

The Bioshelters of New Alchemy Institute

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From 1971 to 1991, the New Alchemy Institute built and tested a series of specialized greenhouses that contained soil, soil life, plants, insects, and fish ponds. These indoor food-producing ecosystems were called bioshelters, a concept described by Sean Wellesley-Miller and Day Chahroudi in Architecture Plus Nov/Dec 1974.

Bioshelters are solar buildings that create a year-round growing environment in a temperate climate, heated primarily by solar energy. The ecology of species within the bioshelters are various combinations of soil life, insect life, aquatic life in ponds and terrestrial plants. A general goal of New Alchemy's bioshelter research is to grow food crops and edible fish year-round in northern climates without using harmful pesticides or heating with fossil fuel.

Starting in 1971 with a small plastic dome over an inflated wading pool, New Alchemy tested a series of increasingly more complex prototypes of greenhouses that used fish pond water to store solar heat and contained a complex ecosystem as well as food crops. Like natural outdoor ecosystems, indoor bioshelter ecosystem involved nutrient cycling between agriculture and aquaculture, insect pests and insect predators, management using predatory insects, and pillow-dome architecture.

The Cape Cod Ark

After testing several small greenhouses and domes, this large bioshelter was made in 1976. It is about 90 feet long, insulated on the north, air-tight, glazed with double fiberglass, and has many fish ponds in it to absorb and store solar heat. The growing areas for plants are deep soil beds in the ground like an outdoor garden. Beneficial insects live inside to control pests. Vents are opened all summer, closed all winter, and manually adjusted spring and fall. In a climate where winter temperatures often dip below twenty degrees F., the interior climate was kept warm by the solar ponds inside and could grow crops all winter.



The Ark on Prince Edward Island, Canada

Also in 1976, this bioshelter was built in a bitterly cold, far-northern climate. It used multiple systems of solar storage - passive solar fish ponds, active solar hot water panels and hot water tanks, active hot air transfer to a rock matrix, and a back-up wood stove. This bioshelter is also residential, with a house and barn attached to the greenhouse. Designed and built by Solsearch Architects, PEI, Canada.



The Pillow Dome – Cape Cod

Built by J. Baldwin in 1982, the pillow dome is 30 feet in diameter, made of inflated plastic pillows (3 layers of Tefzel, which is not degraded by sunlight) and aluminum tubing. Ten pillows open manually for convection venting. Inside are many tall solar fish ponds, a fig tree, and raised soil beds for crops. In Cape Cod's climate, the indoor winter temperatures could grow cold-hardy crops through the winter, but would occasionally frost. Tests and computer modelling suggests that adding an insulated, reflective north-wall area in winter would keep it warmer. The pillow dome was dismantled in 2004.



Cape Cod Ark - 2008

Originally a free-standing greenhouse, in 2000 the Cape Cod Ark was renovated and connected to a new house on the north. The glazing is triple-layer polycarbonate and thermopane glass. On the south peaks are solar panels for PV electricity and water heating, primarily serving the house.

Inside are solar aquaculture ponds, vegetable crops, lemon trees, ornamental plants and living space. Vents are open in summer, closed in winter, and manually adjusted in spring and fall.

