

# Healthy Soil Restoration: The Key to Sustainability by Achim Ecker - ZEGG, Germany

*"The best thing that humans can do is build topsoil."*

**Healthy Soil = Healthy Plants = Healthy Food = Healthy People**

## Global Situation

The first 30 cm of soil are vitally important for the development and sustainment of Life on Earth. This level, the humus top-layer, feeds plants, animals and humans with all the necessary nutrients. This is how it has always been. Since the beginning of industrial agriculture, however, we witness an alarming loss of this vital topsoil. Worldwide, 24 billion tons of fertile soil annually are washed or blown away, or are simply destroyed. This huge mass of material would suffice to cover the entire agricultural surface of the United States.

## The Role of Healthy Soils

The key to sustainability is to begin with soil restoration. It sounds so simple yet can be quite profound: Ultimately, soil is our only source for healthy food/nutrition. In addition to air and water, it is one of the essential environmental systems, which together make up the basis of life for us humans, for the flora and the fauna. Only healthy soils are capable of sustaining biodiversity, genetic and natural resources. Healthy soils are indispensable for the production of food and for the storage of water and energy. Healthy soils also have active microbial life that are capable of breaking down and utilizing many pollutants.

Soil life – micro-, meso- and macro-fauna – is a key indicator. These soil biota are the managers, or underground stewards of the Earth. Worms, in particular, break down organic material into smaller forms that can be digested by microbial beings such as bacteria and fungi. These in turn further digest the organic matter in order that minerals can be more easily assimilated by plants. Worm castings (worm poop) are Nature's best fertilizer, and worms can create 60 tons of worm cast per acre per year.

The amount of soil organisms is unimaginably large. Just one gram of healthy soil contains approximately 600 million bacteria, 400,000 fungi and 100,000 algae. On one hectare of soil this amounts to more than 20,000 kg of microorganisms within the upper 15 cm. In addition there are 4500 kg of higher organisms at work in and on the soil.

Decaying organic matter may well be considered as fuel for bacterial activities in the soil, which operates as a factory producing plant nutrients. Soil bacteria, the agents of



decomposition, use carbon mainly as fuel, and nitrogen as building material for their bodies. Bacterial activity will not occur in the absence of water or mineral elements such as calcium, magnesium, potassium, phosphorus, and others. These, as well as nitrogen, are essential. Soil organic matter is the source of nitrogen, the basic component for all proteins and amino acids.

## **Natural Recycling**

Decomposition by micro-organisms within the soil is the reverse of the process represented by plant growth above the soil. Growing plants, using the energy of the sun, synthesize carbon, nitrogen, and all other elements into complex compounds. The energy stored up in these compounds is then used more or less completely by the microorganisms whose activity within the soil makes nutrients available for a new generation of plants. Organic matter thus supplies the "Life of the Soil" in the strictest sense.

## **Soil History**

Soil, that incredible medium in which our food is grown, is made up of three basic elements – water 25%, air 25% and solids 50%. The solids are made up of organic (humus - living and/or once living, now decaying) and inorganic (non-living such as rock and mineral) matter. It is the amount and variety of organic matter in the soil that determines how potent and fertile it is. The exact composition of humus is still a mystery to chemical science today.

Once upon a time, most parts of Europe (and the whole world!) were densely forested. A thick deciduous forest layer kept moisture in the ground, prevented erosion, and was a continuous source of organic matter. The high productivity of most virgin soils has always been associated with their high content of organic matter, and the decrease in the supply of these soils with cultivation has generally been paralleled by a corresponding decrease in productivity.

The glacial residue of pulverized rock offered minerals in solution for plant growth. As the plants found nitrogen to combine with these minerals, they grew, expired, and began to accumulate in the soil. Finally, when the rocks were more completely weathered so that they provided less minerals, an equilibrium point was reached at which the accumulated organic matter held in combination most of the minerals that could be turned into soluble forms.

To re-establish this equilibrium is the main goal of all soil restoration.

## **Soil Restoration**

Coming from these considerations, the protection and improvement of the soil layer are key concerns of the ecological work done at the ZEGG. In the state of Brandenburg, with deep post-glacial sands, the soil is well aerated but water drains right through taking precious nutrients with it. In the forests, average humus layer is no more than 2 cm deep. In open terrain, a thin grassy sod covers pure sand. Originally the soil was very poor in organisms and vitality. One problem is the low amount of rainfall, amounting to only 500 mm per year, together with the sandy soils and their poor capacity to store water.

A soil rich in diverse forms of organic matter is a healthy soil. Such soil will contain life forms such as bacteria, fungi, molds, worms, insects, plants and more. This rich variety, or biodiversity, is what will ensure the plants receive an abundance of nutrients in the correct balance. Crops will thrive! Healthy soil is the foundation for a prospering organic vegetable garden and fruit orchard. Our two main strategies of soil quality restoration at ZEGG are: improving organic matter content and re-establishment of soil dwelling populations (microbes, fungi, worms, insects, etc.) by creating good life conditions for them. We have steadily increased the humus layer by mulching with old straw, leaves and hay from the parks and public gardens of the Belzig municipality, and with cardboard. Mulching creates a habitat for a multitude of organisms and fungi, which make nutrients available to other plants.

Fresh organic matter is characterized as a rule by a large amount of carbon in relation to nitrogen. So, initially, the decomposition will draw nitrogen from the soil: the mulch layer needs nitrogen for its decomposition. After the breaking down of the mulch, thanks to the soil life activity, there will be more nitrogen available. Each time the process will be faster. The restoration of soil organic matter, thus, is often a problem of increasing the nitrogen level. This is the basic principle behind the use of legumes as green manures. In building up the organic content of the soil itself, it will often be desirable to use legumes and grasses rather than simply to add organic matter, such as straw and compost, directly. Legumes draw nitrogen from the air and deposit it in the soil; the amount in the soil is further increased when their own remains are added to it.

“Shit makes flowers grow!” Together with urine it contains high amounts of nitrogen and minerals. We eat the plants (or animals that ate the plants). Plants contain nitrogen that we pass on in concentrated forms. On some of the mulched areas at the ZEGG, we also spread the compost from our dry toilets, as the nitrogen, phosphorus, the innumerable microorganisms, fungi and worms promote decomposition of the organic material into rich, usable humus. Initially we scattered clay dust, which forms a mineral compound with humus, thereby improving its ability to retain nutrients and water, preventing their loss by leaching into the groundwater in our sandy soils.

Another valuable method of soil restoration is the use of green manures. These include peas, beans, lentils, clover, alfalfa (*Medicago sativa*), lupines (*Lupinus polyphyllos*), broom and black locust (*Robinia pseudo-acacia*) – all members of the pea family (*fabaceae*). Over a period of several years, we have sown a large variety of green manure plants, which now freely propagate themselves. Alfalfa (*Medicago sativa*) was especially important to us in re-cultivating the land. It is able to extend its root system down to an astounding depth of more than 10 meters, enabling it to remain lush and green even during the driest of summers. In this way, it makes water and minerals from deep levels of the ground available to many other plants, and permeates the soil with veins of humus.

We use a mulch mower and subsequently leave the plant material lying on the ground, in order to recreate a natural layer of humus.

## **Using Local Resources**

For about 12 years now, our local town of Belzig has been supplying us with profuse amounts of Autumn leaves. Before this, they would drive them to the garbage dump about 10 km away. They actually had to pay to deposit this “waste.” Ever since they have been bringing it to us, they have been paying less, driving less, and wasting less energy. We let these leaves sit for awhile, and then spread them under trees and bushes, or cover and consequently feed entire grasslands with the intention of cultivating them with vegetables afterwards.

The leaf mulch has proven to be particularly beneficial in the forest, as in addition to improving the soil it suppresses the dreaded grasses. Leaf mulch contains seeds from a host of other trees and shrubs which all contribute to transforming a typical, post-modern pine monoculture into a full mixed-use forest, combining a variety of fructiferous trees with the usual understory plants. Leaf mulch provides these seeds with the perfect conditions for germination and early growth (cool/damp stratification).

Additionally, in the forests on the grounds of the ZEGG, we created so-called Benjes – hedges from brush-wood – providing habitat for hedgehogs, snakes, toads, amphibians and birds. The slow decomposition of organic material over time steadily improves the soil. These hedges retain water and slow down winds. Birds settle on them and drop seeds, which can then sprout and grow protected from game. Since we began our soil restoration work, vitality has already been considerably improved and a large variety of micro-organisms, insects and fungi, but also birds and many other animals, may be observed. A very particular healing dynamic has been initiated, which is especially obvious during dry spells. We have been able to reduce watering to an absolute minimum, while the vegetation remains vibrantly green for much longer periods. While we strive to improve the soil in large parts of our land, other areas are left untouched as rough pasture, forest biotope, etc. We very rarely enter these enclaves, leaving them to themselves as much as possible, so that they remain sanctuaries for the animals and nature spirits on our terrain.

When neighbors and guests enter ZEGG, they instantly notice many more birds and much more lush vegetation than just a hundred meters away. Birds thrive on this richly set table of a healthier food chain. Every year a greater variety of birds come to enjoy this and help us with our gardening. An herbalist discovered more than 80 healing herbs growing wild here. The enriched soil life has given us “Paradise” and has provided natural ground to support a higher diversity of plants, insects, birds and animals – and higher diversity means higher resilience in extreme times. Just remember: the basis of all this is a healthy soil: it is the Mother of health for all that live upon it.

Further reading: <http://www.zegg.de/zegg-community/ecology.html>  
“Sustainability and Ecology at the ZEGG Community” by Achim Ecker