The Eco-unit Concept

Sustainable development with focus on real assets

Basic description

Version B3 (Swedish)
2006-07-23

English Version A
2007-08-23

Holon Ecosystem Consultants
A Very Beautiful Place AVBP

For more information:
http://avbp.net/en
www.holon.se/folke

Description of the Eco-unit concept

Introduction

The purpose of this document is to describe the Eco-unit concept in enough detail to lay the foundations for, among other things:

- Commercialization.
- Further research into the possibilities of addressing energy security issues.
- Developing a baseline for measuring potential sustainability ”fit” for organizations, living conditions, potential projects etc.

Purpose of Eco-Units

Eco-units meet the challenges created by a number of factors that have combined to make our way of life non-sustainable. If these challenges are not urgently addressed, coming generations will have massive problems creating even a minimum living standard for themselves as supplies of fossil fuel deplete and populations continue to rise pushing up energy prices.

These challenges stem from:

- **Energy intensive food production**

  Today’s methods of food provision, from field to table, use at least 10 times more energy to produce than they contain. This energy comes mostly from fossil fuels. Furthermore, natural gas is the base from which artificial fertilizers are produced. Food systems are highly vulnerable to energy price hikes and fossil fuel shortages.

- **High dependency on transport**

  Commuting to and from work and a high transport component in leisure means that the average household spends approximately 17% of their income on transport. Furthermore, food distribution and long supply chains for the majority of goods means, in Sweden for example, transport accounts for a quarter total energy use, 111 Twh, which is the equivalent of 12,3 Mwh for every Swede each year. Again as fossil fuels deplete alternatives must be developed.

- **Leakage. Linear consumption of resources**

  In the farming world the addition of phosphorus is a necessity. Through a system of mining, commercial fertilization etc., phosphorus is added to fields and eventually ends up in the surface water. How long this type of linear use can continue depends upon the world’s phosphorus reserves plus energy prices. Mining requires huge amounts of energy. As fossil fuels deplete and prices rise it may become uneconomical to mine phosphorus, creating a lack of fertilizer.

- **Growing mistrust of economic growth, associated increased consumer spending and how they effect quality of life**

  Most political parties prescribe economic growth as the magic pill for maintaining a high standard of living. However, there is evidence to suggest that increased economic growth does not necessarily lead to increased quality of life. The question arises, if we are working to improve our quality of life, is society organized in the best way to achieve this?

- **Increasing demand for eco-friendly solutions**

  More and more individuals want to take control over their ecological ”footprint” so that the ecosystem can take care of future generations.

Negative consequences

The increasing price of energy will challenge our way of life. One serious issue will be that of food production; without artificial fertilizers productivity decreases and prices increase.

Insecurity will be created when it gets difficult to live on a normal wage, and uncertainty will grow that investments and pensions will loose value.

The Eco-unit concept attempts to answer:

How can we organize working and living to produce a secure, acceptable living standard as well as sustainable investment, in a time of increasing energy prices, where we ensure the ability of our ecosystem to supply food and other necessities for future generations?

Key strategy with Eco-units is to create:

- A group, committed though co-ownership or contract, that shares resources to produce food, water, accommodation and in some cases work.
- A settlement where farming, living, recycling and energy production are contained in one geographic location easy to overview i.e. within sight.
- Living accommodation that is a long term investment.

Key figures for eco-units

- They provide inhabitants with the majority of their energy needs from food (4000 kwh/year/individual)
- Number of people permanent residents will be maximum 200 based on 50-80 households
- 50 hectare (approximately 0.25*person) of farmland is needed

Scientific principles

- **The phosphorus cycle**. Phosphorus is the only element that all living things need in a higher concentration in the body/organism than is naturally found in the earth’s crust. Land-based organisms have solved this via circular flow from the earth, to plants, to

animals and back to micro-organisms again. This circulation is essential for organisms to live on land. Eco-unit functioning retains phosphorus in the area.

- **A mature ecosystem.** An ecosystem develops spontaneously in the direction necessary for maximizing use of the Suns energy. An eco-unit works to promote maturity of the eco system in which it is located.

Some attributes that indicate the maturity of an ecosystem

Young ecosystem	**Mature ecosystem**	**Examples of activities that increase the maturity of an ecosystem**
Low diversity	High diversity	A large number of different animals and plants gathered in the same place with a degree of mutual dependency
Short-life planting	Long-life planting	From perennial plants, such as cereal crops to agro-forestry (sow once harvest annually)
Competition	Cooperation	From ”cows or pigs” to pigs that eat waste from dairy and household use
Parasitism	Mutualism	From ”hunting and fishing” to farming where people and animals are dependent upon each other (farmers and dairy cows)
Nutritional leakage	Natural circulation of plant-based elements	From monoculture of humans and animals with a linear nutritional flow to integrated farming and living practices
Production>respiration (cereal crop) or production<respiration (compost heap)	Production in balance with respiration (P=R)	Products (i.e. food) for local consumption. Import and export avoidance.
Quick changes	Stable system	From perennial culture to long-living crops (hemp?) High degree of stable biomass

Diversity should not be confused with variety. If we say that 100 individuals are divided in to 10 different species in 2 ways. Variety is the same in both cases, but in one case we have 91 of a single species and 1 each of the other species. Diversity is much higher if we divide into 10 equal groups. A natural system normally develops a high diversity with mutual dependencies.

Eco-units components

The Farm

Farming produces enough food for 200 inhabitants. Farming is done without artificial fertilizers as local waste products are used in the farming process. The farm is dimensioned to support 200 people. Only excess production is exported to the surrounding areas.

Farming is double balanced; i.e. food is produced for the animals that fertilize the soil with their manure. At the same time nutrients that are exported in food are re-used in the form of fertilizers. In this way nearly 100% of the phosphorus and many other elements are kept in the cyclic process.

The nutrient flow in a settlement of this type shows many similarities with a mature ecosystem.

Part of the food production can be done by individuals between and close to dwellings. Basic foods are best produced using integrated farming, carried out by a farmer. This naturally necessitates a different living infrastructure than the current urban living arrangement.

Farming becomes a common commitment where participation is a group effort where each participates according to their abilities.

Accommodation

Accommodation is flexible and of different size and standard. Living accommodation should be so close to the farming that it allows for easy collection of food and delivery of waste products back to farming. Most long distance transport will be unnecessary.

Acreage

Acreage needed depends upon the climate and the terrain. Approximately 0,25 hectare farmland per inhabitant is appropriate.

Water cleaning and recycling

The amount of water leaving the area is minimized. As much water as possible is used ”productively” by passing through plant life.

Grey water

Grey water is recycled by being treated in wet parks, living wells and the like. Collected rainwater is treated in the same way.

Drinking water

Drinking water is taken from natural springs/wells within the farming/living area and from recycled water.

Energy use

- Fossil fuel use should be considered a luxury. Reliance on fossil fuels is continually minimized due to cost and availability.
- Use of energy from renewable sources is maximized using existing and new inventions.

Recycling

- The quantity of material within the system that can not be recycled will be kept to the absolute minimum. The goal is zero rubbish, only products used or renewed.
- Nutrients from urine, faeces and other biological waste are returned to farming, where the majority of food is produced. The goal is to trace phosphorus molecules from the soil and back again.
- Collection of waste products and their return to the farm. Partly for the sake of energy use and partly the psychological factor it is important to have the farm as close as possible to the housing.
- Phosphorus is a priority when handling waste back to farming.

Ownership

- The owners are, directly or indirectly, the people who live within the eco-unit system.
- The eco-unit members are responsible for the work running, maintaining and decision-making within the eco-unit.

Other activities

- Besides the living accommodation the eco-unit has common areas, such as workshops, workspace, guestrooms etc., to encourage entrepreneurship.

How an Eco-unit works

Eco-units are set up to achieve and maintain a good basic standard of living for the unit's members, with a sound economic structure and activities that have a positive effect on the surrounding ecosystem.

Farming produces the food that is consumed by the unit members. Waste from animals and humans circulate within the living farming environment. Water is handled under the same principles. The members, who are also the owners, work together in the organizational form they choose and maintain the eco-unit. As the eco-unit reaches ecological maturity it's ability to support the community increases. When the entrepreneurship of the members is stimulated an eco-unit can offer services to the local area improving the return on investment for the owners.

Eco-unit characteristics

- Permaculture, ambition to achieve an increasingly mature ecosystem.
- The area's geographical boundaries are the same as the boundaries of ownership. Members belong to an organization which is responsible for a geographical area which provides their living standard.
- The values measured in quality of life (security, understanding, homeliness etc.,) are higher than today's society.

Benefits of eco-units

Lifeboats One of the reasons for developing eco-units is to provide a "lifeboat" in an increasingly difficult future, where the availability of cheap fossil fuel has very serious consequences for society as it is built up today. The first eco-units will function as centers of knowledge/experience around the changes needed in a society where cheap fossil fuel is not available.

Geographical boundaries coincide with organization and membership The benefit of having your investment, work, maintenance and operation of your energy, food and accommodation in the same place gives a strong feeling of control over your future and living "close to nature".

A manageable area (on a human scale) As an eco-unit member the area you see around you is where your food comes from, your investment and that you pass on to future generations. In addition it is a piece of the earth which contributes to a balanced global ecosystem. Your living is simplified and given more depth at the same time.

Integrated farming Locally grown food has many benefits; it is cheaper, fresher and means less waste, higher quality at a lower price. Delivery security is higher than if you have to rely on a large number of people and processes to provide food on the table.

Different forms of accommodation In an eco-unit it is important that all life's phases are catered for, e.g, single, family, pension, temporary accommodation.

Other activities That there are possibilities for entrepreneurship in an eco-unit increase self development and pleasure. If the activities are profitable the value of your initial investment also increases.

Off-grid Water nor energy comes entirely from the national network. This increases the future security of supply and limits the effect of future price rises. Investment in renewable energy gives cheap energy once the original investment is paid back.

Mature ecosystem An area that retains nutrients and produces a large number of ecological services, that we use industrial processes for today, benefits both the global ecosystem and survival for future generations. The nutritional flow in this type of community has many similarities with a mature ecosystem. With this type of process for example, the "over-feeding" of the Baltic can be tackled – on land!

Appendix

Comparison eco-units and mature ecosystem

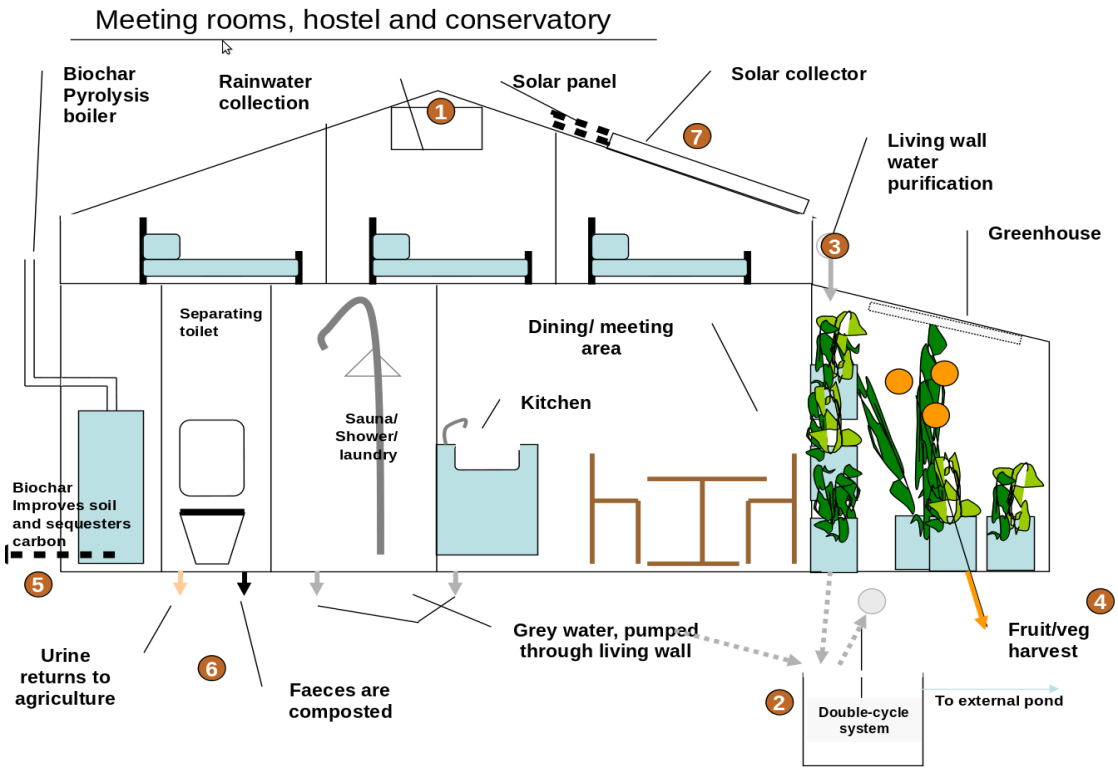
Attributes, mature ecosystem	**Attributes, eco-unit**
High diversity	Not monoculture
Perennial planting	Permaculture
Cooperation	All eco-unit parts work together to create a high quality of life
Mutualism	Mutual dependency between people and animals and their environment
Nutritional elements are circulated	Phosphorus (nitrogen and other nutrients) are recycled from balanced farming, urine separating toilets and wetlands
Consumption kept within the area (P=R)	The food is produced (grows) within the eco-unit and is consumed in the eco-unit
Gradual change	Gradual change once the eco-unit is established. Large proportion of perennial planting.
Water export through evaporation	Grey water using wetlands and living wall. Cultivated draining is avoided.

Water loss throughout living system
Water loss through evaporation from plants
Water is kept within the system for as long as possible and is used for planting, wetlands and ponds.

Comparison today's living and eco-units

	Swedish inhabitant	**Eco-unit inhabitant**
Food production	Far from consumption (global)	Local (within 10 km)
Understanding of food production system	Low	High
Amount of food processing	High	Low (raw materials are handled at home or within the eco-unit)
Capacity for recycling of man-made material	High	Low
Capacity for recycling of nutritional elements	Zero	High (using urine separating toilets, composting, etc.,)
Dependency on infrastructure such as water, electricity and heating networks	High	Low
Water	National network	Local
Water cleaning	Water cleaning works	Grey water, urine recycling and water recycling
Fossil fuel dependency	High	Low
Energy price vulnerability	High	Low
Value of investments with energy price increases	Negative (living costs increase)	Positive (living costs decrease in relation to the average)
Social interaction with the neighbors	Seldom	Often
Distance to friends and acquaintances	Long	Short
Living density	High (up to 1400 people per km2) to moderate (200-1000 people per km2)	Moderate (between 500-1000 people per km2)

Meeting place that demonstrates the technology integrated



How it works

1. Rainwater is channelled to pond. Water from pond is pumped to roof tank.
2. After being used for laundry, showering etc, grey water returns to double chamber well.
3. Grey water is pumped through a ”living wall”. The roots of the plants absorb nutrients and soil bacteria neutralise bacteria in grey water.
4. Leaves, fruit, etc which grow above soil are harvested to eat.
5. Organic waste, wood etc is burnt to charcoal in the boiler, providing heat to the building. The charcoal is used to clean water, as a component of the soil in the living wall and in other soils.
6. Urine and black waste are separated, the urine is used to improve soil. The black waste is composted and returned to the soil when safe to use.
7. Solar panels and collectors provide electricity and heat from the sun.