CLIMATE CONTROL

Marie O'Mahony discovers how ingenious textiles can lead to healthy harvests

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Today, more than at any other time in history, we are acutely aware of the impact of textiles on the environment. From the labels on our clothes that tell us how to care for them with minimal water and energy use, to reuse and repair campaigns initiated by high street brands, we have never been better informed of the consequences of our behaviour as textile designers and consumers.

At one level we have the materials that we come into contact with on a daily basis. These are visible, designed and have a physicality that allows us to touch them. But there are also the textiles that are largely invisible but equally important in their impact on the world around us. These are technical textiles, almost exclusively driven by performance rather than aesthetics. And although sportswear might spring to mind when reading that sentence it's actually much more fundamental. Textile engineers are pitting themselves against the elements and their textiles have an growing role in increasing food supply and protecting it from the consequences of climate change. Sounds impressive, but, before we hail these positive innovations, let's be honest about some of the ways textiles have adversely affected the production of food and even helped to create some of the problems we must now solve.

The Aral Sea is one of the most infamous examples of the impact of textiles on the landscape through water abstraction. The lake was once one of the largest in the world but between 1960 to 2000 it lost an estimated 60% of its area and ▸

80% of its volume, largely due to irrigation for cotton production. According to the Water Footprint Network cotton consumption requires 256 billion cubic metres of water per year, of which 42% is considered 'blue' water taken direct from lakes and rivers. The impact of this on food production is twofold. Fishing is depleted because of the reduction of water levels, while on land the landscape is covered in a salt deposit making crop production impossible in the worst affected areas. Dust storms and more extreme temperatures are a further by-product of the reduced water level, again making farming difficult and lowering yields.

Water use during the growing stage is only part of cotton's story: Levi Strauss & Co are one company looking to address the wider issue. In an environmental audit on their iconic 501 jeans Levis estimated that over 3,000 litres of water is used in the product life cycle. Almost half is in the growing of the cotton, 6% in the manufacturing and around 45% by consumers in the wash and care of the jeans. The company is developing a Waterless jean range to reduce the amount of water used during the manufacturing and finishing process. As a percentage it is the smallest in their audit. However, the ripple effect is tremendous. Contaminated water damages fish supplies, endangers the health of livestock and reduces crop production such as rice, a staple for much of Asia. The contaminated water is returned to the environment unfit for human washing or ingestion, yet not everyone has a choice.

The damage is extensive but with the help of technical textiles a measure of redress is being made. In land food production they play an important role in helping plants to grow, maximizing crop yields, preventing exposure to harsh climate conditions and, in the waters, they assist in the clean up of chemicals and rebuilding eroded habitat.

And while the term 'textile design' might evoke repeat patterns, knit or weave, these are innovations as much associated with fields of engineering. The fabrics are produced in recognisable forms of knit, weave and nonwoven structures but additional structures are introduced from engineered materials including composites, sandwich structures, membranes and grids. A new textile lexicon is also emerging to describe these materials and hint at their practical applications above and below ground as well as in the water.

The term Geosynthetics is used to denote textiles that are used in the land for reinforcement, protection and enhancement (drainage). Within this there are several sub-categories such as Geomembranes, Geomesh, Geomats, Geogrids and Geocomposites that combine two or more of these to fulfil a function. Polyester, polypropylene and biodegradable materials are all being utilised in this field. The structure is dictated by the intended use. A membrane would be used to prevent water leakage, such as a liner for a landfill site: while a mesh or grid is employed to prevent soil erosion or attack by animals from below ground. Composites combine two or more materials and bring together

their respective capabilities. Remote monitoring is being introduced so that sensors are incorporated into structures: the structures can then be checked for fatigue or for attack by rodents at a level that may not be visible.

Above ground Hortisynthetics are a group of fabrics designed to protect plants from predators or the climate. As the pressure to grow crops in increasingly inhospitable and exposed regions increases, these materials perform an essential function offering protection from intense heat during the day and a corresponding drop in the temperature at night. Commonly knit or woven from polyethylene or polyester fibre they are designed to protect young plants in particular against drying out in the heat. Colour plays an important role in their functionality with black yarn used to absorb the sun's heat during the day and reduce heat loss at night. A white knitted shade cloth will absorb and reflect the white scattered light from the environment. This leaves the plants cooler than if they were covered by a black shade cloth. The use of flat tape rather than a round yarn offers increased cover. Often aluminium finely coats the synthetic core reducing weight and cost. The metal reflects sunlight away from plants.

Coastal erosion, ocean pollution and damage to seabeds are serious challenges to marine life. Textiles in the form of geotextiles and geogrids act as barriers to combat coastal erosion and protect shorelines. Geosynthetics can be used in the form of small sand-filled geotextile bags that can be stacked along the shore, or as larger mega containers that are

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made to order for reef and breakwater protection. Elcorock Mega containers have been used in the construction of Narrowneck Reef in Australia. The reef measures 450m x 250m and required 400 containers filled with sand. A heavy grade of Elcomax, a geotextile, has been used to prevent stress concentrations and to withstand storms Monitored for their impact on marine life, within weeks seaweed was found growing on the containers helping to attract sea life to the area.

Environmental disasters cause catastrophic and continuing damage on land and sea. Geotextiles are being used to protect against disasters and as a fast response in disaster zones. In 2010 a fire on board led to the sinking of BP's Transocean Deepwater Horizon drilling rig off the coast of New Orleans leading to the spilling of hundreds of thousands of gallons of oil over the Gulf of Mexico. The geosynthetics industry provided oil containment booms to form a floating barrier.

Food insecurity is a major world problem, particularly in developing nations. Feeding the global population is an achieveable goal yet the US government estimates that one in eight people suffer chronic hunger. Today the environmental challenge for textiles goes beyond water and energy use, beyond consumption, repair, recycling. We now have to ask what is the broader impact of textiles on food production? Our colleges and universities must invest in and promote this branch of textiles. Advances in sophisticated textile technologies will provide further innovative solutions to food problems on land and sea. They might not be pretty but practical textiles can change the world. •••