EXCEPT
Integrated Sustainability Consulting & Design
Creating the Foundation for a Sustainable Future

InnovatieNetwerk
Grensverleggend in Agro en Groen

Polydome

High Performance Polyculture Systems

Polydome offers the possibility of commercial scale, net-zero-impact greenhouse agriculture. It outperforms traditional systems in production levels while enabling increased energy savings, production stability, and market response.

Using Polydome, cities as densely populated as New York City could provide the majority of their own food supply using available roof space, with its high yields (60 – 90 kg per square meter) and diverse outputs (over 50 crops, two mushroom varieties, chickens, eggs, fish, and honey). A less dense city like Rotterdam could provide an estimated 80% of its food needs using only 3% of its surface area.

Productive ecosystems

Polydome's true inventiveness lies in a non-technological strategy: it maximizes food production and variety by operating more like a self-maintaining ecosystem than an industrial farm.

Polydome is a polyculture system that can replace conventional monocultures with many crops and livestock growing at once.

Plants, crops, animals, and insects are strategically interwoven to connect waste, water, and energy flows and capture the benefits of varied space and light conditions.

Animals within the system range freely and live naturally, and the design of the crop layout limits the need for repetitive human labor.

EXCEPT

It's time for the next leap forward in food production systems.

Polydome systems produce high quality food efficiently and locally while creating environmental benefits and caring for human and animal welfare. They are a step toward truly sustainable agriculture and could double our food production by 2050 while reducing the overall impact of agriculture.

Environmental Benefits
Depending on the mix of crops and animals, Polydome systems can be zero-waste, and energy-positive. Plant waste is reused as mulch, compost, or fish feed, while animal wastes are processed into plant nutrient supplements. Rather than shading plants with mechanical screens, shade-loving plants are intercropped below plants with a high demand for direct sunlight.

A Community Asset
On a socio-economic level, the model shows that this system is highly profitable. It provides high-density production, captures of several high-value niche markets, and saves on technological inputs. Polydome produces many high value niche market crops (herbs, mushrooms, berries), instead of focusing on single valuable crops like tomatoes or peppers.

Potential for Urban Agriculture
Polydome systems can be customized to match local market conditions, and scale requirements from small urban agriculture to commercial systems. For example, a Polydome system combined with a shop or restaurant can sell directly to customers. Shrinking the distance between producer and consumer produces higher profits and increases food security. Polydome also provides possibilities for urban agriculture that might not be feasible with traditional systems, such as small to medium scale direct-sale urban food facilities.

Robust Enterprise
Polydomes can function beyond 30 years, largely because they utilize many perennial crops that do not need to be replanted every year. This means that an investment can be made in its physical structure and appearance, ensuring that it provides a positive aesthetic contribution to the built environment.

Key Polydome Benefits

Economic & Environmental:

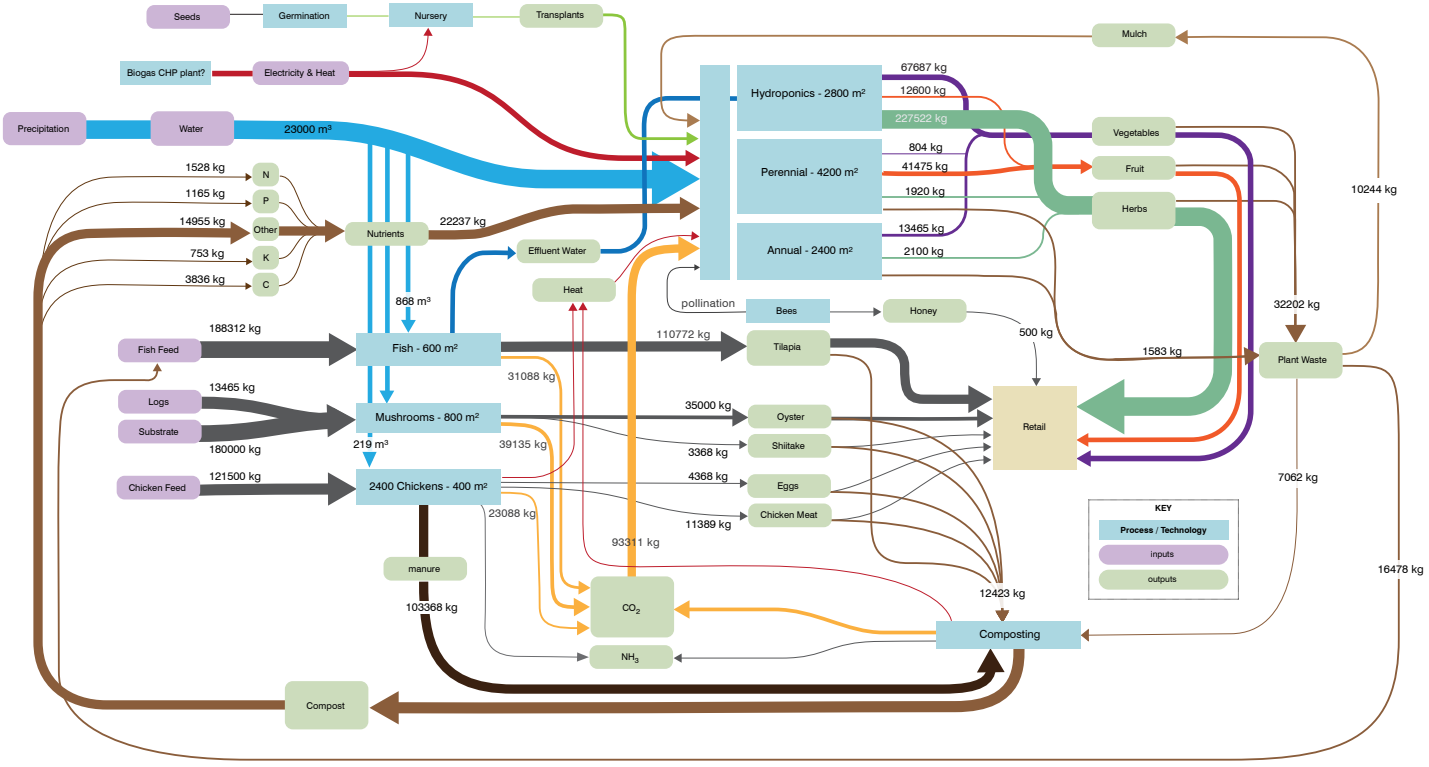
- By following through on the design principles of Polydome to their fullest extent, we can achieve something previously unheard of in human history: approaching net zero-impact food production.
- Stacking of crops in space and time achieves very high density production.
- Integrated Pest Management (IPM) and nutrient cycling strategies result in avoided costs: no need for pesticides, chemical fertilizers, pollination services, and many other inputs that are typically associated with a greenhouse system.
- Internal reuse of material flow reuse can make the greenhouse into a zero-waste facility, and reduces the need for outside resource purchases.
- Diverse, local production reduces local community's dependence on food products shipped from distant locations.
- Polydome production can replace other forms of environmentally damaging farming.

Sustainable Business:

- Economic productivity higher than in conventional high-tech horticulture.
- Diversification of crops offers protection from sudden market volatility in commodity prices.
- Product diversity reduces the chances of total crop failure as a result of disease or pests; some crops will always be more susceptible than others.
- Diversification allows capture of all the small "high-value" markets in a local area.
- The opportunity for direct sales creates a possibility for greater earnings.
- Crop output is relatively easily adjustable on an annual basis to the demands of the local market.
- Initial investment continues to produce returns for several decades.

Socio-Cultural:

- The Polydome greenhouse creates opportunities for creative, diverse labor in comparison to traditional agriculture.
- Polydome creates the possibility for direct interaction with local community and allows for direct market response to local demands.
- Can potentially improve the health of nearby residents by providing access to fresh, local produce..
- Contributes aesthetically to the local environment.
- Can reduce transportation in its food network, improve food security and food access, thereby aiding climate adaptation strategies.
- Polydome systems are compatible with other forms of local agriculture.
- Polydome can reconnect urban dwellers with the biological building blocks of life, and be used as an education tool.



Closing Material Cycles

All the material and energy flows in Polydome can be designed to feed into one another; creating a zero-waste system with a renewable energy and water supply.

Greenhouse Modules
There are two categories of functions in the Polydome greenhouse: production and support.

The primary role of production modules is the output of marketable products, though each one also plays a unique supporting role in the system.

The support modules provide key functions to the greenhouse, such as pollination, pest control, or logistics management.

Hydroponic Crops:
- High profit, quick turnover crops consisting of greens, herbs, and strawberries.
- Produces year-round.
- Runs partially above the soil crops, providing additional vertical stacking.
- Uses recirculated waste water effluent from the fish aquaculture system, which is monitored and supplemented with liquid nutrients from the compost module.

Temperate Crops in Soil:
- Consists of two sub-components: perennials and annuals.
- The annual crop zone is operated year-round and provided with supplementary heat and lighting in winter months.
- The perennial zone is chilled and allowed to go dormant in winter.
- The perennial zone, which primarily consists of crops such as tree fruit, berries, and vegetables such as asparagus and artichoke, takes several years to reach full maturity. In that time, it is intercropped with annual crops to provide additional yields.

Chickens:
- Eggs and meat are sold as products.
- Chickens provide extra CO_2 and heat through vents connected to the main plant zone.
- Chicken manure is collected to enrich compost.
- For several months of the year, the chickens are given free access to the greenhouse to till soil and control pests.

Mushrooms:
- Cultivated in heavily shaded areas of the greenhouse (under rows of hydroponic beds and underneath trellised vines), mushrooms utilize an otherwise unusable space.
- Year-round production of a high value crop.
- Provide a large part of the supplemental CO_2 needed to raise crop yields.

Fish Aquaculture:
- Very high production per m^2 allows for a high output of product.
- Wastewater is used as a primary nutrient input for the hydroponic crops.

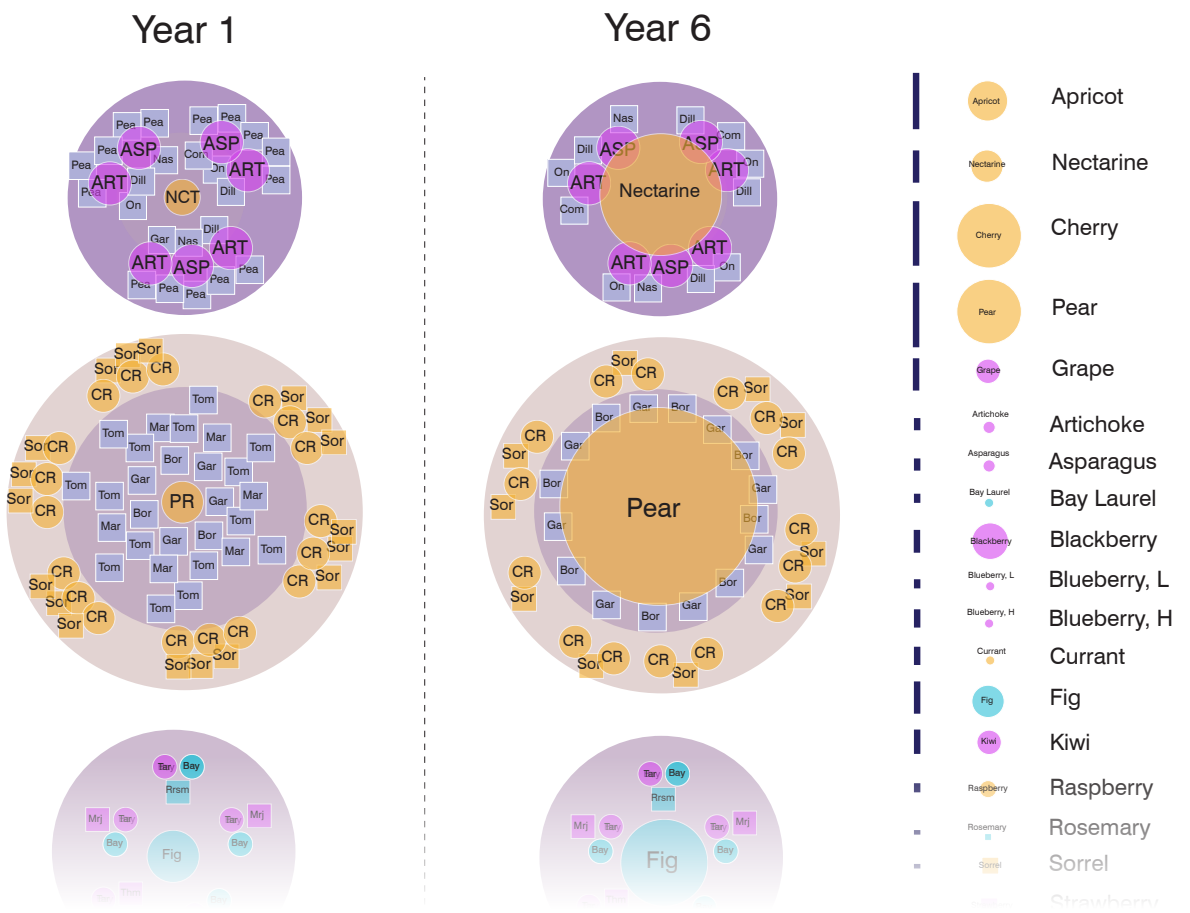
Bees:
- Twenty hives are included in a special zone that can be opened either to the outside or inside of the greenhouse for pollination.
- Honey can also be harvested from the hives once a year as a supplemental product.

Vermiculture Compost:
- Processes excess plant and animal wastes into usable compost.
- Liquid extracts from this compost supplement the hydroponic production system.
- Worms cultivated in the compost aerate the soil zones in the main greenhouse.
- Provides extra CO_2 and heat into the main plant zone.

Support Crops:
- Pest repelling crops and dynamic accumulators are interplanted with commercial crops.
- The dynamic accumulators (comfrey, borage) enrich and activate compost.
- The pest repelling crops reduce the need for other pest control measures.

Plant Nursery:
- Contains a germination zone with higher degrees of environmental control as well as an early-stage growth zone.

Logistics Center:
- A central area in the core of the greenhouse is used for crop collection, washing, and preparation for retail.
- The hydroponics channels are uniquely designed to bring crops to a central work station as they mature, creating a central, social work environment.



Functional crop clusters evolving through time
Polydome greenhouse work with specially-designed clusters of plants that can grow close together, protect each other from pests, use complimentary sets of nutrients, and maximize yields from a single area.

EXCEPT
Integrated Sustainability Consulting & Design
Creating the Foundation for a Sustainable Future

InnovatieNetwerk
Grensverleggend in Agro en Groen

Except - Integrated Sustainability developed Polydome in association with Innovation-Network and SIGN. More info on Polydome can be found on www.except.nl.

w: www.except.nl
e: info@except.nl
t: +31 (0) 10 7370215

Stadhuisplein 15
3012 AR Rotterdam
the Netherlands

The Bourse, 839 Chapel Street
New Haven, CT 06511
United States of America