future focus

Cornwall's Eden Project isn't just the world's largest greenhouse – it's also a test-bed for future growing techniques and an early proving ground for the human race's leap in to outer space. Duncan Peberdy went there to find out why

The Garden of Eden, put on this Earth to sustain life, relied on miracles for its creation, whereas the construction and operation of the huge domes, or 'biomes', of Cornwall's Eden Project rely on advanced computer technology. According to 21st century folklore, the Eden Project is a self-sustaining ecosystem, essential for future development of life-supporting environments in outer space. And there is much can we learn from these plant-filled biomes.

Model behaviour

Traditional flat-sided greenhouses are an ineffective way of enclosing space, and their rigid structures would be problematic with the continually changing floor of the project's disused china clay quarry. Instead, using computerised 3D modelling developed specifically for the project, a geodesic design – made up of thousands of interconnecting hexagons – was conceived. This design would allow the domes to interconnect and merge with the landscape, literally dissecting the quarry walls. The same computer program that designed the biomes was also used to program the lathes that cut each section of the steelwork frame to its unique length.

Without a single internal support, the largest biome is 240m long, 55m high and 110m wide. Instead of glass, triple-glazed ETFE (ethyl tetra fluoro ethylene) foil, an 'industrial clingfilm', clads the structure. This material is 99 percent lighter than glass, provides better insulation and conducts light more efficiently. ETFE is not new – Centre Parcs at Sherwood Forest was one of the first UK buildings to use a single-glazed version – but it is a product that will continue to advance. Inflating the foil pockets with gases other than air will alter insulation and light absorption, thereby establishing new uses.

Weather-beaten technology

Computer technology regulates the environment for the trees and plants from all four corners of the globe. Again, not all of the concepts are new, but research at Eden will move their implementation forward to a higher level. The system controlling irrigation is one pioneered for golf courses; water is automatically piped to individual sections when sensors indicate the soil is dry. Temperatures dropping below a specified threshold switch on the hot air blowers, whereas high temperatures trigger diamond-shaped vents in the roof and louvre windows at ground level to open and circulate cooler air. External sensors monitor wind speeds, ensuring that damage is not caused to open vents during gale-force conditions.

On the surface the Eden Project is an awesome visitor attraction for professional and amateur horticulturalists. Dig a little deeper and you'll find technological reasons for its continued importance. Working with the best universities in the country, research into plant genetics and other horticultural advances are taking place that wouldn't otherwise be possible in the UK.

Garden of Eden

So are we going to see biomes in our own gardens or used in the commercial growing of food? Hothouses using inflated cushions of ETFE foil would need a far greater footprint than a conventional greenhouse. And which crops necessitate a construction height of more than two or three metres? The real benefit would only be in growing plants outside of their natural habitat, and this would need computerised climate-control. Small-scale constructions would be vastly more expensive than using conventional greenhouses.

And what of that self-sustaining ecosystem? Development of an environment capable of sustaining life in space is a long-term aim of Nasa. Not only would a far bigger structure with greater properties of insulation and climate control be required, but simply opening external vents to cool down the environment would not be possible. In essence, Eden is little more than the world's largest high-tech greenhouse, but the research being carried out in plant development and maintaining artificial environments will no doubt contribute in the long term to the goal of conquering outer space. ■

So are we going to see biomes in our own gardens or used in the commercial growing of food?

PHOTOGRAPHY: FAITH WARDLE