Ecotheology and Agriculture.

A personal reflection from Ekeby Research Farm, written by Kristina Belfrage

It all started when I was a child and my grandma read in the Bible about Jacob who lay down to sleep in the middle of the desert. He had a dream where he saw angels walking up and down a stair reaching all up to the heaven and he heard God talking to him. When he woke up he said to himself "Surely the Lord is in this place and I was not aware of it".

My grandma and grandpa lived a frugal life mostly based on the resources the farm itself could produce. They had an awareness of God´s presence in the land they cultivated, built on and lived on. They did not regard holiness as something that was applicable only to some rare places on Earth. They believed that every piece of land is equally precious in God´s eyes. They regarded their land as God´s property and managed it in accordance with that.

If the land we manage is a gift, how do we put such a gift to good use? How do we assure that all millions of living organisms also considering that piece of land as their homes can thrive and flourish? If we make it very practical and hands on, how do we do it? These questions I have tried to answer my entire life, as a farmer and as a scientist in the agricultural sector.

During my years on Ekeby research farm I have come to understand that one answer to these complex questions is biodiversity. We often regard biodiversity as something that has to be saved for its beauty or recreation values but the truth is that biodiversity generates ecosystem services that are absolutely crucial for our survival on this planet; nutrient cycling, carbon sequestration, decomposition, nitrogen fixation, soil aggregation, pest and disease control, pollination, degradation of harmful substances, cleaning of ground water etc. Thus, enhancing and increasing biodiversity is something we do for our very survival.

On Ekeby research farm, our fundamental conception is that it is a gift to share our home on Earth with all the other-than-human lives, in all their amazing life forms. Hence, our care for biodiversity is born from our love and respect for all these – plants, animals, fungi and even the tiny microorganisms. Our effort has been to not only increase the number and diversity of species, but also to improve our collaboration with them all.

The largest amounts of species are found *in* the soil, most of them too small to be detected by our eyes. For example, in one teaspoon of soil there are more bacterial cells than the total number of people on Earth. Add to that millions of nematodes, billions of protozoans, springtails, mites, fungi and the larger and more noticeable species like ants, insect larvae, earthworms, millipedes etc. and you have the assembly responsible for a large amount of the life essential ecosystem services on Earth. In addition, all these species ensure that we get sufficient yields, also during periods of stress. It is my task as a farmer to, like a conductor, facilitate for every different assembly of this soil biota to do their job just in right time. In that way the symphony of the underground biodiversity results in not only higher yields but also healthy and nutritious foodstuffs. The only things they want from us in return are supply of lots of carbon rich materials e.g.

manure, compost, human excreta and poison-free, well-drained, non-compacted soils ploughed as seldom as possible.

The above ground species in and around the fields help us control crop pests and diseases. And their contribution is astonishing; for example, a ladybird and its offspring eat around hundred million aphids every vegetation season, a ground beetle around five million and an earwig about one million aphids. And this is not just theoretical calculations- their appetite makes it possible for us to be organic, their work substitute inputs of pesticides. And it seems like their contribution is even more reliable than chemicals. We have had several outbreaks of oat aphids and mites that have caused severe yield losses for neighboring conventional farmers but none of them have affected our harvest levels negatively. An outbreak of diamond back moths some years ago caused almost total crop failures in neighboring fields, however we got off almost unaffected.

Hence, we try to fulfill their needs of water, food, shelter, nesting places and protection. One way to accomplish that is to conserve and create habitats where insects, reptiles, small mammals and birds can nest, hide and find food, e.g. non-cultivated field edges, open ditches, dams, stone cairns, field islets, bushes, trees. However, a stone cairn in a field does not by itself mean that e.g. a Whetear will nest. Most bird species, and all nestlings, eat insects. Hence, without a large biomass of insects there will be no birds. An organic farm with small fields surrounded by non-cultivated field edges and ditches rich in flowering plants and bushes increases the chance to find a Whetear substantially. However, it takes even more, it takes grazing animals. The livestock themselves attract lots of insects, their dung and dunghills even more. Their mules shape an environment very favorable to a wide range of insects and birds. Different livestock graze in different ways, the cows leave more flowering plants, sheep and horses graze narrower to the ground. This creates a patchy landscape with different grass heights and a rich diversity of insects, where lots of insect feeding birds can find their prey. Swallows, flycatchers and redstarts catch flying insects around the cows and horses while e.g. starlings, whetears, sparrows and wagtails catch insects by running on the ground close to the livestock. The swallows even depend on cow dung to build their nests! In return, the birds help the livestock by decreasing the number of biting flies and mosquitos. And we are not talking about small numbers. A rough calculation the former summer amounted to a number of about 250 000 insects being caught every day! Just at the farm center and its immediate surroundings!

However, the bird community has changed. The number of crows like ravens and carrion crows has increased dramatically over the last 20 years. Rapid and substantial decline of their main predators is one explanation. Since both ravens and carrion crows steal eggs and nestlings from other birds, they have caused substantial declines of many bird species, especially those nesting on ground. Besides, altered management of leys, with most farmers today harvesting hay/silage three to four times a summer, formerly very common species like skylark and lapwings have now become endangered. To halt this development we have made strong efforts to change our management methods. By conversion to ley compositions that can be cut one single time in the beginning of July (and still contain sufficient levels of protein and energy), the number of breeding skylarks has increased from one (!) to around twenty. The number of breeding lapwings has also increased and that has turned out to be a perfect way to protect other birds and

mammals since lapwings, if sufficiently numerous, are extremely aggressive to predators, no matter if it is a fox or raven. True, our harvest levels and hay quality are slightly lower than those obtained by using modern ley compositions and repeated cuttings. However, we have to share the gift, we have to leave something to our co-workers and fellow creatures. We can never take it all. That is not how it works. At least not in an ecotheological agriculture.

Owls predate on juvenile magpies and jackdaws. By putting up nesting boxes and in other ways enhancing breeding success the number of owls has increased. This has resulted in decreased number of magpies and jackdaws that, in turn, has resulted in increased number of black-headed gulls, an important predator on many swarming pest beetles. The collaboration patterns are complex and absolutely fantastic! Of course we don't want to eradicate the magpies and jackdaws – they are magnificent birds – but we want their numbers to be commensurate with the other creatures in our web of life.

However, not only the wild animals contribute. Also our livestock are helpful in many other ways than just producing food. One advantage of grazing pastures and forests is that the livestock are able to produce food from land types that are difficult or unsuitable for the cultivation of crops. However, not only do they provide food but they also provide and distribute nutrients from grazed areas in form of manure and in the end, slaughter waste, to arable land. This often forgotten ecosystem service is of great importance for sustaining high yielding and resilient agricultural systems. Furthermore, hens and pigs are excellent soil cultivators, pigs substitute the disc plough and hens the harrow. In addition, they control weeds and pests, and hens are also good parasite controllers, spreading the dung pads, eating the parasite eggs and exposing the remaining ones to sunlight and wild birds. Hence, just by letting our livestock express their natural behavioral needs, they can help us diminishing both energy usage and labor demand.

We also have good help from our livestock in that they guard each other. The cows protect the sheep and lambs from foxes, wolfs and lynx and the dogs guard the hens. Last year a wild pheasant hen joined our hens together with her chickens to get them guarded by our dogs. That resulted in three pheasant hens and one cock reaching adolescence compared to no more than one former years. Also our draft horse helped to protect birds from being harmed by harrows and sowing machines in early spring. She was always very attentive to any signs of nests, eggs and nestlings and when she saw any of these, she stopped immediately and neighed in a certain way to get my attention. When I had moved the nests or nestlings to safe ground she continued, clearly satisfied with our common efforts. The examples could fill a book…

However, the domesticated species have been at our service for such a long period of time we have almost forgotten that they have the same behavioral needs as their wild ancestors. In industrial agriculture, livestock have been reduced to production units with the only goal to extract as large quantities as possible, no matter if it is milk, meat or egg, in the shortest possible time and with the lowest possible labor input. This cruelty that we consider necessary to get cheap food is, in my opinion, not only totally unacceptable and unethical - it is, contrary to the common conception, also highly ineffective. Research shows that if a cow graze and is fed with hay the energy output, her milk, contains four times more energy than the energy put in. In industrialized

agriculture, where the cows are fed with mainly concentrate and milked with robots, we have to put in four times more energy than we gain. Research also shows that cows that are groomed and tended by an animal keeper they trust are more relaxed and have significantly higher milk production compared to cows that are under stress.

During the several short- and long-term field trials that have been performed at Ekeby research farm, we have tested a bundle of different crop rotations and livestock compositions. They have ranged from easily manageable but low yielding to extremely high yielding but also highly demanding in terms of skill and labor input. In line with several research reports, it has turned out that the highest productive agriculture in terms of food production output per area is an intensive, diversified, small-scale organic agriculture, more like a larger scale of gardening. This result stands in sharp contrast to the overall view that it is the large-scale agriculture that is the most effective. Industrialized agriculture sure is the most economically profitable per company unit, but if we consider the largest food production, and in turn our ability to produce enough food for a growing world population with decreased or no access to cheap fossil fuels, it is highly inferior.

That is, ecotheological agriculture is from a natural science perspective absolutely not a utopia. But in the current market economy, the ones who care the least about the environment, their livestock and their workers are the winners. Everyone who cares is a loser and the more you care the bigger loser you are. Hence, from a present day market economy perspective ecotheological agriculture is sheer madness. Despite this, there are attempts around the world to adjust management regimes in a way that also care about and collaborate with the other members of Creation.

In my opinion, the difference between conventional and ecotheological agriculture is not so much a question of agricultural methods as of different worldviews. To start with, how do I regard ownership? Do I regard myself as the master of the land and the other beings there as my slaves, giving me the right to use pesticides to solve problems occurring? Or do I regard myself as a part of a common community of work mates on a piece of land that God owns and has given me, and them, the right to use as a gift? Meaning that I have to take care of them all irrespective of whether I like them or not, dealing with occurring problems by encouraging inherent adjustment mechanisms in the ecosystem instead of using pesticides. Certainly, this is not an easy way of agricultural management! But if resources are limited we have to share them. If we do not, as in the current situation, but use resources far beyond our global share, the poor, especially the poorest of the poor, the environment, the children, the multitude of different individuals and species of animals, fungi and plants will suffer, die and disappear. Hence, a seemingly simple question, how to produce food, not only affects the local environment and society but the very highest levels of global politics and power. We can not separate ourselves from our sisters and brothers living in countries far away from our own, nor from the environment and all other beings on this planet. We are all part of the Creation that God has made and considered as “very good” (1 Gen. 1:31)