1 Holzer Permaculture

1.1 Introduction

"I have lived on the Krameterhof for more than 30 years, and I have learnt that you can overcome the most difficult situations if only you care about nature and are thankful for what it offers to you. Mother Earth belongs to the Creator and her bounty is what we can experience." Veronika Holzer

Ever since our childhood, which was permeated by farm life on our parents mountain farms, we have been deeply rooted in nature. Many of the ideas, which we have now successfully realised, date from that time. Nature was our playground and we learnt to understand it. Like most of the children of mountain farmers of that generation we had to help working on the farm. Since we hardly had any toys, we played with soil, water, plants, roots and stones. There was no limit to our phantasy. At an early age we started to grow plants in our mother's flowerbox and very soon playing with nature turned into a passion for every living and growing thing.

When I began my training as an orchard farmer, I was being led onto the wrong track: farming with fertilisers and pesticides. Very soon I began to realise that conventional farming would only create higher costs, more work, and plants that are dependent on constant care. So after a few failures, I returned to the farming methods which I had been used to as a child. For more than 30 years my wife and I have been running the Krameterhof in the Lungau region, which is in the province of Salzburg, and belongs to the mountain farming zones III and IV. We have extended our farm from the original 24 hectares to 45 hectares. Major areas of the farm that were barren have been made productive again. As a result the standard value of the farm was raised from 1.744 € to 17.950 €. Our way of thinking and farming within the natural cycles and interactions proved to be worthwhile.

It was only in 1995 that we leart, that our unconventional approach to agriculture could be described as Permaculture. The term was coined by Australian environmental scientist Bill Mollison. Permaculture involves farming in cycles, on the model of self-sufficient natural ecosystems.

Sepp and Veronika Holzer

1.2 Applying Permaculture

The philosophy of a life in harmony with nature, thinking within natural cycles and interactions, is a philosophy, which can be applied to all aspects of life. There is more to permaculture than ecological agriculture and forestry. We think that permaculture is above all a basic attitude towards life itself. Permaculture means to live life with open eyes, and to learn how to read the book of nature. With this CD, we would like to pass on our experiences. Applying permaculture, and living within it means to extract knowledge from nature, and to constantly broaden your horizons. We can only share our experiences with you, the book of nature, however, shows you in an incredibly diverse way how the theory works in practice! For your own permaculture, it is therefore necessary to observe nature, to understand and comprehend it. To trust this inexhaustible and reliable source of information is as important as to have confidence in oneself. Todays education systems teach us often to rely only on theories, and consequently we are not able to understand the most simple interrelations, having lost touch with our natural environment. Thus we have to learn to revive our common sense!

Permaculture as it is practiced on the Holzer farm, can be applied everywhere in the world. Our projects in Northern-, Central- and South America are thriving just as numerous projects in Austria are. This cultivation technique requires neither a minimum, nor a maximum area of farmland. Taking nature as a model, you can design balcony and roof top gardens, allotments and large farms along this method. Each permaculture is determined by the site conditions (climate, altitude, soil, natural resources etc.), and the ideas and preferences of the cultivator and is therefore unique. The most common applicaitons can be found in agriculture, forestry and water resource management. We receive a growing number of requests for the revitalisation of land formerly used in intensive farming. But the philosophy of permaculture is also being applied to fields as diverse as art, healthcare and alternative energy.

2 Agroforestry

2.1 Introduction

"In my lectures, seminars and in the Krameterhof video I have been warning for years about the devastating consequences of monoculture farming like torrents, avalanches, storm damage, etc. My application for renaturalisation of the remaining monoculture areas on the Krameterhof farm was turned down about 10 years ago. My worst fears proved to be well founded: In winter 2002 it was exactly this piece of land on the Krameterhof and hundreds of hectares of pine forest in our community, that were distroyed by a strong gale. We still are not able to assess the extent of the damage, because landslides, avalanches and pests will be threatening us in the months and years to come." Sepp Holzer

Agroforestry is an alternative method of woodland management, where both trees and crops are grown on the same land. Even animals can be kept in a forest garden. The aim of agroforestry is to raise total yields, and create a natural woodland eco-system. The higher the diversity of the fauna and flora in the forest garden, the more stable its ecosystem gets. Agroforestry allows cultivation of a wide range of produce with methods that are almost equally diverse: wood, fruits, herbs, grain, mushrooms and much more can be grown, marketed and grafted. In addition valuable habitat is created for a number of plant and animal species, which are ousted by advancing monocultures. A high diversity of flora and fauna decreases the risk of crop failures caused by pests, of natural disasters (avalanches, gales, etc.) and fluctuations in price. The same thing that is true of nature is true of a forest garden: the more diverse a system is, the more resilient and biologically productive it is! Farming based on the principles of permaculture and agroforestry could solve many problems in a sustainable way and provide nutritious food for ones own needs. For the developing world this method of farming could offer the chance to overcome famine. It is especially in these countries that multinational corporations and lobbyists are making a fortune by exploiting the poor population and depleting natural resources. Numerous permaculture projects supported by the Holzer family are trying to counteract to such a development.

2.2 The Edible Forest

Agroforestry as part of Holzer Permaculture is based on the principle of natural diversity. Our forests are adapted from natural mixed woodlands. Woodlands can be very different in terms of species composition, depending on soil condition, climate and altitude. These different types of woodland are the starting points for any agroforestry. On the Krameterhof, which is located on a bedrock that is rich in silicate at an altitude of 1500 m above sea level, the typical vegetation would be a spruce wood. In contrast to a spruce monoculture, however, this spruce wood has great biological diversity. Besides the spruce, trees like the Larch (Larix decidua), the Rowan (Sorbus aucuparia), the Silver fir (Abies alba), the Sycamore (Acer pseudoplatanus), the Mountain elm (Ulmus glabra) and the Ash (Fraxinus excelsior) can also be found there. The shrub and herb layer of this wood is also more diverse than would be expected in a spruce monoculture: Cranberries (Vaccinium vitis-idaea), Blueberries (Vaccinium myrtillus), numerous ferns, mosses and fungi will grow there.

The diversity of the naturally growing deciduous woods has been limited for decades by wrong methods. Deciduous trees were being intentionally destroyed, by peeling off the bark (the methods are called in Austria "Schwenden" and "Ringeln") and applying chemicals (Lignopur D, Dicopur Spezial), in order to support proliferation of fir trees. Agroforestry, however, involves natural woodland management!

The different layers of a forest garden consist of a variety of plant communities. Fruit trees can form the canopy or overstory, different berry shrubs form the understory or shrub layer. Herbs, vegetables and root crops grow in the ground layer. Additionally, climbing plants such as grapevines and Kiwi can entwine themselves around the trees. Not only does this vertical structure enhance productivity of the land, it also creates a suitable habitat for every plant, functioning as a natural forest. Thus the foliage of the fruit trees provides the crops of the ground layer with the necessary protection from winds and dryness. When creating an agricultural forest, it is especially important to know how much sunlight, water and nutrients every plant requires. The whole system has to be structured in such a way, that the various plants do not disturb, but support each other. This way agroforestry can be established and thrive even in areas where unfavourable climatic conditions prevail.

On the Krameterhof a diversity of fruit trees is cultivated up to an altitude of 1500 m, which offers many advantages. We grow cherries at altitudes between 1000 and 1500 m. Because of the differences in temperature at the different altitudes, the cherries can be harvested over a much longer period, and there is no need to harvest the whole crop at once. By planting types of cherries that ripen at different times (early types in lower areas/late ripening types in higher areas) this effect can be further enhanced and the cherry harvest can be extended from June until October. This can be a decisive economical advantage, because in our country cherries are usually only available until July**.**

When walking through the woods it is important to keep ones eyes open, to observe and find out, which plants grow well together and in which locations. There are a number of plants that can increase the productivity of others nearby; legumes (such as Papilaceae and clover) fix atmospheric nitrogen to the soil, increasing its fertility. If well thought out, combinations of plants can start a self-sufficient nutrient cycle, as long as dead green matter is left as it is. They can even thrive without further fertilisation. It is also of great advantage to keep animals as well as plants in your forest garden; the benefits of good animal husbandry are discussed in the chapter “Animals”. The work of the forest gardener is generally restricted to planting, harvesting and regulation; we cannot fight against the natural order, but we can help steer it along a desired path. There are problems neither with weeds nor with pests, as there are no gaps in the ecosystem to be filled. Another advantage of mixed cultures is that there are no boundaries to experimentation, and neither mistakes nor failures ever lead to a total loss. A well managed forest is not only a place of work, but also a place where one can relax, and enjoy the variety and beauty of nature.

3 Landscape Design

3.1 Introduction

When we design landscapes for permaculture, we must consider the natural site conditions. First, we have to find out, what goals we have for the permaculture. The cultivator may have special preferences or even want to see a childhood dream come true; we have experienced, that it is in accomplishing these things, that they are most successful. Then the economics have to be assessed: Are there market niches? Where is there fierce competiton? Where are the catchment areas? Will the site be used as a recreational area, or as farmland, and if so, is this feasible?

During a first inspection of the land, which is going to be transformed for permaculture, the different habitats should be marked on a map. Areas worthy of protection, such as wetlands, mixed woodlands, shrubs, ponds and dry biotopes should be marked in the site map and carefully incorporated into the transformation. During the initial inspection, we also pay attention to plants, which can indicate the presence of wells or aquifers on the site. If possible, such aquifers should be tapped and made accessible in the first stage of transformation.

The way the land is remodelled depends on various factors: geological conditions, soil conditions, altitude, gradient, climate, vegetation, the size of the area and the previously applied farming methods. Small pieces of land can be worked by hand, for larger areas we recommend the use of heavier equipment, such as an excavator. The agricultural transformations, that we have done so far, have mainly involved the renaturalisation and recultivation of previously damaged land. In intensive farming, vast areas of land are transformed for more efficient use of farm machinery and the land is used in an imbalanced way. These farmlands all suffer from highly compacted and degraded soil. Very often, the water balance is disturbed, which, particularly in sloping areas, results in soil erosion and loss of the valuable humus layer. Impoverishment of flora and fauna is another devastating consequence.
Here are some measures to combat the above mentioned problems, measures which are economically viable and ecologically sustainable.

3.2 Soil

Healthy soil is at the basis of successful farming. There are different factors which influence the properties of the soil. Climate, bedrock, vegetation, soil life (edaphone) and humans contribute to the formation of different types of soil. The climate influences the speed and type of erosion process. The bedrock contains minerals which are vital for plants, and which determine the particle size ,and thus the looseness and water-holding capacity of the soil. Plants and animals are decomposed by the edaphone and other microorganisms, and contributing to humus layer. This way, important nutrients are generated and supplied to the plants. In addition, the soil is mixed, enriched with oxygen, and soil fertility is raised. Each type of soil has a specific texture and porosity. The soil texture determines the soil structure. Porosity is important as it allows the soil to breath and affects the water balance. Moreover, pores provide habitat for the edaphone. Interfering with the soil's ecosystem can impede its functioning as a habitat for a great number of animals and plants, as a balancing agent in the water cycle and as filter and buffer for pollutants.

3.3 Terrace farming

Laying out terraces for the cultivation of grain, vegetables, coffee, tea, herbs and wine is an ancient farming method, which has been practiced in Asia, South America and Africa for thousands of years. A long time ago, people recognised the many advantages of terrace farming. By terracing a hillside, soil erosion can be considerably slowed down. Valuable humus is not washed away, instead remaining on the slope. Terraces accumulate and store moisture, keeping rain and meltwater at the plants disposal for a much longer time. By creating terraces, additional agricultural area is gained, and farming is much easier than on steep slopes. The microclimate on the farmland can be considerably improved by terrace farming. If laid out in the correct direction, terraces can function as heat accumulators. As a result of the different microclimates that are created, ideal conditions for the development of a great diversity of plants and animals are provided. The range of possibilities for the use of such structures is huge.

3.3.1 Constructing terraces

Ideally, terraces should be laid out in a south-easterly direction, as this allows maximal exposure to sunlight. However, the direction of the prevailing daytime winds also has to be considered, as the terraces have to be laid out at right angles to the wind direction. Wind channels must be avoided, as this could have a negative impact on the soil's temperature and moistness. Shrubs and protective walls can function as additional windbreaks. The gradient of the hillside, the moisture balance and the quality of the soil are the deciding factors for the gradient and size of the terraces. In areas with low precipitation, we construct terraces with a slight tilt towards the hillside in order to increase the water-storing effect. The width of the terraces depends to an extent on the soil conditions but primarily on the gradient of the hillside upon which they are to be built: the steeper the terrain is, the narrower the terrace has to be. Broader terraces are suited to more gentle slopes. However, we are unable to provide standard values, as local soil and climatic conditions have to be taken into account. When dealing with terrain that is particularly suspectible to erosion, such as steep slopes and loamy, delicate soils, it is avisable to be especially cautious. Therefore, we build only very narrow, path-like terraces onto extremely steep slopes, whatever the terrain allows. In order to guarantee the security and stability of the terraces even in heavy rainfall, the following need to be considered: There must be drainage, but it is important to avoid channeling the water, as this will lead to soil erosion. If the terraces are wide enough, fords can be built so that excessive water can run off without causing damage. On the hillside edge of terraces, we build humus collecting pools. These are narrow ditches and ponds where water, humus, and other organic matter is collected. The collected material can be used for creating new terrace structures.

Vegetation is of great importance for stabilising and securing a slope. Thus, plants with different root systems, which can reach different depths, are very useful. On the valley side of terraces, we plant deep-rooting plants, trees or shrubs. Don't alter large adjoining areas within one growing cycle, as this risks landslides. We alter larger areas only gradually; in the first year terraces are laid out in the lower, middle and upper sections of the hillside. In the following year, additional terraces can be built in between, if the stability of the initial terraces is guaranteed. On hillsides start with the lowest terrace first! Then you can work your way up the hill.

If parts of the slope slide down during construction, they are caught by the lower terraces and the material can be incorporated there. Also, stones placed on the terraces stabilise them and store heat from the sun, warming their surrounding.

3.4 Mound beds

Farming on mound beds can bring considerable advantages compared to conventional agriculture on flat ground: Different microclimates are generated, and the water-storing capacity of the soil is enhanced. Mound beds, directed towards the east or west, can be planted according to their sun exposure (morning or afternoon sun). Due to their structure, mound beds heat up very quickly, which can be a great advantage in cold regions and at high altitudes, because the growing season can be considerably extended. We have seen, that on properly planted mound beds the freezing of the top layers of ground can be delayed by several weeks in winter. The conditions for germination and plant growth are improved, and productivity of the farmland is raised.

3.4.1 Creating mound beds

The soil that is needed to create the mounds is dug from the ground of the terrace upon which they will be constructed, and the humus layer separated. The beds should not run in a parallel direction to the hillside, as during rainfall, the side closest to the hillside would absorb all the water, while the lower situated side would not receive enough. It is important to try to achieve a balanced supply of water to the mound beds. Optimal layout is achieved, when the longitudinal axes of the mound beds run from north to south. This kind ouf layout provides the best conditions in terms of sun exposure and plant growth. The core of such mound beds usually consists of organic matter, such as wood, leaves and straw, but they can also be built from soil only, if there is not enough organic matter available. If it is available, then large organic matter (e.g. tree trunks and root stocks) is placed longitudinally. Then topsoil, preferably mixed with finer organic matter, is shovelled on top. Afterwards, the humus layer, which had been carefully removed at the beginning is added. The height of the mound beds depends on the needs of the cultivator. We usually design mound beds with an angle of 45 ° and a height of approx. 130 cm. This allows people of average height (150 – 170 cm) to harvest the mounds with ease. A steeper angle than 45 ° is sensible, if the mounds constist of loamy soil or are made entirely from soil. The mound beds are stabilised by sowing a seed mixture and by different plantings. The steepness of mound beds keeps the different soil layers from collapsing, and the ground from being compacted.

Once the mound beds are constructed, we add a mixture of earthworms from our own vermiculture (see chapter "Earthworms"). The earthworms are transported in a bucket with some soil, and dispersed evenly on the mounds. This should be done on rainy days or in the evening, as earthworms are very sensitive to dryness and ultra-violet radiation.

High beds (mounds higher than 1,5m) can provide effective protection from noise, wind and various pollutants. They should also have a minimum angle of 45 °. High beds can be constructed with or without a core of organic matter; the possible height can vary as well. Onto beds, of more than 3 m in height, we add small terraces to facilitate harvesting. The slopes of such structures are also stabilised by planting well balanced groups of plants.

It can be necessary to repair or renew mound bed structures, which have become overgrown, or which have been damaged by harvesting, weather and grazing animals. This can be done by hand or with the appropriate equipment.

3.5 Aquaculture

Our water landscapes of ponds, wet biotopes and water gardens are one of the best examples of self-sustaining systems. They are reproductions of natural water bodies, and work like natural systems. Not only are they places for rearing precious water plants, crayfish and different species of fish, they are also viable man-made ecosystems. Water gardens have many other important functions within a permaculture. Microclimates generated by the creation of water gardens aid the growth of lush vegetation. Ponds can improve the water-balance of a permaculture. Large surfaces of water balance out temperature differences on hillsides, by reflecting the suns rays and emitting warmth. Water landscapes provide habitats for aquatic life and amphibia. These fill important gaps in an ecosystem. Earth toads, for example, regulate the insect population and eat slugs, such as e. g. the Arion lusitanicus slug. In the water, aquatic life provides a natural food source for fish. Water means life, therefore, it plays a central role in Holzer Permaculture.

When we design water gardens, nature is our only reliable source of inspiration. Before we decide to build a pond, we take a close look at a natural body of water. A water garden can fulfill its purpose only when it has become a viable self-sustaining ecosystem. First we assess the ground, on which the pond will be built. Soil conditions, topography and existing water resources have to be considered. The higher the density and impermeability of the ground is (which is the case for soils with natural loam and clay layers) the easier it will be to create a pond. Topography is an important factor for the stability of ponds. Landslides and breaking of banks can be avoided by sensible pond design. It is necessary to assess the soil conditions of the area in order to find out where swampy areas are, and whether the ground is stable. It is of great advantage if natural water resources are accessible on the site, however, the water can also be piped in from a different location. If there are no accessible wells or aquifers on the site, then surface water can be collected at the bottom of a slope and used in the water garden. Terraces can be laid out with a slight tilt towards the hillside. Their dense vegetation is able to store rainwater. As additional water is absorbed from the hill, the terrace works like a sponge. Like this, it is possible to feed water gardens that are located underneath a terrace by continuous influx of gravitational water. Such water gardens are very useful when cultivating water plants.

The structure of a man-made pond should be as close to a natural pond as possible. It is very important for the pond to have areas of both deep and shallow water. Only such a structure allows the creation of a self-sustaining ecosystem, because it provides the different habitats that each of the plants and animals need. Deep water can be used by the fish as a retreat to survive cold winters, and it also prevents the pond from being overgrown with water plants. Shallow zones encourage many varieties of fish to reproduce. The structure of the pond needs to be adjusted to fit the geological conditions of the site as well.

3.5.1 Creating a pond

First the planned shape of the pond is digged out; the size and kind of the utilised equipment depends on the terrain, and on the size of the pond. Small moist biotopes can be created by hand, but for larger structures we recommend the use of excavators. To construct banks, it is necessary to divide coarse soil from the fine. This is done by piling the excavated soil into a tall heap. The coarse parts will roll down the sides, the fine soil remains on the heap. The structure of the bank consists of various layers of fine soil, each about 30 to 50 cm high, which are packed to densen them. When larger ponds are created, the different layers can be compacted by driving over them with an excavator. The coarse material will be used later to stabilise and secure the banks. It can also be incorporated into the pond to create different micro-biotopes.

After the pond has been shaped, the bottom has to be compacted. Water is poured into the basin, enough that the excavator will be in water of 30 – 40 cm depth. Then the bottom of the pond is agitated with a narrow excavator shovel. The shovel is inserted approx. one half to one meter deep into the ground and is agitated. The depth depends on the geological conditions. This action makes the fine soil particles sink to the ground and compact the bottom of the pond. The method is similar to the vibroflotation of concrete.

After the pond bottom has been compacted, the banks have to be finished. Rocks and root stocks can be used for this. Rocks that project from the water surface quickly accumulate heat from the sun, thus raising the waters temperature. In winter the pond will not be covered entirely with ice, or only for a much shorter time, decreasing the potential risk for the fish population due to oxygen deficiency. This effect is especially valuable in water gardens, where thermophilic species of fish and water plants are reared. It is even possible to breed Japanese Koi karps in a region, which is known as the “Austrian Siberia”.

Our method of creating ponds is very different to conventional techniques. Conventional methods use lining to make the pond bottom impermeable. However, the lining can be easily damaged. Moreover inserting a pond-lining is costly and labour-intensive. We are convinced that a natural pond should not have any lining as it impedes the formation of a natural pond bottom.

4 Plants

4.1 Introduction

Mixed plantings and a high diversity of species are the basic principles of our cultivation method. Because of this versatility, problems caused of individual species can be avoided. We obtain the seeds directly from our permaculture. It is important to treat the seeds as if they were in the wilderness. Don't try to do something better than nature does, as this will inevitably lead to failure. It is important to be demanding of the plants, and even to put them under stress. This way they will develop the best possible resistance and will be able to adapt themselves even to harsh conditions. We only use seeds which appear especially strong and healthy. It is these plants that we use for seeding, those which can thrive on even the poorest soil and still appear healthy, which can easily overcome frost and in extreme locations are still able to yield good crops.

This goes against the common opinion that only the strongest plants, growing on the best soil, can provide good seeds. We have experienced that the reverse is true. By using only the toughest plants from the poorest soil to obtain seeds, it is possible to harden them, and to turn annual plants into perennials. Only a small selection of them survives the winter, and these will be propagated! When selecting the various plants (vegetables, grain, fruit), you have to remember to use only old, robust varieties of plants. These do not need many nutrients but, all the same, are very nutritious. They can yield good crops even on steep sites and on meagre soil. Overbred plants and hybrid seeds, however, need a lot of attention and nutrients and do not allow further propagation by the farmer. As most of these plants are sterile due to overbreeding, cultivators are obliged to buy expensive seeds in seed shops. The cost and energy input for the cultivation of such plants is high, the crop, however, is often of low-quality.

4.2 Alpine Plants

We have gathered a lot of experience with the cultivation of plants from alpine regions, such as the gentian. Using the Yellow Gentian (Gentiana lutea) as an example, we would like to demonstrate, how the seeds can be encouraged to germinate.

The gentian starts to germinate only after being exposed to frost; it is a frost germinating plant. The seeds of the gentian ripen at an altitude of approx. 1800 m in September. The ripe seeds drop to the ground and are exposed to frost and sun several times, before they are covered with snow. In winter the seed rests under the snow cover. In spring the same procedure as in autumn is repeated. Frost, thawing weather, moisture and dryness affect the seed until the first summer months. It is only in July that the seed starts to germinate at this altitude. The tiny sprouts can hardly be seen in the first year. Then, in the next autumn and winter they are again exposed to the same harsh conditions as the seed was in the year before. Only a small proportion of the seeds develop into new gentian plants. This process demonstrates clearly, that seeds should not be "pampered" and that one should not try to improve natures own mechanisms. We undertook many unsuccessful attempts to cultivate the gentian, before we realised, that it is in the nature of the gentian, to germinate only under extreme climatic conditions.

If you forgot to seed out frost germinating seeds in winter or autumn, you can still do it in spring, as there are still going to be some frosty nights. If this is not possible, there are some alternative techniques by which the natural processes can be imitated. The seeds can be put in a plastic bag, the bag filled with water, and frozen at –10 to –15 °C in the deep freezer, for a couple of weeks before sowing. Various plants need several periods of frost in order to germinate and sprout. For alpine plants, it is especially important to keep the seeds together with some soil from around their roots. This soil usually contains various symbiotic fungi, which the plant needs for germination. If the seeds are sowed in their natural habitat (at altitudes, alpine pastures), to enlarge the natural population, it is, of course, not necessary to mix the seeds with their native soil. This is only necessary if the plants are to be seeded at lower altitudes, where they don't occur naturally, and where such fungi don't exist. We mix the soil and the seeds in a bucket, add some water and freeze and defrost this mixture several times.

Also, exposure to light is important for the germination of gentian seeds. The seeds must not be covered or digged in, as they could decay. In nature, the seed simply falls onto the ground and is exposed to the weather. If the surface of the ground is digged up (broken ground), the seeds can be sowed there, as this facilitates germination. After sowing, the seed is left unattended. Neither irrigation nor fertilisation are useful. If alpine plants, which naturally grow at altitudes as high as 1800 m, are being sowed in lower areas, it is also necessary to consider and balance out the different altitudes and growing periods. Thus, we start sowing the seeds at 1000 m some five weeks later than the time the seed would normally fall to ground in its natural habitat.

4.3 Companion planting

On the Krameterhof, numerous species of fruit and even Mediterranean fruit is cultivated. Nature shows us, which possibilities we have. When we experiment with new plants, we start on a small scale. If the experiments succeed, cultivation can begin on a larger scale. This way, for example, we found out that the Sweet Chestnut (Castanea sativa) can thrive and grow fruit at altitudes up to 1400 m without being affected by frost.

When cultivating vegetables, you have to keep in mind that the plants should be grouped according to their nutrient needs. Plants with a high nitrate uptake, such as maize and sunflowers, should be planted in association with legumes. Legumes have noduled roots containing nitrogen fixing bacteria. Peas, beans and vetch are legumes. The plants nurse and support each other mutually: maize and sunflowers receive nitrates and provide a stalk for the climbing legumes in return. To our surprise, companion planting is also used by the indigenous people in the Brazilian rainforest.

For better ground cover, we also plant radish and salad vegetables. Even potatoes and root crops can provide good ground cover. As they also need nitrate, we plant White Clover (Trifolium repens) in between. Clover is also a kind of legume; in addition, White Clover is able to expel weeds. As described above, seeds can be obtained from existing plants. Since we don't harvest all the crops in our permaculture, enough plants remain to propagate in a natural way.

Seed dissemination is done by different methods, depending on the plant. Even voles can contribute to plant propagation. They feed on the juicy vegetative parts of the plant, such as fresh roots and sprouts. Since they do not hibernate, and food is scarce in winter, they store seeds and other vegetative matter in underground chambers. The seeds that are forgotten or not eaten will germinate in spring without our help, and in such a way that the permaculture starts to regulate itself. Therefore we call voles our workers. If there is enough food for all, and if the ecological cycles are in order, then the vole will never become a pest.

When cultivating grain we use only old and resistant varieties, and wild growing species. If possible, we cultivate hardy or perennial grain. The seeds can be obtained naturally. If grain is cultivated in field farming, there should always be ground cover, consisting of clover, radish, lettuce and various medicinal herbs. The ground cover is only seeded after the grain blooms. While the grain ripens, the seed mixture can develop; when the grain is harvested, the ground cover will receive more light and start to flourish. This way you can soon harvest another crop. This method has proven to be successful. We cultivate different species of wheat and rye, as well as Canadian and Russian primeaval grain, Einkorn, Emmer, spelt, oats and barley. In any case we use old, resilient varieties, which are undemanding and have a high nutritional value.

4.4 Medicinal plants and herbs

Medicinal plants and herbs are cultivated in biotopes, which are very similar to the natural habitat of the plants. Only there can they develop to the full. No rise in quality will be achieved, if for example Thyme (Thymus vulgaris) or Broad-leaved Thyme (Thymus pulegioides) is cultivated in a moist garden soil, which is rich in humus, because in the wild they occur in warm and dry habitats. The plants do grow higher and seem to yield a better crop, but their aroma and medicinal value will be considerably lower, leading to using the wrong dosage of herbs in preparing recipes. There are numerous wild-growing medicinal herbs. Very well known are the Yarrow (Archillea millofolium), St. John's Wort (Hypericum perforatum), Ladies Mantle (Alchemilla vulgaris) and the Mullein (Verbascum densiflorum). Moreover there are many inconspicuous plants, which grow on waysides and slopes, like the Mugwort (Artemisia vulgaris), the Nettle (Urtica dioica) and the Comfrey (Symphytum officinale), whose medicinal values are very much underestimated. The better the cultivator knows these plants, the better use he can make of the abundance of medicinal plants growing in his environment. Producing teas, ointments, tinctures, oils and syrups for your own needs can be done very easily. We cultivate medicinal and gourmet herbs in harmonic associations of plants.

4.4.1 Herb spiral

It has proven very useful to build a herb spiral. Herb spirals can provide diverse site conditions for a number of different plants in a small space. The spiral can consist of shady, sunny, damp and arid locations.

The size of the spiral depends on the demands of the cultivator. It is necessary to dig up soil; this will be the basis of the spiral. It is also possible to dig a bit deeper on one side and to create a water garden there, if the condition of the ground allows it. Stones and bricks can be used to secure the outer embankments. The heat stored by them has a positive effect on growth. If deep-rooting plants are used to secure the embankments, no stones are needed. A reverse model of the conventional herb spiral is also possible: the spiral gets deeper towards the middle instead of higher, the centre of it being a small water garden. In this case the outer embankments of the structure can be terrace-shaped, which supplies additional space.

4.4.2 Planting

The herbs are chosen and planted on spots that correspond best with their natural habitat. When planting herbs, it is necessary to balance tall plants with lower growing species. Use Fescue (Festuca glauca, Festuca scoparia, etc.) to control the growth of tall grasses. This plant covers the ground and ensures that other plants do not overshadow the herbs. Thyme (Thymus vulgaris), Majoram (Origanum marjorana), Broad-leaved Thyme (Thymus pulegioides) and Lavender (Lavendula angustifolia) associate very well. Oregano (Oregano origanum vulgare) should be combined with low growing nettles (Urtica urens), which have a positive effect because their roots release potash and phosphate (take care that the nettles don't overgrow). Nitrogen fixing plants like White Clover (Trifolium repens) should also be incorporated into the plantation. Wind breaks on the edges of the herb spiral, as for example sunflowers (Helianthus annuus) and Topinambur (Helianthus tuberosus) can help create an even more favourable microclimate.

4.5 Storage

Cellars, made of rock or earth are well suited to storing food, because the rocks and earth generate conditions favourable to storage. In our cellars, humidity is constantly at 90 %, and the permanent temperature lies between 8° and 10°C. This allows optimal storage of potatoes, fruits, vegetables and other food. Air circulation in the cellar is very important. Preferably, air should enter the cellar from a centrally located inlet in the ceiling or from vents along the bottom of the walls. Gravel, dispersed on the ground serves as drainage. The diametre of the air inlet-pipe should be large enough to guarantee sufficient oxygen supply for the whole cellar. We use a pipe of 10 m length for air inlet. The pipe runs underground, at a depth of one metre. On its way through the piping, inflowing air comes to ground temperature. If the temperature of the inlet air wasn't adjusted to the indoor temperature, this would lead to an undesired sudden drop in temperature, resulting in the condensation of water. If condensed water drops onto the food, the food could start to rot, or become mouldy. The diameter of piping for the outlet needs to be adjusted to the size of the cellar as well. In our cellar, which has a volume of 108 m³, ventilation and air supply is provided by pipes with a diameter of 15 cm. If the piping is laid out slightly tilted towards the outside, it can be also used as a drain pipe when the cellar is cleaned. In vault cellars, outlet vents should be located where the room is at its highest. This also prevents condensation. Moreover, a well insulated door, which is not exposed to the sun, is of great importance for creating stable storage conditions.

5 Fungi

5.1 Introduction

The cultivation of mushrooms is a pleasant and relaxing leisure activity and it provides delicious and nutritious produce. It doesn't need a lot of space; a 2m² balcony is large enough to grow mushrooms for ones personal needs. For farmers, mushroom cultivation could turn out to be an additional source of income, with minimal costs and work involved. However, beginning large-scale mushroom cultivation needs some prior experience and it is useful to spend some time experimenting with various varieties and substrates. The acquired experience can be then be used to launch a productive mushroom cultivation. Inoculated hardwood stumps and logs can yield good crops with minimum maintenance for about 10 years, depending on altitude and climate. When the natural processes are closely observed, it is even possible to cultivate well known and common mushrooms like the Cep (Boletus edulis) and Chanterelle (Cantharellus cibarius).

The growing technique used depends on the habitat of the fungi and the way they live. Symbiotic mushrooms are relatively hard to cultivate, since the symbiont needs a living partner, which also has to be considered for successful cultivation. It is much easier to grow wood and straw decomposing mushrooms; all that's needed is mycelium and a suitable substrate. Although a warm and humid climate is ideal for the cultivation of most species, some mushrooms can also be grown on protected sites even on high altitudes. On the Krameterhof for example, we successfully grow Shiitake mushrooms at altitudes as high as 1500 metres.

5.2 Cultivation on Wood

Many well known and popular mushrooms can be grown on hardwood, like the Shiitake mushroom (Lentinula edodes), the Two-toned Wood-tuft (Kuehneromycs mutabilis), the Velvet Shank or Clustered Woodlovers (Flammulina velutipes), the Black Poplar mushroom (Agrocybe cylindracea), the Nameko mushroom (Pholiota nameko), mushrooms of the Pleurotus family like the Branched Oyster (Pleurotus cornucopiae), the King Oyster mushroom (Pleurotus eringii) the Tree Oyster mushroom (Pleurotus ostreatus), the Chinese morel (Auricularia sp.) and the Shiny Bracket (Ganoderma lucidum). They can be grown either on logs or on sawdust. Mushroom cultures on logs are the least complicated to grow, as they require only minimal maintenance. For this technique, pieces of wood, branches, wood stumps or even whole tree trunks can be used. Thus, when tree trunks are stacked in order to secure embankments temporarily, they could be used at the same time for the cultivation of mushrooms. Rootstocks with no obvious practical use in the garden could also be utilized for growing mushrooms.

For the cultivation of the species mentioned above, practically any kind of deciduous wood could be used, with the exception of stonefruit wood (such as peach trees etc), which are the least suitable kind of wood. There are also big differences between harder woods (beech, oak, etc.) and softer woods (poplar, alder, birch, etc.) as regards to lifespan and yields of the mushroom culture. Cultures on the softer woods grow quickly and after 6 months to 1 year can yield crops. However, these woods decompose much faster, and therefore produce for a much shorter time. Mushrooms, cultivated on harder woods, usually take about twice as long until they yield a first crop, but they will produce over a much longer period of time. The lifespan of a mushroom culture, and the amount it yields also depends on the size of wood used, and on the duration of the growing season. We have Shiitake mushrooms growing on Sycamore maple (Acer pseudoplatanos) at an altitude of 1500 m, which have been producing crops for the last 16 years.

As a rule, under favourable conditions the yield can reach up to 20 – 30 % of the weight of the wood used. The wood needs to be healthy and be sufficiently moist to support the culture; it should have been cut no longer than 4 or 5 months prior to using it, as it could otherwise be contaminated by competing fungi, rendering it useless for mushroom cultivation. There is one exception: oak stumps should only be inoculated after several months, in order to avoid rejection of the fresh fungal mycelium. Inoculation is accomplished by drilling holes or by making cuts into the logs. This should be done during the warm seasons of the year for the mycelium to have enough time to permeate and colonise the wood before the first frost. After inserting the fungal mycelium into the holes or cuts they are closed again in order to protect the mycelium during initial growth. The holes can be plugged with small pieces of wood. Afterwards the wood logs should be kept in a shady location, at a temperature of around 20, to 25^{o}C to ensure optimal growth. It is also advisable to bury the logs partially; this way the fungi can extract additional moisture and nutrients from the soil. This system prevents the logs and fungi from drying out, and reduces the work involved to a minimum. The first signs of growth should appear a few weeks after inoculation, if there is white mycelium growing from around the inoculation holes into the wood, then the mushroom culture is proliferating.

If the mycelium has grown in well but no crop is obtained, even after a couple of years, then the conditions are not optimal for the development of fruit bodies. To achieve this, the mushrooms usually need a humid environment. "Dormant" mycelium can easily be awoken by watering the wood logs for a couple of hours, and tapping them with a rock or club. Humidity and the vibrations stimulate the growth of fruit bodies. In most cases this method, leads to the desired results.

5.3 Cultivation on Straw

Some species of mushrooms, like the Stropharia rugoso-annulata or mushrooms of the Pleurotus species, also grow well on straw. We use straw bales that have been soaked in water for a day. The straw has to be healthy and organically grown, as it cannot be used for mushroom cultivation if it has been treated with fungicides. The soaked straw bales are placed in a shady location and are inoculated with mycelium. The straw should not be too wet, as the fungus would die off. Wetness due to accumulated water should be avoided at all costs! However, drying out is also a potential cause of failure. The humidity of the straw bales has to be checked on a regular basis. When the top 5 – 10 cm of the straw bales are dry, they have to be watered. If the straw bales are placed outside and exposed to the weather, they should be covered in case of heavy and continuous rainfall. Usually the first mushrooms will appear after a few months; these cultures will yield crops for up to 2 years.

5.4 Forest Mushrooms (Symbiotes)

On the Holzer farm, we have also successfully cultivated symbiotic mushrooms, primarily the Cep (Boletus edulis), Chanterelle (Cantharellus cibarius) and the Brown Birch Bolete (Leccinum scabrum). These species live symbiotically with forest trees. In order to cultivate them, they require a suitable habitat and must be provided with suitable symbionts. Using the example of the Brown Birch Bolete, we would like to explain the principles of our techniques.

5.4.1 Brown Birch Bolete (Leccinum scabrum)

The first step is to select and create a cultivation site. For example, we plant young birch trees on terrace-like slopes, and insert mycelium into the ground surrounding the trees. It is difficult, however, to obtain proper mycelium. Therefore it is necessary to have a piece of land, where Birch Boletes already proliferate. The difficulty is creating new mycelium. For this we use our own substrate mixture, which we disseminate around the existing fruit bodies. The substrate consists of mixed hardwood sawdust, soaked in a herbal slurry. This technique improves the growing conditions of the mycelium into the substrate. The sawdust mixture is disseminated in early summer, when the first fruit bodies have cropped up and remains there during the whole vegetation period. Then we have to find out, whether the mycelium has colonised the substrate or not, by carefully examining it for delicate white filaments. This substrate is then implanted at different depths (up to 30 cm) around the young birch trees or around birch stumps, which are still living and sprouting. It can also be inserted carefully into the planting hole when the birches are planted. If the initial steps have been done well, the mycelium will proliferate and grow fruit bodies the following year.

6 Livestock

6.1 Introduction

Poultry, pigs, horses, cattle, sheep, goats and many other animals can be kept in a permaculture. We only choose robust and hardy species for breeding, those which can manage to live on rough territory. Ancient, sometimes even rare breeds of domestic animals are able fulfill these requirements best. Red Deer, Muflon, Fallow Deer, Roe Deer, Ibex and Chamois as well as wild cattle such as the Bison, Yak and the Steppe Cattle have been successfully bred. We rear animals in families. The ratio of male and female animals in such families varies, depending on the kind of animal. The size of the population should be adjusted to the available grazing land, which should be large enough to avoid additional feeding. Only an excessive population of animals causes over-fertilisation and compaction of the ground. The space required depends on the kind of animal, the soil conditions, the gradient of the slope and on the growth of vegetation. Planting trees, usually deciduous, on which animals can browse is an important aspect in keeping animals. The buds and leaves of some trees provide a favourite browse. Therefore we grow specific plants to guide the animals away from our valuable crops. The choice of such plants depends, again, on the kind of animal to be distracted from our crops. It requires some experiece to find out which plants are prefered by which animals. However, with some empathy it is quickly possible to find out, which the animals prefer. Choosing the right plants like this guarantees success. To prevent parasitic infestations, it is advisable to plant a variety of medicinal herbs, such as Male Fern (Dryopteris filix-mas), Thorn Apple (Datura stramonium) and Celandine Herb (Chelidoni herba), which the animals will eat insinctively. When you choose which animals you want to raise, it is very helpful to find out what kinds of breeds were kept and reared in your area 50 to a 100 years ago. Old farm experience can be very useful in this respect.

6.2 Earthworms

Breeding earthworms is very simple, inexpensive and very important for a successful permaculture. Even on ground areas as small as 1 m², earthworms can proliferate, and kitchen scraps can be disposed of simultaneousely. Earthworms feed on organic matter and minerals. Their excretia contain small amounts of nitrate, potassium, phosphorus and calcium, and, because of its crumbly texture worms are particularly important for soil structure and for plants. By digging tunnels through the ground, earthworms improve air circulation and help the soil respirate, whilst improving the soils water holding capacity. With their excretia they bring nutrients close to the plants. In Holzer Permaculture, we breed amongst others the Red Wiggler (Lumbricus rubellus), the Nightcrawler (Lumbricus terrestris) and the Manure Worm (Eisenia foetida). These species complement each other in their work, as they prefer different food sources. In order to establish a vermiculture (earthworm breeding), a sound knowledge of their habitat is necessary, and your own vermiculture has to be adapted accordingly.

For small-scale breeding, a wooden box of 1 m³ is sufficient. Small holes can be drilled into the bottom of the box for better drainage. Then it is filled with cardboard, straw, some manure and soil. This will be a sort of retreat area for the earthworms. Upon this, we place kitchen scraps. Earthworms are especially fond of coffee grounds. Onions, garlic and meat, however, should not be used. In order for the scraps to be decomposed well, they have to be fresh and provided in a suitable quantity for the earthworm population. Optimum breeding conditions include constant room temperature, protection from ultra-violet radiation, good air supply and sufficient moisture. Air circulation can be improved by incorporating straw into the soil. Biodegradation can lead to a rise in temperature inside the box. It is important to get the right feeling for optimal breeding conditions, the soil should neither dry out completely nor contain too much water; earthworms turn pale when the soil is too moist! Breeding these useful animals can widen your understanding for biological processes, and it will yield valuable humus. Moreover, selling earthworms can be quite profitable.

6.3 Poultry

6.3.1 Active Bird Protection

A large number of bird species have become rare due to the loss of their natural habitat. Even allotment holders can make a valuable contribution to active bird protection by designing gardens which have a rich structure instead of an English lawn, berry shrubs growing instead of Arbor vitae monocultures, and which provide food and habitat for birds. Good forage plants for native birds are, for example, the Blackthorn (Prunus spinosa), Elder (Sambucus nigra), European Cranberrybush (Viburnum opulus), the Wayfaringtree (Viburnum lantana), the Domestic Apple (Malus domestica), the Fly Woodbine (Lonicera xylosteum), Barberry (Berberis vulgaris), Blackberry (Rubus fructosus), the Beech tree (Fagus sylvatica), the Hornbeam (Carpinus betulus), the Dog Rose (Rosa canina), Privet (Ligustrum vulgare), the Yew (Taxus baccata), Ivy (Hedera helix), the Spindle tree (Evonymus europeus), Doogwood (Cornus sanguinea), Serviceberry (Amelanchier ovalis), Whitebeam (Sorbus aria) and Rowan (Sorbus aucuparia). These trees and shrubs offer the birds a varied source of berries, fruit and seeds.

6.3.2 Domestic Poultry

Keeping and Breeding

On the Krameterhof, poultry is reared extensively and serves mainly to help us be self sufficient. Of course, it would also be possible to breed poultry as a source of income for the farm. In order to fit the principles of cycle economics, and to avoid unnecessary additional labour, the following should be considered before the purchase of any birds: "*What goals am I persuing? Which habitats are appropriate to which species? Is there enough space for the desired stock?"*

In Holzer Permaculture we try to recreate natural habitats even for our poultry, and by planting forage crops, we avoid additional feeding. The animals should be able to survive on their own, and deliver valuable produce in the right conditions. For rearing we exclucively use animals which have been naturally bred. Animals hatched in an incubator develop only poor motherly instincts and they are usually not able to hatch their eggs. Often they do not brood for long enough, leave the nests and don't take enough care of their young. Although finding naturally hatched animals can sometimes be quite hard, the less expensive alternative of buying and incorporating artificially hatched animals into the stock should never be considered. We have had good experiences with Crested Ducks, Mallard ducks, Runners and Altsteirer Chicken. Crested Ducks serve us particularly well by helping to regulate the slug population.

When keeping poultry it is necessary to be aware that the chickens should not remain in the same area for a long period of time. The danger of the animals becoming affected by parasites and of the ground getting over-fertilised (causing "chicken-weary" soil) would increase if the chickens were not moved regularly. This also applies to the breeding of all other kinds of poultry. Any imbalanced use of soil, regardless of the duration, is detrimental to its structure.

In order to provide our poultry adequate protection from predators, we plant hedges. In the chicken paddock, for example, we prefer planting various thorny hedges. Various species of roses have been very useful in this respect. They function as hide-outs, which are well accepted by the animals, and the fruits from the rose hedges are tasty food for the animals. We recommend the following wild-growing roses: The Rambler or Multiflowered Rose (Rosa multiflora) – a heavily winding rose with an intensive scent, which is also liked by the bees. The Dog Rose (Rosa canina) is a wild rose, which is easy to cultivate and has a high medicinal value; its fruits are rich in vitamin C, and also make delicious jams and fruit teas. The Rugosa Rose (Rosa rugosa) produces delicious, apple-like and shiny rose hips.

For our poultry we create mobile nesting places. They are made of two small round logs with just enough space for a hen and a clutch of eggs in between and covered with some thorny branches. Such nesting places are quite advantageous, because they can be removed, and then installed in a different paddock. As far as we have experienced, such mobile nesting places are hardly attacked by predators. The changing locations seem to turn off suspicious wildlife. The thorns of the hedges, of course, are also a potential deterrent.

It has proven worthwile to establish ponds for breeding ducks and geese. We build islands of different sizes into the ponds, which can only be reached over a shaky wooden constuction (sometimes a single plank will do). Predators such as Foxes, Polecats and Martens steer clear of the water and won't risk the unsafe passage over to the islands. On the islands, protected nesting places are created and hedges are planted, to protect from birds of prey. There should be twice as many nesting places as there are adult females to ensure succesful breeding. The nesting places should be dry and aerated, but not draughty. The animals prefer semi-dark and hidden nesting places. The animals need to have an open water surface at their disposal all year round. If the pond is covered with ice in winter, they are at risk from predators. We, therefore, construct the ponds in such a way that the water feeding it falls steeply. Because of the water pressure and currents caused, and also because of rocks and roots in the water, the surface should remain free of ice.

Ducks are omnivores, their diet includes everything from young leaves, roots, aquatic plants and grain, to worms, amphibia and even small fish. They are particularly fond of slugs. Geese, however, are herbivores. They are grazers and can fertilise small meadows. Moreover, they make excellent sentries because of their remarkable territorial behaviour they are very wary of strangers and will greet strangers with loud calls. They have been kept as guards for a long time all around the world because of these instincts. We have also been successful with breeding guinea fowl, partridges, pheasants and other species of game bird.

6.4 Pigs

Holzer Permaculture would be impossible without pigs. They are valuable and loveable workers on our farm, and fulfill many tasks: As they forage for food, they dig up the upper soil layer, loosen it up and aerate it. In fact, it is very simple to control their forage and rooting activity by spreading out lure feed (peas, grain, corn etc.). This is a perfect method for loosening up areas which have compacted soil and to prepare them for subsequent sowing. The animals can be used for the tilling both of small and large pieces of farmland, and even hard physical work can be done without any problems. Mixed orchards are an ideal place for pigs. Unlike goats and sheep, pigs do not damage fruit trees by browsing on them. Very often, large quantities of windfalls can lead to the spreading of putrefiers and mould. If pigs are allowed to forage on them, such developments can be stopped before they start. Pigs also do a great job at weed and pest control, e.g. in slug prevention. By rooting around and foraging, pigs help prevent incursions of insects, whose grubs develop underground (e. g. Cock Chafer or Summer Chafer).

Keeping pigs out-doors is still uncommon in Austria and it therefore receives a lot of public attention. Many visitors and walkers are captivated especially by the strikingly coloured and often unknown old breeds and their piglets. This positive experience increases acceptance, and creates an awareness for rare breeds, and it also makes it easier to use direct marketing for our produce.

6.5 Keeping Pigs

We have had very good experiences with breeds such as Mangalitza, Duroc, the Schwäbisch-Hall Landrace and Turpolje Pigs. All breeds are kept in outdoor paddocks all year round. The well-being of the livestock is very important for a farm. Animals, kept appropriately, will stay healthy, feel and grow well, and produce good offspring. Keeping pigs appropriately, inludes providing them with enough space to move and forage, allowing them to wallow in mud and building protected nests where they can farrow their young. Pigs have no sweat glands, so when temperatures rise, they need puddles and wallows to prevent them from becoming too hot. In addition, by wallowing, the pigs cover themselves with mud, which can protect them from parasites and from sunburn (this is especially important for pale and for less hairy breeds). Wet areas and streams are ideal locations for the pigs to create their own wallows. Keeping pigs this way, requires only minimum additional work by the farmer. When pigs are kept outdoors, ground conditions and sloping hillsides have to be observed closely, as the animals can cause quite heavy damage to the ground by foraging for feed, especially on wet ground. On very dry and sandy soil, it can lead to nutrients leaching into ground water, thus polluting it. The right number of animals, and the period of time they are kept in a paddock are therefore very important. By constantly observing the pig population, and the state of the paddock, such damage can easily be prevented. The population needs to be adjusted according to the food available in the paddock, in order to avoid constantly having to feed them. When the pigs swap to the next paddock, the loosened soil is planted with a seed mixture of green and root crops (carrots, turnips, potatoes, cabbage etc.).

In the next paddock, the pigs can be used to weed out any nettles which have grown between the trees. Afterwards, this paddock is also sowed with a mixture of seeds. Other paddocks follow, and after a sufficiently long period of time the pigs can rotate to the first one again. Thus a cycle is perpetuated, and if it works well, the animals don't need additional feeding. We ensure that enough tuber and root crops are left in the ground for the plants to be able to propagate themselves. In permaculture, paddocks are farmland at the same time, hence, they are not unproductive ground but can be used in an even more diverse way for crop farming. Orchard meadows and open mixed beech and oak woodlands, can hold larger populations of pigs than open meadows or fields can, because of the diversity and richness of food available. In Holzer Permaculture we keep between 3 and 12 pigs per hectare in paddocks, depending on the soil conditions and available vegetation. The pigs swap paddocks on a regular basis.

Simple open sties made of wood logs serve as shelters for the pigs. The location of the shelters has to be considered carefully. A few days after the pigs have moved to a new paddock, they will have already found their favourite lying area, where open sties can be erected, according to the needs and number of pigs. The sties have to be dry and draughtfree. The size and structure of the sties can of course vary. It is important, however, that the sties are closed on three sides and that the entrance is directed towards the east, with a slight slope. The sties can be covered with fir branches, but you have to ensure, that they all point the same way, so that rainwater can flow off. If the roof is constructed of logs, they can be covered with soil. This provides good insulation and improves the indoor climate.

Since Holzer Permaculture provides enough green feed all year round, the pigs can be kept outdoors all year, without needing additional food. Even in winter, the animals can still find enough food under the snow. They especially like to dig out Topinambur (Helianthus tuberosus), a delicious sweet potatoe.

Our pigs get enough exercise and a well balanced diet. They therefore stay healthy, and after a happy life they deliver high-quality produce.

6.6 Fish

The natural structuring of our water gardens at the Krameterhof allows us to breed prey- and predatory fish combined in one pond, at an altitude of 1500 m. Each species of fish requires a suitable habitat in order to proliferate and grow. Brown Trout (Salmo trutta) and Arctic Char (Salvelinus alpinus) need cool and clean water, which is rich in oxygen, as well as sandy and shallow shore or ditches as spawning ground, therefore we create sand and gravel lined ditches, which we constantly nourish with fresh, flowing water. Karp (Cyprinus carpio), Tench (Tinca tinca), Northern Pike (Esox lucius), Wels Catfish (Silurus glanis) and whitefish live in shallow areas with dense aquatic vegetation. These fish prefer shallow waters for spawning. Zander (Sander lucioperca), however, like sandy and deep water zones. They should be provided with branches and stumps bearing fine root systems, where they can build their brood nests. A sufficient number of spawning and breeding grounds have to exist, since they not only provide the fish with the most favourable conditions for spawning, but also allow the fish to grow up safely.

Deep water is also important for the temperature balance in the ponds and allows fish with different habitat requirements to be kept. Trout, for example, withdraw into cool deep water zones in summer, whereas Japanese Koi seek warm zones near the water surface. In winter most of the fish are to be found in the deeper water, as it is mildest there.

Besides the different species of karp, we also rear Tench, Northern Pike, Wels Catfish, Zander, Trout, Char, and whitefish such as Roach (Rutilus rutilus) and Rudd (Scardinius erythrophthalmus) in our ponds. The pond system is self-sustaining, because it provides the fish with food and they can proliferate. Additional stocking or feeding of the fish is not necessary. Aquatic plants, insects and plankton are feed for preyfish, which on their turn are eaten by predator fish. It is important to keep an ecologically balanced combination of predator and prey fish. They complement each other using different resources, and as links in the food chain. As predator fish prefer to hunt for ill and weak prey, life in the pond is kept in a stable balance. Additionally, overpopulation of prey species and degenerative developements are avoided, if the pond is left entirely to itself. Before stocking a pond with different species of fish, it is important to know the ecological requirements of the selected species.

A viable aquaculture with fish-farming doesn't require much work. The pond has to be nourished with ecologically sound water, needs sufficient spawning ground and sheltered areas, and has to be structured with zones of different depths. Suitable aquatic vegetation, the right size of population, and a balance between prey and predator fish can create a balanced life cycle.

7 Urban Permaculture

7.1 Introduction

Holzer Permaculture can be practiced even in small spaces such as balconies, terraces, small greens and inside flats. If only political and business decision-makers decided to apply this philosophy of sustainability, then entire cities could turn into green oases. Profuse vegetation would thrive on every single court yard, park, playground and public square as well as on facades and roof-tops. High pollution from dust and harmful substances could be mitigated in the long term.

But this requires a global change of mind. Permaculture does not work if cut off from outer influences; it requires continuous interaction. If you can convince your neighbours of the benefits of your approach, then suddenly you might have even larger garden areas, whole facades, bright staircases, and much more to change along your ideas. Every single square metre added raises the possibilities for cultivating nutritious home-grown produce. Moreover, urban permaculture is a creative leisure activity, which can help save money, and which enables life within natural cycles even in urban areas. It is especially important for children to grow up attached to nature and for them to learn from it.

7.2 Options

When cultivating produce in an urban area, pollution from traffic and industry has to be taken into account. Facades exposed to heavy traffic should therefore not be used to grow food. In this case we recommend enhancing the appearance, and also the climatic conditions of the facade by planting climbers. The more protected courtyards are usually better areas to cultivate plants. In order to yield good crops on small ground, it is necessary to have enough humus rich soil. Don't buy potting compost, as it contains large amounts of peat taken from valuable marshland, and unknown amounts of artificial fertilisers. If you don't have access to ground soil, large clay containers will serve just as well. The better you use all available space, the more green will fit into a small space. Stacking plants according to their different heights is the best way to achieve this. Plants with different heights should be planted in such a way, that they do not have to compete against each other. Every plant should be located on sunny or shady spots, according to its needs. With some imagination you will find numerous possibilities to practice permaculture in a city.

This could be one of them: Take a trough of any size, drill some holes into the bottom and place the trough on bricks. Place a waterproof tub underneath the trough. Insert wood inoculated with fungal mycelium through the holes in the trough until they touch the bottom of the tub. Then gravel is placed around the wood. The trough is then filled with soil, and stocked with earthworms. See how simple it is to create your own mushroom and earthworm cultivation! If the trough is exposed to the weather, enough water should be collected in the tub, to supply the mushrooms with moisture. If this is not the case, water can be added from the gutter, or by collecting rainwater in a butt. The gravel around the logs takes care of drainage, and avoids the accumulation of water in the trough. The earthworms recycle kitchen scraps and produce humus for the cultivation of plants.

If you use gnarled wood, this will enhance the appearance of your mushroom cultivation. In addition, the logs can be used to guide climbing plants such as vines, courgettes, cucumbers and kiwis. If they have access to walls and other areas, the plants can grow, and can even serve as a pergola on the balcony. Urban permaculture can be extended to any size, as there are no bounds to your imagination.

If you have only a few square meters of ground it can be used to construct a small mound bed. The positive effects of mound bed cultivation can be experienced on both, small, and large scales. To gain additional ground, it is possible to construct several mound beds at different levels. Herbs, vegetables, mushrooms and much more can thus be grown, either on a balcony or in small gardens. Not only is urban permaculture a source of nutritious food, but it also raises the value of balconies and gardens as recreational areas. The beauty of a flourishing permaculture will most likely also be appeciated by the neighbors. If they also start to become interested in permaculture, it is even possible to launch a kind of terrace farming on the different floors of the building. Climbing plants such as vines and kiwi can grow along the facade, and grow from one balcony to another. Troughs filled with soil should be placed on every balcony for the climbers to take root. The plants can be maintained and harvested by the inhabitants of each floor, creating a common garden. This may soon lead to the spreading of permaculture to several balconies and to uniting single allotments into one whole. Fences which inhibit plant growth in such allotments may become useless, and could then be removed. The more people become attached to nature, the more they become attached to each other. Urban permaculture can improve the climate in a city, but it can also improve the atmosphere of human relations.