factors you have listed in answer to question 2 is reduced. For each of the factors you have thought about, explain how the hydroponic farm reduces or eliminates them.
4. Carry out some research into an aspect of hydroponic growing that interests you; for example, find out about one hydroponic farm such as 'Growing Underground' in London. Display your research using one sheet of A3 paper so that other students can gain an understanding of hydroponic growing generally and the farm you have chosen in particular. Use words and pictures to illustrate your research and present the facts you have found.

#### Extension work: aquaponics

Some hydroponic farms put fish in the water that supplies the growing plants. This set-up is known as **aquaponics**. The Wigan UTC vertical farm also uses aquaponics (read about it here: [wiganutcverticalfarm.blogspot.co.uk/2014/05/peppers-on-vertical-farm.html](http://wiganutcverticalfarm.blogspot.co.uk/2014/05/peppers-on-vertical-farm.html), for example). The fish produce waste containing nitrogen that would be toxic to them if it accumulated, but the plants are able to use this waste as a nutrient that they need to grow well, at the same time removing the toxins from the water. This resembles the nitrogen cycle that occurs in nature (like the carbon cycle and the water cycle). Aquaponics can use edible varieties



of fish, giving farmers the ability to produce both fish (a valuable source of protein) and plants for food in a very small space.

## Question

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5. Design a table to show all the advantages and disadvantages of hydroponics and aquaponics that you can think of, giving reasons for your opinions.

## Further reading

Feeding the world – hydroponics: [12.000.scripts.mit.edu/mission2014/solutions/hydroponics](http://12.000.scripts.mit.edu/mission2014/solutions/hydroponics)

Underground hydroponics (video from the *Daily Telegraph*):

[www.youtube.com/watch?v=xFL\\_u3qk73U](http://www.youtube.com/watch?v=xFL_u3qk73U)

Growing Underground (hydroponics in old bomb shelter under London): [growing-underground.com/](http://growing-underground.com/)

Wigan UTC vertical farm: [wiganutc.org/vertical-farm.html](http://wiganutc.org/vertical-farm.html)

... and the informative Wigan UTC farm blog: [wiganutcverticalfarm.blogspot.co.uk/](http://wiganutcverticalfarm.blogspot.co.uk/)

Sky Greens vertical farm (soil and hydroponics), Singapore: [www.skygreens.com/](http://www.skygreens.com/)

Small- and large-scale hydroponics in Indonesia: [www.hydroponics.com.au/jakarta-towards-food-security/](http://www.hydroponics.com.au/jakarta-towards-food-security/)

Intermediate technology hydroponics with waste:

[www.agriculturesnetwork.org/magazines/global/farming-at-close-quarters/simple-hydroponics-for-food-security](http://www.agriculturesnetwork.org/magazines/global/farming-at-close-quarters/simple-hydroponics-for-food-security)

Smart floating farms project (hydroponics, aquaculture, photovoltaics): [smartfloatingfarms.com/](http://smartfloatingfarms.com/)