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## Regenerative Agriculture: the new direction of food production

Regenerative agriculture is an emerging holistic approach to food production that strengthens the ecosystem. In addition to high-quality and good yields, it improves soil health (Figure 1), increases biodiversity and serves a functioning water management. The storage of carbon from the atmosphere back into the soil is one of the studied benefits of regenerative agriculture. In Finland, the principles and measures of regenerative agriculture are promoted, for example, in the Carbon Action platform, launched by the Baltic Sea Action Group. Carbon Farming is term referring to food production in a way which also increases soil carbon stocks.



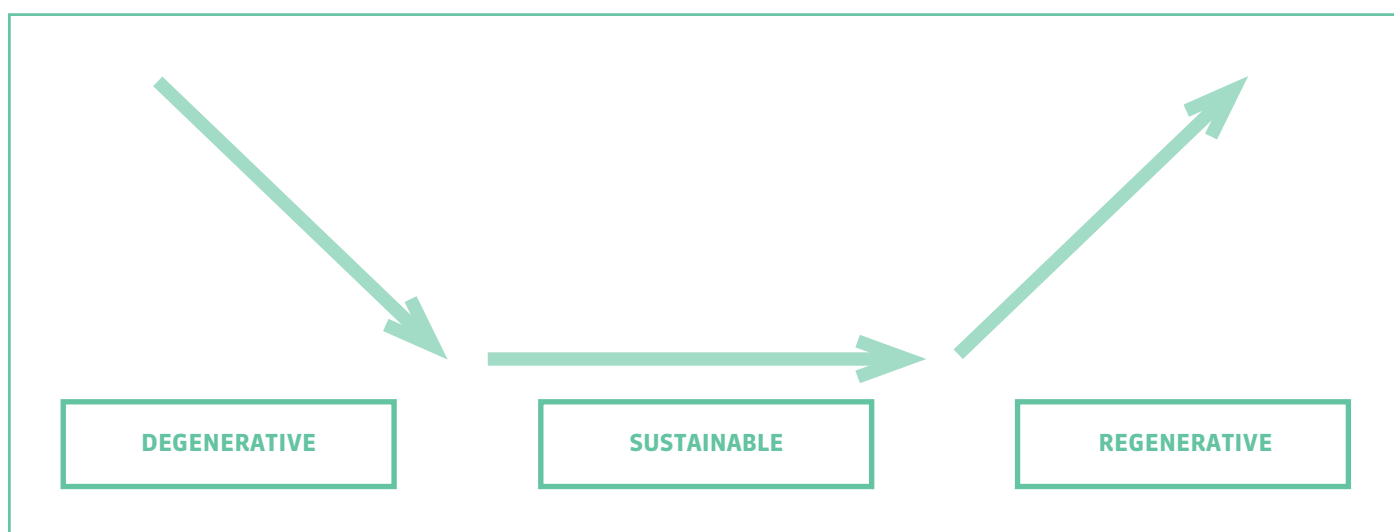
*Figure 1. Soil health affects crop yields and carbon storage among other things. A faba bean seedling. Photo Eija Hagelberg*

In regenerative agriculture, the aim is to improve the functioning of local agroecosystems through suitable farming practices. There is a lot of scientific research on regenerative farming practices and their environmental benefits that can be applied in different circumstances. Properly selected and applied practices grow soil organic matter stock and reduce dependence on external production inputs. At the same time, they reduce environmental emissions and increase biodiversity. Regenerative agriculture can be practiced in the same way in conventional and organic production. It also aims for a good and secure harvest with high nutritional quality.

Farmers interested in soil management are already working according to the principles of regenerative agriculture. Crop yields have not increased in recent years using the methods of conventional agriculture, which has led many farmers to look for new perspectives and alternative methods. That is why regenerative agriculture has gained popularity. Farmers are looking for solutions that can simultaneously improve the profitability of the farm and the functioning of the soil. In the long run, regenerative agriculture can increase the profitability of agriculture and the economic sustainability of food production. It is important for regenerative agricultural products and their markets to strive for diversity, crop security and adequate yield levels.

### Soil management combines different definitions of regenerative agriculture

Regeneration refers to the process of healing damaged tissue and is also used in ecology to describe the recovery of an ecosystem from a severe disturbance. The opposite of the word regenerative is degenerative. The state of the system living in it is gradually deteriorating. In between these two there is the sustainable state. (Figure 2)



*Figure 2. A food production system can either degenerate, sustain or regenerate its operating environment. Which direction do we choose?*

How the term 'regenerative agriculture' is defined can vary. In its broadest sense, it includes not only agricultural ecosystems, but also social sustainability and animal welfare, and the rearing of new generations of farmers. Broadly defined, regenerative agriculture can almost be seen as a parallel term to the agroecological approach. At the other end of the spectrum, the definitions are strictly limiting. The stricter the definition, the fewer farms fit the definition. For example, the Rodale Institute's Regenerative Organic Agriculture certificate only covers organic farms that use minimal tillage and catch crops.

However, most definitions, like the ones on the Carbon Action platform, emphasize the management of agro-ecosystems, with soil management at the forefront. The definition, which focuses on soil health, makes it possible to develop farm sustainability, regardless of the direction and method of production. A good example of a soil-centered definition is the list of six core principles presented by General Mills to its producers (Figure 3).

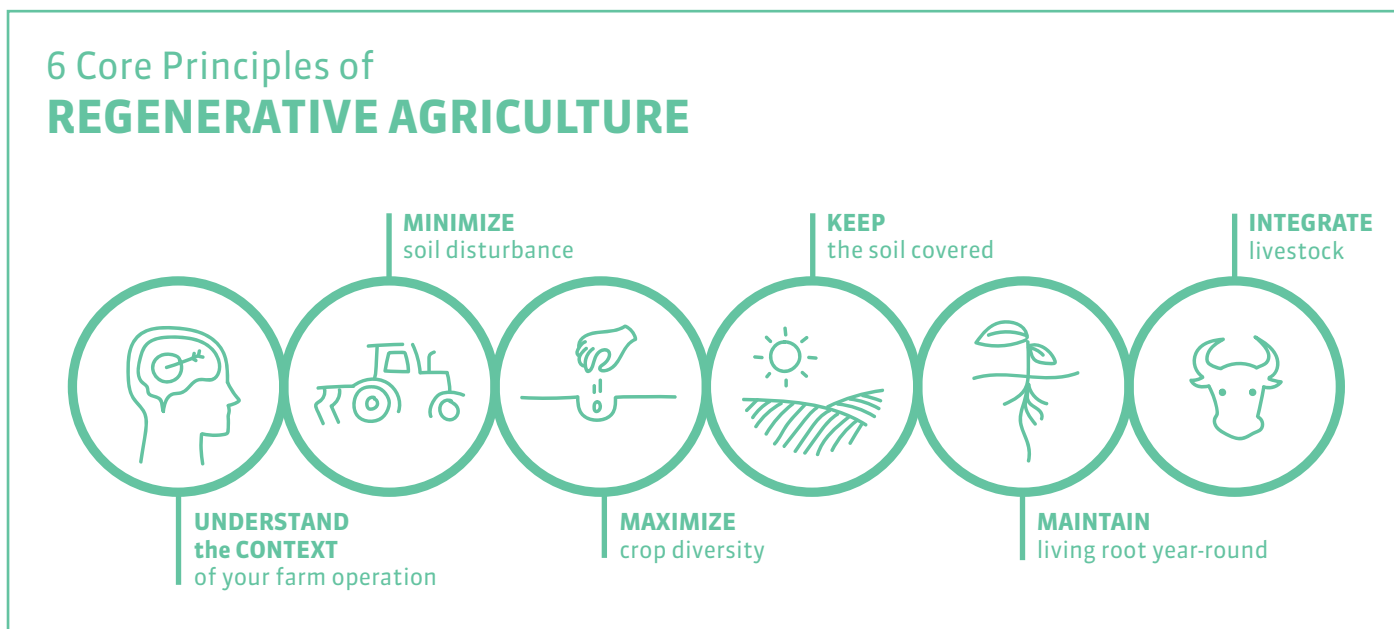


Figure 3. A good example of the progress of regenerative agriculture globally is the goal of the American food giant General Mills to implement regenerative agriculture on 1,000,000 acres (i.e. about 405,000 hectares) by 2030.

The General Mills' definition of regenerative agriculture includes six core principles:

1. Understand the context of your farm operation
2. Minimize soil disturbance
3. Maximize crop diversity
4. Keep the soil covered
5. Maintain living root year-around
6. Integrate livestock

<https://www.generalmills.com/en/Responsibility/Sustainability/Regenerative-agriculture>

### Other useful definitions of regenerative agriculture:

The Carbon Underground

<https://seureservercdn.net/184.168.47.225/02f.e55.myftpupload.com/wp-content/uploads/2017/02/Regen-Ag-Definition-7.27.17-1.pdf>

Regenerative Organic Certified [www.regenorganic.org](http://www.regenorganic.org)

Terra Genesis International [www.regenerativeagriculturedefinition.com](http://www.regenerativeagriculturedefinition.com)

A common feature of all definitions is the need for a more diversified and integrated agricultural production system than the current conventional agriculture. The current agricultural system is characterized by the separation of livestock and crop production, monoculture, external inputs and intensive tillage. Agricultural development has made it possible to feed a growing population with the help of fewer farms, but the condition of the soil and arable ecosystem has been overlooked. Soil compaction, soil degradation and erosion, which affect yields and the continuity of production, have prompted producers to look for farming methods that improve soil health. Reforming agricultural methods help farmers to turn their fields over to the next generation in better condition.

### **The agroecological approach**

In the agroecological approach, food systems are treated holistically and developed towards ecological, economic and socio-cultural sustainability. At the heart of the agroecological food systems the food production is based on holistic sustainable agriculture. The approach views agricultural production as part of the agroecosystem. The production is based on an understanding of the functions and effects of the ecosystem. Production methods are based, among other things, on the sustainable use of local resources, the support and use of ecosystem services, and the most multibeneficial and comprehensive solutions possible for the entire food system and the various aspects of sustainability. The agroecological approach also focuses on considering the diversity of different places and food systems. The aim is to adapt the solutions to the resources and constraints of each location and system.

### **Regenerative farming**

At the heart of a regenerative agricultural system is soil management. Through a soil management perspective, we can talk about regenerative farming. It is farming that improves soil health, recycles nutrients, increases soil carbon stocks and promotes biodiversity. The term carbon farming is used to emphasize the carbon-storing properties of the methods used in regenerative agriculture.

## Practical methods for soil regeneration

Healthy soil with a good structure is a farmer's most important asset. Achieving good soil structure can take years and can be lost in an instant. Driving a heavy tractor on wet soil is likely to cause damage that will not repair on its own. Soil compaction causes many problems: plant roots cannot develop normally, soil organisms are few, there is no air space and no water is stored. Regenerative agriculture begins with a plot-by-plot assessment to remedy compaction and other characteristics that weaken soil structure. Suitable means include, for example, drainage, liming and subsoiling. A basic rehabilitation of the field is a necessary first step, after which the annual measures not only maintain the condition of the soil, but also further improve it. Good condition of the field is a prerequisite for carbon sequestration.

Once the field has been rehabilitated, its functions are further developed by maintaining a continuous living root system in the ground, keeping the surface of the field protected by litter and leaves, and increasing crop diversity (Figure 4). Continuous access to food and shelter allows the soil organisms to grow and the field ecosystem to develop. Disruption from tillage and the use of pesticides should be kept to a minimum, in other words, fields should be tilled lightly, and the pesticides used should be as harmless as possible. Perennial grasses in the crop rotation improve soil health. When managed sustainably, pastures and mowed grass leys store carbon in the soil. Ruminants can take advantage of grasslands and are therefore a necessary part of regenerative agriculture (Figure 5).

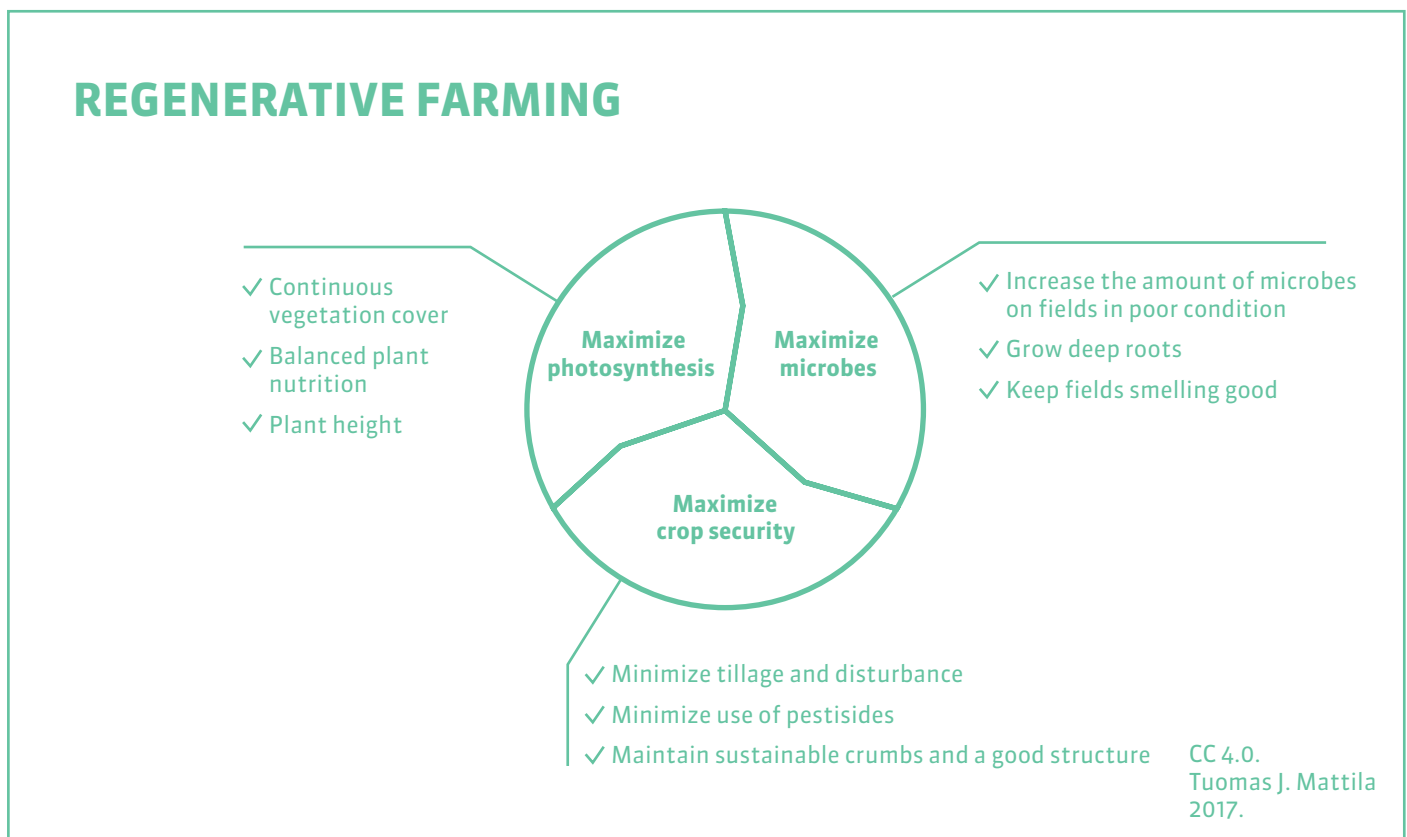


Figure 4: One good thing leads to another and creates a complete positive cycle. The three main principles of regenerative agriculture reinforce each other. Reference: Mattila, Joonas and Regina, 2020.



*Figure 5: Ruminants play a big role in regenerative agriculture, as they can feed on the grass leys necessary for crop rotation. Dry manure is a good soil amendment. Sustainable grazing increases biodiversity and increases soil carbon stocks. Dairy cattle in Käsämäki. Picture: Tapio Heikkilä.*

## **The food system and its sustainability challenges**

There are ecological, economic and socio-cultural sustainability challenges at different levels in agriculture and the food system. Ecological sustainability challenges include, for example, climate change, biodiversity loss and severe changes in nitrogen and phosphorus cycles. Other sustainability challenges include the weak economic viability of agriculture, lack of food security, unethical behavior towards producers, workers and farm animals, sectoral food production, the growing demand for food due to a globally growing population, and the challenges of human nutrition.

## Regenerative agriculture offers solutions to sustainability challenges

Regenerative farming can make climate change mitigation and adaptation more effective. Regenerative farming increases the amount of carbon in the soil, which improves soil structure and field productivity. At the same time, the resilience of the ecosystem increases and the ability of the soil to retain water, soil particles and nutrients improves. As climate change progresses, extreme conditions increase, which underlines the benefits described above.

Preserving and increasing diversity is an important goal in regenerative farming. A diverse agro-ecosystem also provides habitats and food for organisms that support food production, such as soil organisms, pollinators and beneficial insects. The benefits of diversifying production include improved productivity and increased resilience to extreme weather conditions as well as plant diseases and pests.

Diverse yields support diet diversification and improved nutritional quality. Living and healthy soils and diverse cultivation can improve the nutritional value of food.

The local economy and closed nutrient cycles can be strengthened by buying from local regenerative farmers. This increases social sustainability as well as the transparency of food production.

### Recommendations to support decision-making: How can regenerative agriculture be promoted?

For regenerative agricultural production to become more widespread, it is necessary to increase long-term research and research funding. More information is needed on the methods and benefits of regenerative agriculture in ever-changing climatic conditions and in different environments. However, there is no need to wait for the research results to be completed: there is already enough information on the benefits of regenerative farming methods to support their widespread adoption.

The first step is to increase the interaction between the research and farming communities. The change in agriculture requires practical information, and in the scientific research, it is important to take into account aspects based on farmers' practical skills. The application of research requires that results of research are made comprehensible and that it is applicable to the agricultural working practice. The role of advisory services is critical. Ensuring the level of knowledge of advisors is crucial in putting research into practice.

To a wider extent, advisory should be carried out in small groups. Positive experiences have been gained from small group advisory. The input of researchers should be utilized in this type of group advisory. Everyone benefits from working together: advice is based on the latest scientific knowledge and researchers are able to address issues that are relevant in practice.

Farmer's peer support and learning play a key role not only in disseminating information but also in creating an atmosphere that encourages experimentation. An atmosphere that is conducive to experimentation enables the development of new innovations and a new operating culture. Adopting new information from science and through peer-learning and thereby increasing know-how strengthen the capacity to develop farm operations and to adopt new farming practices.

The next EU Common Agricultural Policy (CAP27) and the EU Farm-to-Fork and Biodiversity strategies include individual goals in line with regenerative agriculture such as reduction in fertilizer and pesticide use. The achievement of these goals should be supported with incentives for farmers. Incentives are needed not only in the eco-schemes and the agri-environment-climate compensation scheme, but also in investment support and information and cooperation measures. The details written in the program will influence farmers' choices in the coming years. Reform of incentives, such as the introduction of result-based payment schemes, could also help to introduce regenerative farming practices on an increasing number of farms.

The market for sequestered carbon credits is gaining interest among business, market actors as well as in research. Also, the EU is preparing for a functional carbon credit market by 2050. In the future, carbon sequestration may be covered by carbon trade or exchange and various compensation schemes. This presupposes that the long-term binding of carbon to the soil can be verified reliably. The farmers could also potentially be compensated to produce other ecosystem services in the future. New types of payment system models should be piloted quickly, as this is the only way to find realistic, viable alternatives.

### **Requirements for promoting regenerative agriculture**

- Long-term research funding for research to restore the viability of the agroecosystem
- Application of research data and development of research-advisory-farmer cooperation
- Training of advisers and small advisory groups for the training and peer-learning of farmers
- Incentives for farmers to support sustainability targets in CAP



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