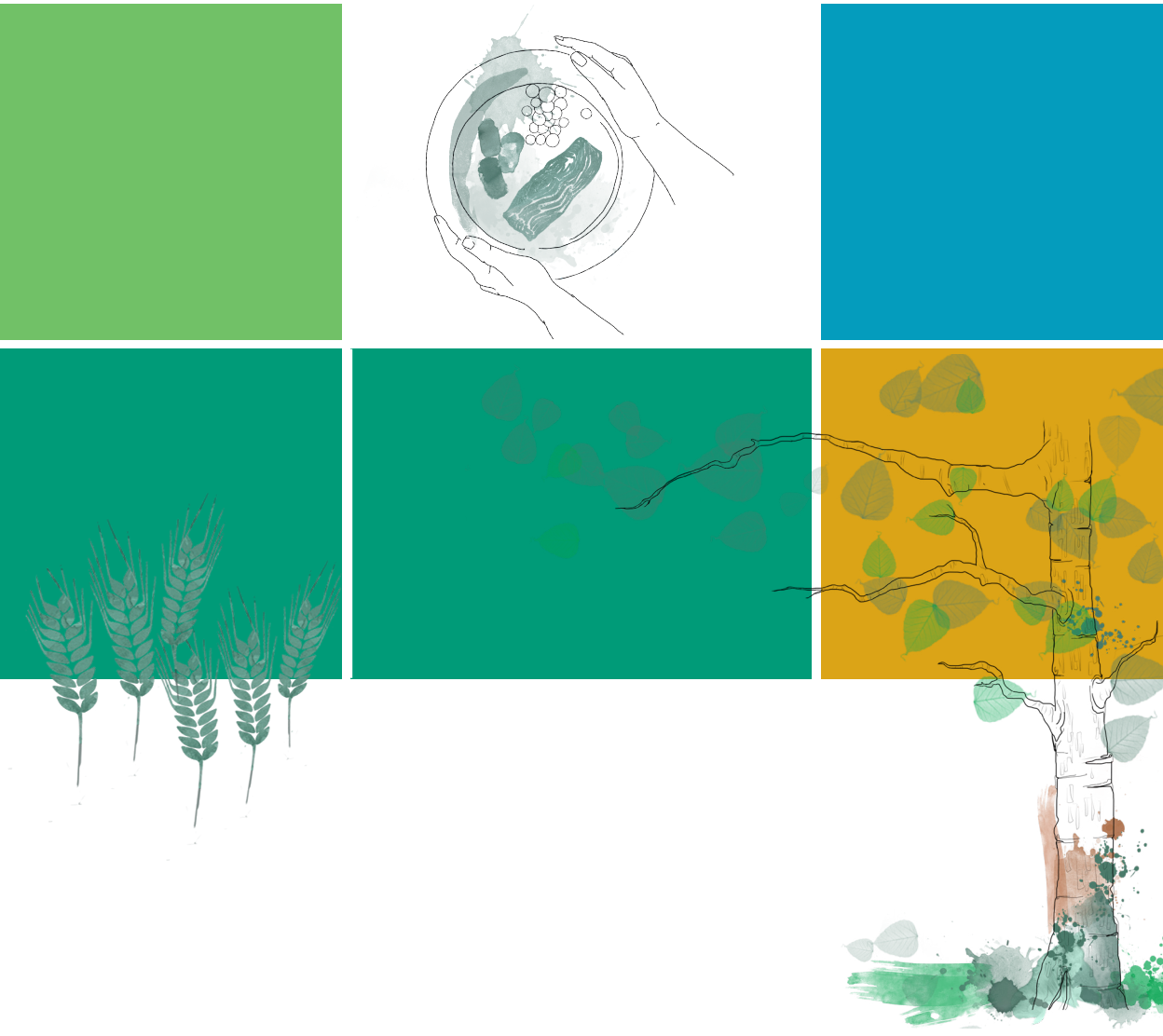
Towards 2030 – sustainability as the business case for agriculture and forestry



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Foreword

Swedish agriculture and forestry are among the most sustainable in the world. Strong legislation, effective monitoring and controls, competent agencies, an engaged business community and civil society, well established cross-sectoral collaboration and stakeholder dialogue, a good environment for innovation and high levels of technical and other expertise are some of Sweden's success factors. At the same time, there are major challenges also in Sweden; challenges that many other countries may also recognise. The challenges of sparsely populated areas, profitability problems, generational shifts, skills supply and, not least, environmental and climate challenges mean that Swedish agriculture and forestry also need to continue to develop. How is food supply to be secured without further exacerbating global warming? How do we maintain both plant and animal biodiversity? How do we safeguard water supply? How do we ensure that we have people willing to and able to produce our food? These questions have no easy answers but perhaps the solutions lie in the challenges themselves. In Sweden there is a growing demand for sustainably produced food that takes climate, environment, animal welfare, food safety and social issues into account. Consumers today are making informed choices in terms of what they eat and how it affects the climate to a greater extent than they did in the past, and the industry has been quick to meet these demands. This can open up new opportunities which attract young, innovative entrepreneurs into the sector, seeking to play their part in global sustainable development. This trend may fundamentally change agriculture.

In this 2019 publication[1], the Swedish FAO Committee has chosen to highlight examples from Sweden, and Sweden's engagement in the world, that demonstrate the necessity of sustainable agriculture and forestry and where the sustainability perspective is also the recipe for success. The examples show how the integration of all three dimensions of sustainability has led to better environmental, social and, not least, economic results.

To start with, the Swedish Board of Agriculture and the Swedish Forest Agency give an account of developments in Sweden in the modern era. The roots of many of Sweden's success factors can be found in it's history, and the lessons learned may perhaps also inspire other countries. This account is followed by two specific examples of farming and forest management in Sweden today, where beef farmer Agnes Jörgensen and forest owner Leif Öster share their personal thoughts on

[1]The publication as a whole is a product of the Swedish FAO Committee. The content of the individual sections is the responsibility of the writers concerned.

sustainability and the future of their respective businesses. The Lantmännen agricultural cooperative then outlines the Sustainable Supply Chain for Food Initiative, which demonstrates the need for, and power in, collaborating at systemic level despite the participating companies beeing competitors.

The lessons learned in Sweden are not merely kept within Sweden's borders. Sharing knowledge is an important part of the Swedish model, and is also necessary in order to safeguard progress. The Löfbergs coffee company describes the Next Generation Coffee project, which aims at encouraging young coffee farmers, and contributing towards sustainable and stable coffee production. Next, the civil society organisation We Effect shows the good results of using agroecological methods in Latin America. Finally, we look ahead and identify new solutions that may help us to attain the 2030 Agenda and the Sustainable Development Goals. The forest company Stora Enso, sets out the potential to be gained from managing the forest sustainably for new bio-based products, and the Swedish University of Agricultural Sciences, SLU, explains how for example diversified cultivation systems can contribute towards sustainable intensification of crop production in the future.

State Secretary and chair of the Swedish FAO Committee, Per Callenberg

Content

Main messages

Success factors in Sweden

- Regular cooperation across sectors and between stakeholders
- Competent government agencies providing timely support and expertise
- Business and civil society engagement
- Investment in research and development
- Long-term data and monitoring
- Openness towards diversification
- Good and forward-looking innovation environment
- Informed and responsive consumers
- National reforms and support for modern, large-scale agriculture
- Organisation and democratic member organisations, e.g. cooperatives

Needs for the future

- Need for coordination to enable goals to be better integrated and improved opportunities for synergies and balance between the different dimensions of sustainability
- Competitive companies for sustainable production
- Continued emphasis on a circular approach, integrating green industries
- Harnessing the driving force of all actors
- Increase biodiversity, in farming as well as in the wild
- Increase carbon storage by various means
- Continued long-term research and innovation
- Dissemination of knowledge, not least to young people and the urban population
- Focus on long-term sustainable production systems (e.g. agroecology)

INTRODUCTION

The Swedish bio-based economy – from agricultural reforms to three dimensions of sustainability

Andreas Davelid, the Swedish Board of Agriculture and
Anders Malmer, the Swedish Forest Agency

The development of agriculture and forestry in Sweden is strongly intertwined, not least in that historically, the majority of agricultural businesses in Sweden have owned and farmed arable land, grazing land as well as forest. There has been a shift over the years from extensive multiple use, via the intensive production of industrial raw materials, to demands for social, ecological and economic sustainability. Climate change and the Sustainable Development Goals (SDGs) set out in the 2030 Agenda pose a major challenge for our society. Can the land and the forests provide sufficient raw materials to produce more materials and products in an increasingly bio-based and locally/nationally based economy while delivering the ecosystem services expected of them in a changed climate? Today the farming and forest sector is operating subject to investments and structures in land and forest holdings. This is the result of dynamic policies, and economic and technical development over a long period of time. Innovation and new products can provide new business opportunities, but the green sector simultaneously must consider the basis for its existence, which involves long timescales, not to mention ever-increasing demands for social values and ecosystem services.

This section firstly sheds light on developments in Swedish agriculture and forestry and some of the most important political decisions affecting the green sector before concluding by outlining the challenges of today and tomorrow.

Rationalisation and the dawn of industrialisation in Europe

The nineteenth century

In the nineteenth century, economic freedom, land reforms and improvements in farming techniques led to higher productivity in Sweden. Industrialisation intensified this trend due firstly to greater demand for agricultural products as a result of an increase in population and secondly to higher numbers of people working outside agriculture. However, these reforms did not affect the use of forest land to any major extent. Private landowners/farmers continued to use their forest for a variety of purposes. Pressure on land for slash-and-burn agriculture and grazing continued to be high in southern Sweden, while the mining industry's need for timber and charcoal led to deforestation and poor regeneration. Growth in Western Europe increased demand for Swedish timber in the second half of the

nineteenth century and in northern Sweden this led to increasing amounts of forest being felled. It was still uncommon for forest owners to take steps to regenerate their forests, and natural regeneration was prevented by expanding agriculture and grazing in southern Sweden as well as by an unfavourable climate and sparse forest stands in the north.

National effort and support for sustainable management of resources

1900–1930

Despite grain duties on imports, Sweden imported considerable amounts of grain in the early twentieth century. The First World War led to an acute grain shortage, and the Swedish government therefore introduced a variety of agricultural support schemes to avoid similar situations in the future. This support resulted in increased national production. Falling prices for agricultural products in the 1920s led to further regulation.

In this period incentives to safeguard continued access to forests increased. Sweden's first Forestry Act was adopted in 1903. This included a requirement for forest owners to replant after harvesting, which still applies to this day. Greater international and domestic demand created business opportunities for sawmills and timber production. Other factors, such as emigration and more people starting to work in industry, reduced the pressure on land and made it easier to meet the statutory reforestation obligation. The Forestry Act also put in place regional forestry boards in which forest owners and other people involved in reforestation efforts were active. Extensive investments in education, trials and research as well as the National Forest Inventory which commenced in 1923, enabled the evaluation of development and forest policy.

Increases in productivity and regulation take off in the decades following the Second World War

1930–1980

Farmers' unions go back a long way in Sweden, but at the end of the 1920s, the first steps were taken towards a nationwide farmers' cooperative movement which was to play an important role in shaping agriculture and agricultural policy. In the 1930s, the agricultural regulation that had previously been introduced was expanded further. The importance of domestic agriculture for the food supply in periods of crisis came into even greater focus during the Second World War. Both agricultural regulation and the focus on being prepared for a national emergency came to characterise agriculture and agricultural policy for a long time thereafter.

After the Second World War, Swedish agriculture underwent major structural rationalisation, partly as a result of an active land policy. The number of people who work in agriculture has fallen drastically since then, from 870,000 people in 1951 to 171,000 people in 2016; see figure 1.

Figure 1

Source: https:/jordbruketisiffror.wordpress.com/

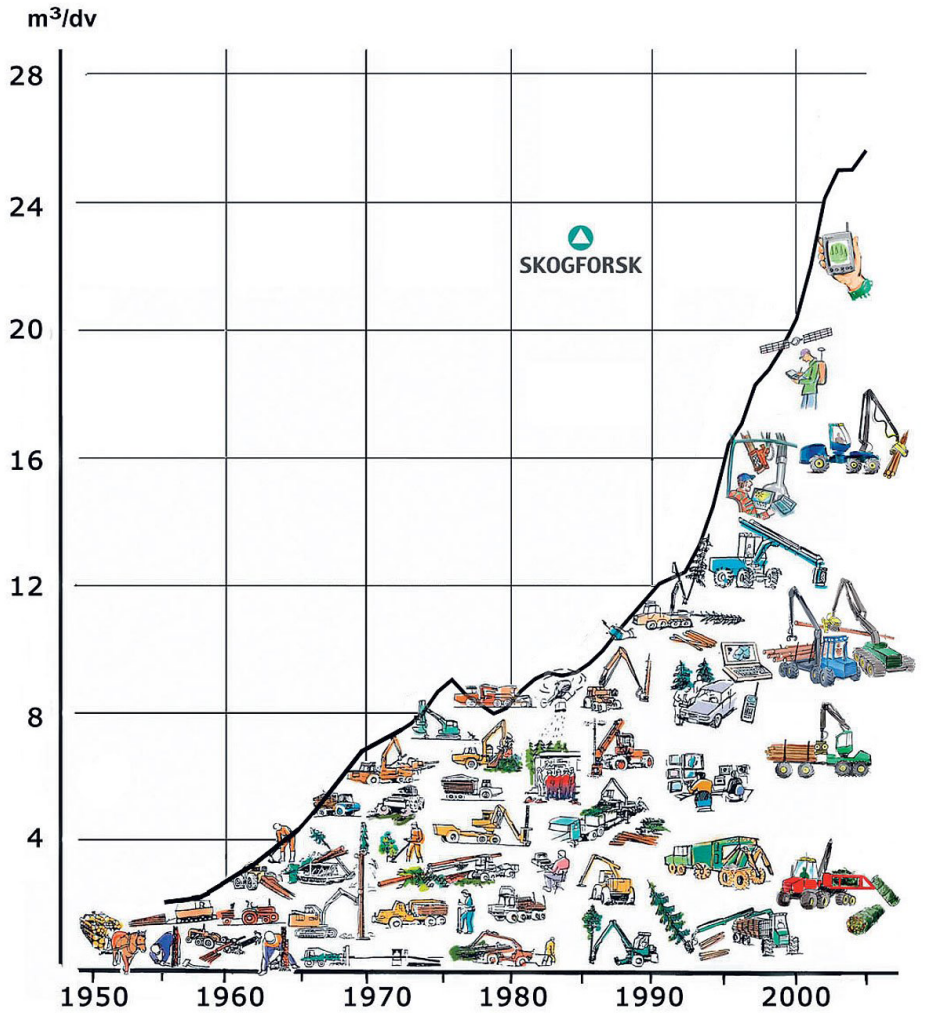
Mechanisation also contributed towards making agriculture more efficient and more productive, but demand failed to keep pace. It also became increasingly clear that regulations were holding back developments in productivity due to limited competition from abroad. In the 1960s the environmental dimension in agricultural production started to gain attention. It became mainstream in the 1980s, partly through taxation of artificial fertilisers and plant protection products.

As far as the forests were concerned, multiple use faded in this period and initially production was focused on sawn wood products. The latter part of this period was dominated by the need for raw materials for a growing pulp and paper industry, and a drive towards mechanisation and more intensive forestry, with interventions such as fertiliser and chemical brushwood control. During this period, the volume of standing forest almost doubled, while harvesting sat at around estimated annual growth. Although Sweden's forests make up less than one percent of global forest land, Sweden accounts for about 10 percent of the global market for many forest products. Continuous increases in productivity have been an important factor in developing and retaining Sweden's share of

the global market. In the space of sixty years, productivity rose from two to more than 25 cubic metres per day of work (figure 2).

One, often highlighted, success factor is diversity of forest ownership and the variety of actors in the market, from small private landowners to large state ownership and private industry. In this respect, the forest owner movement that developed in the 1930s has been particularly significant for enabling competitive forest ownership and farming.

Figure2



The development of productivity in Swedish forestry expressed in volume m3 net felling on private land and company land per day of work. Here, days of work represent both forest management and harvesting.

Source: Skogsforsk

Deregulation and more focus on all aspects of sustainability

The 1980s onwards

Initiatives for national market liberalisation deregulation to address the production surplus in agriculture in the late twentieth century rapidly had to give way to the EU Common Agricultural Policy (CAP) when Sweden became a member of the EU in 1995. The common market for agricultural products in the EU brought with it opportunities and challenges for Swedish farmers. It became clear that Sweden's agricultural sector was poorly equipped to cope with competition from other EU countries, which led to declining or stagnant production and profitability problems for the majority of production sectors. However, step by step, the EU's agricultural policy was soon deregulated, whereupon what was produced was increasingly steered by consumer demand, and the prices for several agricultural products approached global market prices. Farmers in the EU were compensated for lower prices through direct income grants in relation to the size of their agricultural land holdings.

In forestry, far-reaching mechanisation and the large-scale approach aroused growing attention from environmentalists from the 1970s onwards. In parallel with this, new expertise evolved and improved the effectiveness of regeneration without the use of pesticides. In addition, machinery became more flexible, enabling a reduction in areas where clear felling is carried out.

After the stringent production-focused legislation introduced in 1979 (where forest owners could be ordered to fell mature forest), the revised Forestry Act of 1993 was a clear turning point. As in today's Sustainable Development Goals (SDGs), social and environmental assets in the forest were ranked as being equally important as production targets. At the same time, forest owners were given greater freedom to choose how their own forests were to be managed. Despite milder legislation in this respect, productivity continued to increase, presumably thanks to technological development and improved forest management and processing. The positive trend in productivity was broken after 2005, however. There are doubtless several interconnected reasons for this but no broad conclusive analysis has been carried out as yet.

Recent decades have seen increased emphasis on the ecosystem services that forests provide. Besides pressure brought to bear in Sweden itself, the EU's Water Directive, international conventions on biodiversity, the climate challenge, and, most recently, the Sustainable Development Goals in the 2030 Agenda have been driving factors. An intense debate is currently raging about the kind of development desired to optimally meet the goals of Swedish forest policy.

THE FUTURE: Can major challenges be tackled with support and without regulation?

Although there are major needs for changes in order to to tackle the transition to economically, socially and environmentally sustainable agriculture and forestry in Sweden, there is little interest in seeking a return to market regulation and detailed management. In the forest sector, the government and the industry itself are conducting extensive research and innovation to increase productivity and produce new products in order to maintain and improve competitiveness. Work on a Swedish food strategy identified the same needs for the agriculture sector. Many national challenges in the 2030 Agenda coincide here: not only increasing domestic food production and developing new industrial materials for the forest industry, but also the problems of earning a living and finding employment in rural areas, biodiversity, adapting to climate change, cutting emissions, water conservation, etc. One central challenge is the generational shift in land-based sectors. Is there perhaps a paradox in that many young people perceive using the land and the forest for production as a threat to the environment, while genuinely seeking a route towards a more resilient and bio-based society?

In 2017 a food strategy was adopted for Sweden, with the overall objective of a competitive food supply chain that increases overall food production while achieving the relevant national environmental objectives. Sustainability in all three dimensions – environmental, social and economic – is key. Internationally, Swedish agriculture is comparatively environmentally friendly. It also has a very low consumption of antibiotics as a consequence of Sweden applying good animal welfare practices. Sustainability can be a competitive advantage when the number of informed consumers is growing, but it is essential that farmers and growers receive enough payment for what is produced. The rules applied in Sweden produce certain cost disadvantages, although there are also other reasons why the costs of Swedish agriculture are high compared with competing countries.

A constantly ongoing global process that increases long-term sustainable productivity is necessary if we are to attain the Sustainable Development Goals. Investment in research and innovation is undoubtedly an important component. Structural rationalisation and measures to increase the value of food products are other important elements in agricultural development. Ultimately, it is the opportunity to earn money from farming that will determine the future of this sector. However, society has a responsibility for contingency planning and in line with growing international uncertainty, the role of Swedish agriculture in safeguarding the national food supply is once more on the agenda.

ANTIBIOTICS

Antibiotics are one of the most valuable drugs we have. We have long taken it for granted that we can use antibiotics to treat bacterial infections, but antibiotic resistance is growing, partly due to us using antibiotics incorrectly, by overprescribing, or by prescribing for preventive use or to promote growth. Resistant bacteria are a rapidly growing threat across the globe, affecting people, animals and the environment – and thus also our global food supply. When people or animals are infected by resistant bacteria, a disease can become hard or impossible to treat.

Combatting the spread of antibiotic resistant bacteria is therefore a matter of life and death on many levels. In 1986, Sweden was the first country in the world to ban all use of antibiotics with the aim of growth promotion. The initiative behind the ban came from the Federation of Swedish Farmers, LRF. The same ban was introduced throughout the EU in 2006. Sweden has long worked to prevent illness and injury, and the use of antibiotics is very low. We have the lowest use of antibiotics in livestock farming in the EU. We also have fewer problems with antibiotic-resistant bacteria in animals compared with many other countries.

In 2018, Sweden's first national forestry programme was adopted, with targets in five focus areas[2]. One central sustainability issue for the future is whether forest raw materials will be sufficient to meet all new needs, not least the replacement of fossil-based materials and fuels. However, there is also demand for other forest assets; with the right conditions and investment, for example, in some locations ecotourism could provide far greater income than traditional production of raw materials. Will the idea of balancing many assets from the same land be abandoned in favour of specialisation to achieve high levels of production and greater productivity, or to focus on social assets or high levels of natural assets in specific locations? Will freedom under responsibility as set out in the Forestry Act of 1993 be curtailed by governing interests in society, or will market development in the forest sector be capable of meeting national and global needs in the future?

[2]1. Sustainable forest management with greater climate benefits
2. Multiple uses of forest resources for more jobs and sustainable growth throughout the country
3. World-class innovation and processed forest products
4. Sustainable use and conservation of forests as a profile issue in Sweden's international cooperation
5. A knowledge leap to ensure the sustaina¬ble use and conservation of forests

Examples from Sweden

Reflection, the resources of the farm and market-oriented innovation – beef farmer Agnes Jörgensen talks about her strategy for the future

Agnes Jörgensen, Slåtte naturbeteskött

My name is Agnes Jörgensen and I am 29 years old. I grew up on the family's beef farm in Alsen in Jämtland, the farm I am about to take over. Today I spend 50 percent of my time working on the farm and the remaining 50 percent working in the regional office of my farmers' organisation. My father still runs the farm, but the idea is that we will soon switch roles. I will take over the farm and dad will step aside a little and work less.

The challenges; time, money, profit

My father put a lot of thought into the investments he made in improving the farm the whole time he was running it. On our farm it has always been important that the investments lead to more efficient use of our resources. Dad has always had a sharp focus on cutting costs and earning more money by making the work on the farm easier, hence reducing the number of working hours. But for him, the most important thing has always been to make sure the animals are well looked after.

That's a philosophy I share! The business must be sustainable in every respect – from a climate perspective, a financial perspective and an ethical perspective. With that in mind, the focus then becomes ensuring that production is as natural as possible, based on the resources available. This is something I've been pushing even harder since I came on board. What I mean is that the cattle must be reared in a way that is as natural as possible. Their conditions should ensure that they have everything they need to be healthy and happy. That makes it resource-efficient too. In purely practical terms, it's about making sure that it is easy to keep things clean, that the cattle have access to food and water round the clock and receive a lot of love. It costs in the form of working hours but pays off in animal health, lower veterinary bills and low use of drugs.

All this is about having made and continuing to make the right investments. It can involve major financial challenges. And here it is important to make the most of our natural circumstances and resources. We have rainwater and in the summer, we have lots of hours of sunshine, which means that a lot of grass grows. If we manage it right, we can transform the grass into nutrient-rich food.

I believe in the cattle spending long periods outside and being able to graze a lot, partly for animal health and partly to benefit the climate. Our animals are out to grass for as much of the year as possible. Even when the cattle are inside for the winter, they have access to a field. For us it's important that the animals graze because that's one way we are doing our bit towards a world that is rich in biodiversity.

To sum up, our focus on natural production leads to healthy animals, a healthy climate and healthy finances.

Innovation in relation to customer contact and better prices

It is important to constantly analyse your business and see what can be even better. We have identified some things that are outside our control, which make us dependent in a way that creates uncertainty and sometimes higher costs. If we farmers are to get the most out of the work we put in, I think we need to be actively involved all the way to the end consumer. We avoid intermediaries as far as we can to retain a good margin, but also because customers appreciate having that personal contact. It can be challenging for many people/farmers to take their product to the market without a middleman. Sometimes it

Agnes Jörgensen and her father at the farm.

can be easier to start by going via a retailer, say, before then switching to delivering to customers directly. It takes a great deal of work to build a relationship with the customer and the market. We have not marketed ourselves in any way other than creating a good relationship with one customer first, after which satisfied customers have then brought in more. And we have let it take time. It is important to have the personal touch, deliver on time and keep the customer informed about deliveries. We had an inquiry from a chain of shops interested in buying virtually all our meat but we think putting all our eggs in one basket would make us too vulnerable. From a marketing point of view, however, it can be a good idea to sell a small amount in large supermarkets. But at the moment we aren't doing that. I think direct contact between consumer and producer is valuable. It is especially important to build customer relationships when you are producing food. The relationship also means that customers see a higher value in the product.

Our latest investment also has to do with the analysis we conducted of where we are dependent on others and our associated costs. As a result, we have invested in our own abattoir. The abattoir means we ourselves have control of the whole chain, from the birth of the calves until slaughter. The abattoir also means we have further strengthened the sustainability of our business. There is no need for transport and the animals are always in their home environment, cared for by us all the time. Our profitability has increased over the years, and the idea is that it will improve even more now that the abattoir is up and running. Our aim is to build up a brand that showcases our quality and our sustainable meat. Our way of working has improved the quality of the meat we sell, and it feels absolutely justified to charge a higher price for our products.

Naturally, getting the business to where it is today hasn't come cheap; a great deal of time and money have been invested in it. But this has been done over a long period. I think not being in a hurry and instead letting the company develop over the long term is an important success factor.

The future lies in resource efficiency and a more business-minded approach

Obviously, there are challenges ahead. One challenge is the transition from one generation to the next. A lot of things have to go well. My dad needs to feel good about handing over, we children need to feel good about taking over and it has to be profitable for the business. We have chosen to bring in expert help at an early stage before we make the switch to find the best way of doing it. You have to keep the emotional aspect in mind.

When it comes to the climate, there is hardly any industry that is as affected by the weather as farming. I am most worried about more extreme weather and about some diseases that we have been protected from so far starting to flourish up here in Jämtland. On the other hand, if it gets a bit warmer and more humid, this would mean more grass and longer grazing periods. When it comes to the challenges I have seen so far, since I

became more involved in decision-making on the farm, the main one is all the regulations you have to keep up with. There is a big worry about getting something wrong when you are introducing changes and making investments. Other questions that are important to consider are how much feed we manage to produce and how long the cattle are able to graze.

But the career I have chosen is extremely attractive to me. It is all about freedom, responsibility and the work environment. There is an incredible freedom in being able to manage your own time and have days filled with so much variety, working in different places on different tasks.

"I am also driven by the sense that there is a future in sustainable production."

I will continue to work in the direction we have decided upon, with as natural production as possible where the investments made are carefully considered in terms of contributing towards resource efficiency and more sustainable enterprise. I believe in a future where we farmers are better at working with our brands and producing in as sustainable a way as possible. Instead of only focusing on production and amounts, we must be innovative in our efforts in relation to the market and the consumer. If we are to still be here in ten years' time, I believe that the innovations in my industry, alongside the improvements in technology that will give us a certain amount of help, will be about finding a resource-efficient way of working that leads to natural production.

About Slåtte naturbeteskött

Started 1990, (suckler herd from 1994)
We have about 250 hectares, 50 hectares of which is grazing, 50 hectares is forest grazing, and 150 hectares of arable land where we grow grass plus some green feed. Approximately 100 suckler cows.
We sell veal meat boxes to about 200 people.
We built our own abattoir which was completed in 2018.

www.slatte.se/

Many challenges and opportunities for rural areas – a return to multiple use in the forest?

Leif Öster, Forest owner

Sweden has an impressively large number of companies in relation to the size of its population. Perhaps this also shows how business-friendly our country is. When my family became forest owners 30 years ago, we also became business owners with a separate company tax code. This encapsulates what land and forest ownership has always been about, i.e. being the basis for the owner's income. Our property has changed ownership over the centuries but the aim has remained the same; providing the owner with a way of making a living. In the past, the owners were perhaps mainly farmers, but today our agricultural land is leased out and our focus is on the family's forest. But, to me, calling us forest owners sounds very passive. I prefer to call myself a forest manager.

Where we live and work, two hours by car north-west of Stockholm in southern Dalarna, people have constantly farmed the land for 6,000 years. So my wife and I are just two people in an endless line of tillers of the soil. What sort of business the next generation will have, we do not know. But we know that the pace of change in the countryside is speeding up. For the first 5,000 years, the focus was on producing food. A thousand years ago the population here also started to develop mining. The forest became a source of energy, not just for the home but increasingly for extremely extensive charcoal production. Out of this gradually developed modern forestry, which has long been focussed on producing timber for harvesting. Both agriculture and forestry have become increasingly efficient. Farming and forestry are carried out by fewer and fewer people.

Dalagård. Photo: Leif Öster

On our land there are two old ironworks so we definitely know that wood was turned into charcoal for the vast needs of the mining industry for at least a thousand years. Up until 1808, the village's forest was collectively owned but then it was divided up according to how much enclosed land each farmer had. We know this because since 1640 Sweden has had one of the world's best land survey authorities. Sweden has a simply fantastic system of recording who owns which property and which forest. This can be said to be an often-forgotten fundamental factor in forest ownership.

So when we became the owners of our property 30 years ago, our plan was to manage the forest rationally in line with the textbooks. That means that after harvesting we have to prepare the land, plant seedlings and clear twice so as to create productive forest which is then able to keep growing for 70 to 100 years. At least that was our plan. Sweden used to have a specific act which regulated the purchase of land and forest, a land acquisition act. But in 1990 it was abolished for most of the country's property. This created many new buyers for agricultural land but not more sellers, and resulted in 30 years of constantly rising prices for farmland and forest in Sweden. In this part of the country, the price of forest land has risen fivefold, while arable land is now worth 10–12 times as much as before.

The challenge

The big question for me, as someone who lives in the Swedish countryside, is where the rural income and jobs of the future will come from? What will our children and grandchildren be able to do? The price of animal products, grain, milk and timber has fallen in real terms in our 30 years as farmers and forest owners. Basically, all raw materials produced in the countryside are falling in price by an average of one percent a year. We producers can partly compensate for this by producing more from the same land area. But increased production with less resources almost always demands major investment in machinery, digitisation and robotisation. And here, capital supply is a growing problem. Almost no agricultural investment can be fully funded by loans. The banks usually want the farmland or forest as security, not buildings and production facilities. Another disadvantage of this trend towards increasingly larger but fewer production facilities is that out of the 20 jobs that existed in the green industries after the Second World War, only one job exists today. Basically, it is the land that is valuable, not the production. There is a saying in rural Sweden, "the landowner lives poor but dies rich".

The future

There is no reason to believe that the price of raw materials that rural areas produce will rise dramatically. So we need to think again and think on new lines. Personally I believe that Sweden's large number of lakes and watercourses with fresh water can be a huge resource in the future, in a world with global water shortages. It is particularly important to prioritise good water conservation in all land-based industries so that we do not saw off that branch for future opportunities.

Recreation at Dalagård. Photo Leif Öster.

To create more jobs and higher incomes, further processing of the forest raw material is something Sweden should develop more. I can imagine that carbon storage and other ecosystem services in the future will be goods from the rural areas that society will be willing to pay for.

There is much to indicate that the entrepreneurs of the future will either be even more specialised or become a sort of "combinators", working with and combining many different types of service and production during a working year. We simply have to create a broader concept of multiple use of all the resources of rural areas.

SKOGENS MÅNGBRUK

In spring 2019, a group of entrepreneurs started a new kind of association (Skogens Mångbruk) to become a network for multiple use of the forest. The idea is to build a strong network for providing and sharing information about multiple use. www.skogensmangbruk.se

Tourism as a solution

There is one sector that is growing faster than most others in the world and that is tourism. The tourism industry is now the biggest industry in the world, growing globally

by 4–6 percent a year. In Sweden the countryside and rural areas are part of what attracts nine out of ten foreign tourists. The rapidly growing nature tourism movement is a very exciting opportunity for rural Sweden. Jobs are being created in this area for young people, women, and people born outside Sweden to a greater extent than in the majority of other industries. These are groups that are incredibly important for rural areas. But the rapid development of tourism also makes new demands of society to be able to handle both over-exploitation of certain destinations and the climate burden of the industry itself. Every year more than a billion people are transported from one place to another. Hopefully somewhat reduced international travel will be compensated for by more Swedes enjoying a "staycation" in our own fantastic country.

My own family is therefore making a broad investment in tourism in the form of a small-scale, organic farm conference centre. The new business will be an excellent complement to our other operations. Because in the end, it is the combined income from all the farm's assets that counts.

About Leif Öster and Dalagård

Leif Öster has a former career as head of information in the forest industry but now runs his own forest and nature tourism business. The family farm, Dalagård, is a small-scale farm conference centre in the middle of the forest in southern Dalarna. Here Leif and his wife Cecilia make multiple use of all the forest's ecosystem services. Having several things going on reduces the risks when the market's demand for conferences or wood changes. Dalagård is in the middle of a UNESCO biosphere area with very high cultural and environmental values and sets great store by protecting the environment. All operations must be ecologically sustainable. Dalagård is a member of the Swedish ecotourism organisation Ekoturismföreningen which seeks to encourage tourism that protects and takes responsibility for our fragile natural and cultural environment in Sweden and abroad. A subsidiary goal of their environmental work is to create local development and employment.

www.dalagard.eu
www.skogensmangbruk.se

Sustainable Supply Chain for Food – business-driven collaboration for sustainability from field to fork

Claes Johansson, Lantmännen

"Collaboration throughout the entire value chain is an obvious success factor for driving development in a sustainable direction. Succeeding with this in practice demands good collaborative forums and platforms in which we can develop goals, frameworks and tools together. This is what the Sustainable Supply Chain for Food initiative is all about, which is why the farming cooperative Lantmännen has chosen to get involved in developing Sustainable Supply Chain for Food together with the retail sector and other food producers."

Claes Johansson, Head of Sustainable Development at Lantmännen

The food security is a cornerstone of every society, and access to food is a fundamental human need and a human right. It has long been an accepted fact that food is central to society. In recent years, food has also become a key question when discussing issues crucial to the future. We are seeing global population growth and greater prosperity, which means that demand for food is growing. About a quarter of the total global climate impact is caused by today's food consumption and the production systems behind it. Furthermore, food consumption affects other sustainability aspects such as biodiversity, eutrophication and depletion of natural resources. On global terms, more than 800 million people are afflicted by hunger, while illness and non-communicable diseases linked to food are becoming increasingly common and 1.4 billion people are overweight. We consume more than the planet is capable of providing in terms of resources in the long term, and social problems are created when food is distributed unequally.

Several of the Sustainable Development Goals seek to address these challenges and therefore have a major bearing on the Sustainable Supply Cain for Food initiative.

The challenge

It is clear that food systems need to be changed and improved. We need to produce more food and also produce and consume it in a way that is compatible with the limits set by available resources. These are by no means easy questions to solve and it will take a plethora of more or less extensive changes and investments to succeed. The food chain is complex by nature, and the chain from field to fork incorporates a number of different actors who are mutually interdependent while simultaneously competing with each other for thight financial margins in the food value chain. The pressure on prices at the consumer level affects developments all the way down the chain, and farmers especially have been forced to put their production systems under hard pressure to cope with the competition and meet the large demand for cheap food.

The challenge is so great and so complex that no single actor can be expected to solve it alone. The task of primary production and the food companies is to develop production systems in a more sustainable direction, and the task of the retail side is to improve the sustainability performance of the range being sold. These two challenges depend entirely on each other, which is why a collaborative approach is vital to drive development in the right direction sufficiently fast. The commercial debate between food companies and retailers also needs to be expanded to include important sustainability aspects.

Innovative solution

On the initiative of stakeholders including the farming cooperative Lantmännen, in 2015 ten leading Swedish food companies and the World Wide Fund for Nature in Sweden (WWF Sweden) set up the Sustainable Supply Chain for Food initiative to work together to tackle the sustainability challenges in the food chain. The group now comprises 15 companies representing the retail sector and its suppliers. Sustainable Supply Chain for Food brings together leading companies that actively take responsibility for making the transition to a more sustainable food chain. The initiative seeks to inspire and engage other companies to contribute to a more sustainable food chain in Sweden. Through constant

"Sustainable Supply Chain for Food has been awarded the prize for energetically bringing together industry, food retailers and WWF Sweden in an exemplary partnership to create definitions and goals, develop practical tools and set out a joint roadmap for a more sustainable food chain by 2030. This is a unique collaboration with the vital awareness that cooperation throughout the entire value chain is necessary to ensure that the food needed by a growing population is supplied within planetary boundaries."

improvements and by openly encouraging and showing the way, the aim is to demonstrate that the food sector is part of the solution and that by working in partnership we can contribute towards ambitious and positive change.

The participants in the initiative currently comprise 15 key actors: Arla, Axfood, Coop Sverige, ICA Sverige, Fazer, Lantmännen, Löfbergs, Martin&Servera, Orkla Foods Sverige, Paulig, Polarbröd, Pågen, Hk Scan Sverige, Tetra Pak and Unilever. These actors are responsible for a large proportion of the commercial interface with the end customer and consumer as well as a significant proportion of sales in the Swedish food industry. The target is to contribute towards considerably more sustainable food production and consumption in the Swedish food chain by 2030.

At the same time as the companies share this long-term ambition, in many cases they are also competing against each other. One important element in this work has therefore been to identify concrete issues on which they can work together despite their opposing business interests. The work of the initiative has been focused on creating a shared vision and roadmap for the changes required.

Together, Sustainable Supply Cain for Food initiative seeks to:

- Increase the speed of the transition to more sustainable food production and consumption
- Act here and now to attain the long-term goal of a sustainable food chain by 2030
- Inspire and encourage consumers and other actors in the food chain to act for more sustainable food production and consumption
- Increase companies' responsibility for people and the environment
- Increase transparency in the food sector and thus consumer reassurance and trust, so encouraging sustainable choices.

What has the initiative led to?

To achieve this, the initiative has produced a Roadmap for a Sustainable Food System 2030 in which relevant goals are set out for the food chain as a whole, and also for particular sectors. The work draws on existing frameworks such as Planetary Boundaries, the Sustainable Development Goals, the WWF Sweden Report "Sustainable Food for All" and the Swedish National Food Agency's dietary advice, and serves as a long-term compass for the initiative, quantifying target levels that are relevant from a 2030 perspective.

One key element in Sustainable Supply Chain for Food is making food products more sustainable. An important issue in this respect is clearly defining what the significant sustainability aspects are in each respective category and creating tools to enable this knowledge to be translated into action on the ground. This work has been completed for all common categories of raw materials: cereals, dairy products, meat and processed meat products, wild and farmed seafood, fruit and vegetables, vegetable oils, sugar, coffee, tea and cocoa.

In an initial stage, a materiality analysis was produced for each category to serve as a shared knowledge platform and a basis for a relevant sustainability discussion between commercial partners. This sums up what the companies in the food chain need to address for the respective raw materials categories to be sustainable in the long term and the specific questions that are currently relevant.

The next most important step for members is to be able to translate knowledge into action and jointly make progress with their business partners. To achieve this, a sustainability agenda has also been produced for each category. This builds on the need to tackle the sustainability question from two directions.

In each category there is a number of high-profile products with clear added value in terms of sustainability, e.g. via different types of certification or other credible concepts produced by progressive companies. There needs to be more products and a greater volume of products that are best from a sustainability perspective – "Growing the top". That creates incentives to continue development and drive the innovation process in a sustainable direction. Having a shared definition of the products that qualify for this top level creates an opportunity to set shared goals for how this part of the category is to be developed through the value chain.

At the other end of the scale, in each category there are products that are worse from a sustainability perspective, with low requirements on key sustainability aspects where the fundamental requirements made of the production process need to be made more ambitious. This takes the form of a number of critical criteria that each product should meet to be at a responsible level. "Raising the bottom" means improving the lowest level and phasing out the products that perform the worst in terms of sustainability so that the range of products is raised to a more sustainable level.

In this way, the companies gain specific guidance in what they need to do to achieve more sustainable products in the food value chain, a shared framework for a more effective commercial dialogue and a system that makes it possible to show progress.

Openness is an important principle in the initiative. All documentation that is completed is uploaded to the initiative's website and can be used by anyone else. The initiative also has clear rules for the type of information that can be shared such that there is no risk of breaching the competition law. The Sustainable Supply Chain for Food initiative was awarded Sweden's Food Prize in September 2018.

About Lantmännen

Lantmännen is a farming cooperative and the leading actor in northern Europe in farming, machinery, bioenergy and food. We are owned by 25,000 Swedish farmers, employ 10,000 people, operate in about 20 countries and have a turnover of SEK 45 billion a year. Based on cereals, we process the resources of arable land to make farming thrive.

Some of the best-known brands in food are AXA, Bonjour, Kungsörnen, GoGreen, Gooh, FINN CRISP, Korvbrödsbagarn and Hatting. Our company is founded on knowledge and values that our owners have held for generations. Through research, development and operations throughout the value chain, we take responsibility together from field to fork.

www.lantmannen.com

Lantmännen

HÅLLBAR LIVSMEDELSKEDJA

The Sustainable Supply Chain for Food initiative's members include Tetra Pak, a member of the Swedish FAO Committee. According to Erik Lindroth, Sustainability Director of Tetra Pak Nordics, sustainability work has always been about the whole picture, both in the company and as part of a wider context. In his view, Tetra Pak's work seeks to break dependence on fossil resources, reduce environmental impact throughout the value chain and increase recycling to take us further down the road towards a low-carbon circular economy. The complexity of the sustainability challenges demands more perspectives and knowledge from many actors. For Tetra Pak, it is therefore natural to join companies with a wide knowledge of the challenges in the food industry in the Swedish Sustainable Food Chain initiative.

True change demands knowledge of one's own responsibility but also of how the solutions improve the result for others. It is all about business development on a basis that is sustainable in the long term. Together. For an increasingly sustainable food chain.

Erik Lindroth
Sustainability Director, Tetra Pak Nordics

Sweden in the world

For the next generation of coffee lovers
– Löfbergs invests in encouraging young coffee farmers with a focus on sustainability.

Anders Thorén, Löfbergs

It is Tuesday morning and the mist is slowly lifting in the small mountain village of Heliconia in Antioquia in north-west Colombia. We are on our way to the home of Emilio Gonzalés, one of the participants in Next Generation Coffee, an initiative Löfbergs is running to improve development opportunities for the next generation of coffee farmers.

"The training and the support I get means a lot. I used to grow coffee; now I am a passionate coffee farmer," says Emilio.

Emilio Gonzalés one of the participants in Next Generation Coffee, an initiative Löfbergs is running to improve development opportunities for the next generation of coffee farmers. Photo: Löfbergs

It is true that coffee means a great deal to very many people, farmers and consumers alike. 25 million people support themselves and their families on coffee farming. And around the world we drink about 1.4 billion cups of coffee a day. But there are dark clouds on the coffee horizon. According to The Climate Institute, there is a risk that half of the land on which we farm coffee today will be unviable by 2050 due to the climate crisis. At the same time, the average age of coffee farmers around the world.

When we visit the people who supply coffee to us at Löfbergs, we can see with our own eyes how the climate crisis is making it harder to make a living as a coffee farmer, and that this is leading to fewer and fewer young people seeing a future in coffee, something that threatens access to good coffee in the long term. This is why we started Next Generation Coffee, an initiative in which we improve opportunities for Emilio and other next generation coffee farmers through training and buying straight from the farmer.

A lot has happened since our last visit to Emilio. He tells us about the investments he has made and how the new things he has learned have led to him being able to develop his coffee plantation. Emilio is one of 550,000 coffee farmers in Colombia. Coffee is an important part of Colombia's culture and economy. Colombian coffee has a good reputation, and export brings in important income for the country and its population. But as in many other places, the average age of farmers is high, around 60.

Starts the day with a cup of coffee

Emilio says that he is a bit tired after a football match at the weekend. He plays with his friends every Sunday. Otherwise Emilio's life mainly revolves around farming coffee. From morning to night.

"I wake up at five and always start the day with a steaming cup of hot coffee on my veranda. Then I go down the steep path to my coffee farm. It takes about 15 minutes. I am usually very busy there the rest of the working day."

A few years ago Emilio thought about trying his luck in Medellin, the second largest city in Colombia, which is a few hours' drive from Heliconia.

"But when I was given a plot of land by my parents, I changed my mind. It was tough to start with but I have learned a lot and been able to develop my business."

Emilio farms coffee on 0.65 hectares of land, about the size of half a football pitch. He often works with his brothers. All the coffee is picked by hand and he hires a couple of extra pairs of hands at harvest time.

"Creating jobs for other people is one of the things that drives me. It's a way I contribute towards developing Heliconia."

Photo: Löfbergs

As in the other development projects we run, we work with other actors in Next Generation Coffee. Working together means we involve more people and get more out of the effort we put in. In Colombia it was natural to turn to Federación Nacional de Cafeteros (FNC), the national organisation for Colombia's coffee farmers. They help us with practical matters and contacts with the participants. Together we have set a number of targets that we are working to achieve.

Emilio and the other participants are visited by dedicated contact persons on a regular basis and once a month or so he meets other young farmers to swap ideas. The training he receives covers everything from sustainable farming methods and quality assurance to marketing and other issues useful to self-employed entrepreneurs.

Climate crisis a challenge

This year the harvest is late. The effects of climate change are clear, and many unripe, green berries are still dangling on the coffee bushes, which are normally teeming with ripe, red berries at this time of year.

"This means a lot of extra work. The harvest is extended because we need to pick the berries over a longer period of time. I can't leave it until they are all ripe, as that increases the risk of damage to the ripe berries, so we have to pick the ripe ones every day."

Tackling the climate crisis is an important part of the training Emilio receives via Next Generation Coffee.

"I have learned to do soil analysis, fertilise the soil correctly and have been given help with planting new varieties of coffee plants that can better cope with climate change. This means that my bushes are producing more, better coffee beans."

As Emilio's income increases, he is able to invest more in his business. Since we were last here eighteen months ago, he has planted 2,000 new coffee plants and built a new drying plant.

"I'm investing so I can be even more successful. This will mean I will be able to create more jobs and my family and I will be able to live a better life. That feels great."

Löfbergs' operations have a major impact on many of the Sustainable Development Goals of the 2030 Agenda. This means we have excellent opportunities to contribute towards socially, economically and environmentally sustainable development in many countries around the world. Particular attention is afforded to gender equality. For example, we run seminars for couples where the woman and man in the family share a training session. We have seen that this leads to work in the home and on the plantation being shared in a better way, making the couple more successful and bringing in higher earnings.

In Colombia, Next Generation Coffee also has a link to the Sustainable Development Goal on peace, justice and strong institutions. Armed conflict between the Government and the FARC guerrilla had a major impact on Antioquia. Many people abandoned rural areas and moved into the towns where it was difficult for people to earn a living, with widening social gulfs and instability as a result. Those who stayed in the countryside were unable to farm their land, and knowledge that was normally passed on from one generation to the next was lost. Next Generation Coffee rebuilt this expertise, making it easier for people to improve their living conditions and their lives in rural areas. Participants are therefore also contributing to peacebuilding in Colombia as role models and change leaders.

Sharing knowledge

Emilio explains that he and the participants in Next Generation Coffee meet regularly and share their expertise and skills on everything from farming methods to finances and entrepreneurship.

"It is valuable for us to meet and learn from each other. I have become known for my quality and it makes me very proud when other people ask how I have succeeded this well. I believe that a lot of it is about the passion I feel for my coffee farm and the fact that I want to improve all the time."

Emilio's passion is unmistakable. His eyes light up when he talks about everything he has done and is doing to continue to develop. Before we say goodbye, he says that he wants to do something no-one else in Heliconia has done before:

"I'd like to buy a machine so I can roast my own coffee. That way I would learn even more about flavours and qualities of coffee and I think it would help me to get even better. It might sound a bit mad but you have to have a dream."

The view from Emilio's farm is magnificent. Photo: Löfbergs

About Löfbergs

The Löfbergs coffee roastery is a family business founded in 1906. Today it has close to 400 employees who share a passion for flavours, trends and sustainability operating in northern Europe and Canada. The company has an annual turnover of SEK 1.9 billion and is one of the world's largest purchasers of organic and Fairtrade coffee. Löfbergs also runs its own development projects which improve development opportunities for small-scale coffee growers.

www.lofbergs.se

Facts about Next Generation Coffee
An initiative in which Löfbergs improves development opportunities for young coffee farmers. Participants gain support through education, training and direct trade. We place a great deal of focus on tackling the climate crisis, increasing productivity and quality and improving so that growers earn more money. The initiative is geared towards young growers in Kenya, Tanzania and Colombia.

www.nextgenerationcoffee.net

A ten-year journey towards sustainable farming – We Effect's work with agroecological methods in Latin America

Ricardo Quirós, We Effect

In the past ten years, We Effect has been running a rural development programme in six Latin American countries. The programme has mainly promoted the use of agroecological methods in We Effect's partner organisations; mainly farmer cooperatives, women's organisations and indigenous peoples' organisations.

Initially, the work was focused on soil improvement through measures including composting, green fertiliser, use of mulch, growing on terraces, contour farming and ditch digging.

Promoting agroecology was a seed literally sown in fertile soil among the individual farming families, partly because it leads to lower production costs and is ideal for family farms. The programme also helped to reintroduce and promote traditional methods and skills which had previously received no recognition from conventional agronomy (e.g. using traditional crops better suited to the climate). Because the production methods draw on technical solutions and techniques that are better adapted to poorer economic conditions, the programme has helped small and family farms achieve greater independence. The agroecological methods also involve diversification and are adapted to the target group in line with local needs and production system requirements.

Those of We Effect's partner organisations that produce and sell coffee, and that already had some experience of organic production immediately integrated new technologies such as agroforestry, shade farming and cutting and planting techniques. This led to rapid improvements in coffee production and also met a number of certification requirements.

When producing vegetables and other crops mainly intended for one's own consumption and for local and domestic markets, methods were introduced (or reintroduced) such as crop rotation, agroforestry, the use of worm compost, fermented compost (bokashi), growing pest-repelling plants and other pest prevention techniques that do not require extensive use of chemicals. These methods enabled small farmers to cut their costs and increase their productivity. This approach can also lead to farmers gaining access to new business segments and markets such as organic markets and farmers' markets.

As the partner organisations have expanded their skills and techniques, the demands on We Effect have increased. The programme was therefore extended by bringing in more experts and institutions specialised in agroecology and sustainable farming.

Ramona Gurdian is a member of a coffee cooperative in Nicaragua. Through PRODECOOP, a partner of We Effect, and their work on agroecology, the cooperatives could handle the coffee leaf rust epidemic. Photo: Marcus Lundstedt

One challenge experienced so far is that the countries themselves do have agricultural experts, organisations and institutions but that these were not always prepared or able to work with small family farms or indigenous populations.

Another challenge is that the methods and techniques introduced also need to be developed and subject to further research, which requires experiments and validation by agronomists. At times this has caused a certain amount of resistance on the part of the producers and technical staff, as it incurs costs and takes time that could be spent on production itself. Research in this field has been limited.

We Effect has resolved this by supporting the organisations' own research centres and seeking support in countries other than those in which We Effect operates. So far, advisory and technical staff, producers and students on placements from Mexico, Cuba, Costa Rica, Brazil and France have been invited to join the projects. These exchanges promote techniques and new and more sophisticated methods. The results seen include the use of effective micro-organisms (EM), the production of bio-ferments (bioles), pest control using entomopathogenic fungi such as Beauvaria bassiana, and the use of pheromones for biological control. Access to products and equipment in order to set up small-scale production and research centres in local communities has been a limiting factor in this process, especially regarding what are termed "biofactories" in rural areas far from population centres.

The introduction of an agroecological approach comprises a blend of methods, techniques and types of training (courses, study visits, regional exchanges, technical assistance and work experience). Additionally, distribution of financial resources for launching new initiatives and local lobbying to enable farmers' markets to be established are also included. There is a particular focus on women's organisations looking to introduce organic farming methods.

Coffee leaf rust: a turning point

The pandemic outbreak of coffee leaf rust in Central America in 2012 was undoubtedly a turning point for regional coffee production. Within the space of a few months, large sections of the plantations were destroyed; conventional pesticides failed to control the disease. The epidemic struck large and small producers alike. The economies of Central America were hard hit by the major reduction in exports. Lower income for small and family producers plus a major increase in unemployment among seasonally employed plantation workers led to higher rural poverty.

In the midst of this bleak outlook, however, cooperative organisations comprising small coffee producers who had joined forces and signed up to We Effect's programme used the agroecological methods introduced to create lasting solutions. The pandemic was a turning

point for developing production methods further with new initiatives and experiments. The agroecological production initiatives were stepped up, and demand for alternative bio-fertilisers led to production being scaled up, in some cases almost to industrial levels. Similarly understanding of the need to diversify the plantations and also grow crops other than coffee increased, and the need to identify new varieties of coffee, work preventively and introduce sustainability criteria was recognised. These are all methods that go beyond short-term production increases and profits.

Under these conditions, We Effect's partner organisations gained a better understanding of the importance of agroecology as part of a vision of sustainable value chains. The projects introduced nurseries, sustainable planting techniques, improved and more effective plant breeding processes and a commitment to finding new niche markets with an interest in ecology and the environment.

Climate change: new challenges for sustainable agriculture

Barely was the coffee leaf rust crisis over before the region was hit by the effects of El Niño in 2014. In Central America, the phenomenon led to a severe drought which destroyed the harvests of large groups of producers. The income of small farmers was hit particularly hard, leading to greater vulnerability in rural areas. Countries in South America, on the other hand, suffered torrential rains, causing flooding and landslides, especially in mountainous areas. This led to a huge amount of damage, with families already living in poverty suffering the most.

Patricia is participating in an agricultural cooperative in noth Colombia, where drought has hit the farmers hard. Agroecology can be an effective method to meet, an adapt the farm, to climate change. Photo: Jesper Klemedsson

Faustina Carreto is a member of the Womens organisation AIGMIM in Guatemala. With support from We Effect, Faustina has learned agroecological methods, which have led to an increased production of vegetables, food security and an increased income for the family. Photo: Claudio Vasquez Bianchi

These natural disasters once more demonstrated the vulnerability of today's conventional farming model, and how urgent it is to convert agricultural systems to more sustainable methods, both from an agroecological perspective and from a climate perspective. The introduction of new technology that improves the collection and storage of rainwater, more efficient watering techniques, mulching, resilient domestic crops and seed banks are some of the agroecological innovations that the programme has promoted in recent years.

In this period, the productive systems that had already started to work agroecologically showed greater resistance to climate impact; the harvests provided the families with basic food during the drought, which in turn led to a lower number of migrants travelling to cities and other countries.

Through We Effect and its partner organisations, in this ten-year period, the programme has contributed to a growing debate on agroecology as part of the solution to the problems caused by environmental destruction and climate change. Furthermore, the programme has strengthened historically vulnerable groups such as small-scale farmers, indigenous populations and women farmers, and highlighted them as important change actors in attaining food security and diversified food production. The programme has also raised the importance of protecting original crops, traditional knowledge and customs, and the unique cosmology of indigenous peoples and traditional farmers.

We Effect has undertaken to contribute towards the Sustainable Development Goals, with a particular focus on SDG 1 (no poverty), SDG 2 (no hunger) and SDG 5 (gender equality). The rural development programme applies a rights-based perspective which takes it for granted that people living in poverty have the right to a life with dignity, access to food and an environment in which they can live. Agroecology is a sustainable farming model that involves adapting to climate change and environmental destruction. As a method for combatting poverty, it demands global responsibility and commitment from the world's leaders and decision-makers. Research institutions, the business community and consumers can and should also play their part in sustainable value chains and sustainable farming.

About We Effect

We are working to eradicate global poverty. We focus on gender equality, women and help to self-help, where people come together and organise themselves. The effect this has is more families increasing their income, putting food on the table and keeping a roof over their heads, and being able to make the leap out of poverty for good.

Our focus areas are sustainable rural development, decent housing, financial services, the right to land, environmental sustainability, building resilience and climate adaptation. We reach millions of people by mainly working with small-scale farming. Agroecology is an important method in this respect, and there is evidence that this model has the potential to build socio-ecological resilience and help to strengthen biodiversity.

We Effect was founded in Sweden in 1958 and today is found in more than twenty countries in four continents and is one of the world's biggest cooperative aid organisations.

www.weeffect.se

WE EFFECT

Is agroecology the model for sustainable agriculture? Questions and answers from Swedish and international research

Georg Carlsson, director of studies for the Master's programme in agroecology at the Swedish University of Agricultural Sciences, SLU

Agroecology is a multi-faceted concept, and has been given a threefold definition as a scientific discipline, a political/social movement and a set of practices. In research and education at SLU, agroecology is described as the study of the ecology of food systems with a focus on the interaction between different actors as well as between different biological processes, biophysical and socioeconomic conditions and their impact on sustainable development of agricultural production systems.

Since 2010 SLU offers a two-year Master's programme in agroecology which emphasises system-level understanding of economic, environmental and social sustainability dimensions in studies of food production systems. The agroecology programme is multidisciplinary and admits students with a bachelor's degree in natural sciences, social sciences or technology.

Research in agroecology covers a wide range of questions, such as how soil fertility can be preserved or improved by different cultivation methods and organic amendments, how weeds and pests can be prevented by crop diversity or how implementation of new knowledge can be improved by including concerned actors, often farmers, and their knowledge and experience in the research process. Still, much agroecological research has a common starting point by questioning modern intensive, large-scale agriculture. The far-reaching specialisation of meat and dairy production, detached from crop production, which in turn takes place in large homogenous fields and with extensive use of pesticides and synthetic fertiliser, is identified as an important cause of environmental problems in food production. Evaluations of large-scale production systems often also highlight weaknesses in social sustainability, e.g. farmers' workload and limited insight/understanding from consumers regarding how their food is produced. In an agroecological perspective, organic production is in many respects more sustainable than equivalent production in conventional systems.

Although organic production is an important driver and source of inspiration for agroecology, agroecology is not identical to organic farming. Rather, agroecology is a holistic approach with the aim of increasing sustainability irrespective of the type of production. Nor is agroecology limited to studying agricultural production; the

system perspective is very important, which means striving to include, for example, the role of consumers and decision-makers in developing more sustainable food systems. Examples of role models for agroecological research and development can be found, for example, in permaculture and agroforestry, conservation agriculture (no-till farming with varied crop rotation and permanently covered land) and alternative food distribution networks, such as community supported agriculture, farmer-to-consumer box schemes or other similar initiatives. Current research on sustainable diets has a lot in common with questions within agroecology.

Research in agroecology has generated a description of agroecological principles for developing more sustainable production methods, e.g. diversity of cultivated crops and circulation of nutrients through the integration of animal and crop production. These rely more on natural biological processes and ecosystem services, such as biological nitrogen fixing and biological pest control, and are less dependent on external inputs in the form of pesticides and synthetic fertilisers. Intercropping legumes and cereals, such as peas and oats, is one example of an agroecological practice with high resource use efficiency. The effective uptake of nitrogen of the cereal stimulates the legumes to rely on biological nitrogen fixing in symbiosis with soil bacteria, while the cereal competes more effectively with weeds. Results of research on intercropping, in Sweden and internationally, has shown that equally high total yields can be attained with lower inputs of chemical or mechanical weed control and lower inputs of nitrogen fertiliser than where the two crops are grown separately.

Another example is that the design of diversified cultivation systems, for example with windbreaks (rows of trees or bushes mixed with cultivated crops) and/or strips of flowers can increase the incidence of pollinating insects and natural enemies, making it possible to attain high yields while simultaneously reducing the use of chemical plant protection pesticides. At the same time, there are many studies showing that managing diversified agroecological cropping systems is often more time-consuming and knowledge intensive, which can make it difficult to translate agroecological knowledge into practice. For successful development and implementation of agroecological practices and principles, contributing to more sustainable food systems, it is therefore important to use a holistic and multidisciplinary approach which builds on both theoretical and practical knowledge and the experience of different actors.

Looking towards the future

New products from sustainable forestry – the raw material and labour market of the future?

Mikael Hannus, Head of sustainability Stora Enso

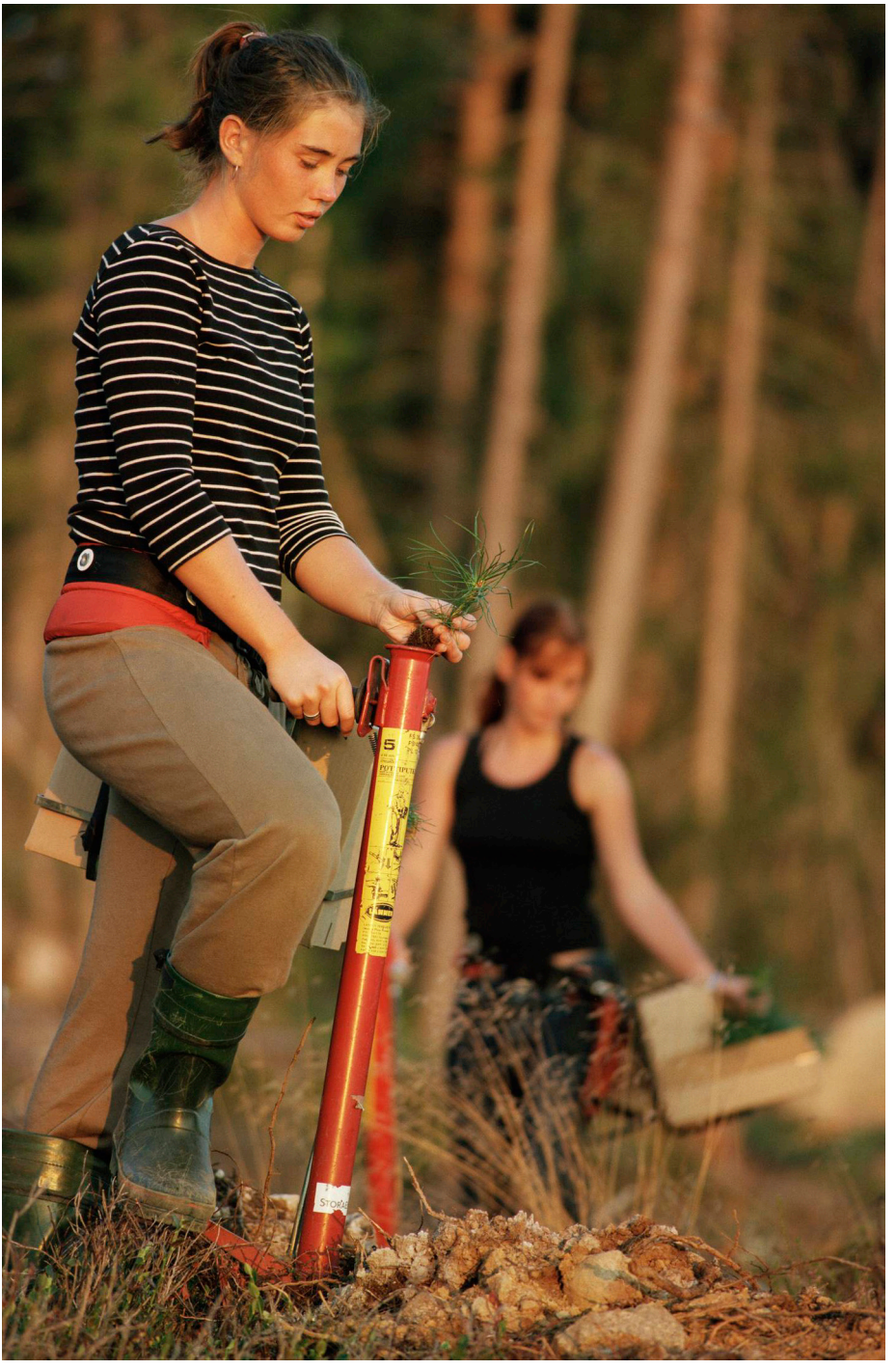
The Nordic landscape is dominated by forest. In Sweden 70 percent of the land area is forest, in Finland – where Stora Enso also operates – a full 86 percent of the land area is covered by trees. This is the result of taking long-term care of this important resource, a valuable resource pool for forest-based products today and in the future. Nordic forest management is constantly developing and sustainable forest management methods are rapidly adopted by forest owners. Growth exceeds harvesting, which has meant that the amount of wood raw material in Swedish forests has doubled in just under a century. We see this as a phenomenal basis for building a future bioeconomy. Knowledge building, research and education in universities, research institutes and companies are translating the new insights into climate-efficient, sustainable methods, products and in all likelihood more food-related solutions year on year.

Inspiring challenges

The major changes taking place in society in the form of urbanisation, digitalisation and, not least, climate change, affect the way we view the forest, the methods we use to manage it and opportunities for using it. Far-sightedness is an important watchword in forest management, as is knowledge-generation and research into forest-based raw materials, their use, properties and potential new applications. Wood as a material has naturally evolved to develop many valuable material properties, and wood also contains many interesting natural polymers and a number of special substances that have been used by humanity for a long time. The inherent biological production of trees will play an important role in meeting the needs of future generations for sustainable necessities in a competitive way. Extremely interesting research and development questions span a broad spectrum, including new, advanced material solutions based on wood, special natural chemicals, pharmaceutically active substances and food ingredients in the form of carbohydrates as well as proteins. These, and many additional substances, are basically produced from sunlight, water and carbon dioxide.

The journey to the innovative solutions of the future

The products and goods we see emerging from the forest depend on both current and future insights into how the whole value chain will be influenced and challenged by developments in society. The desire and the drive to replace fossil-based raw materials with



Planting of trees. Photo: Birger Roos.

renewables challenges the prevailing logic surrounding everything from forest management, logistics solutions and conversion processes to the use of the bio-based molecules and materials. Customer and consumer preferences and their opinions will increase interaction surrounding what biological resources are used for, why and how.

Given this trend, it seems obvious that the raw material extracted, e.g. from the forest or other ecosystems, needs to be used with care and extracting the highest possible benefit. Circular perspectives will also be important here. It is becoming increasingly important to make sure that all the parts of a harvested tree are used in the best possible way. This mix of different purposes of use, will affect the development of forest management methods. It will also effect the processing methods used by the industry and the processing value chains. The combined benefit of raw materials processing can be measured in how much fossil raw material can be replaced with renewable raw materials from sustainable forestry.

The key issue in enabling this development lies in making use of accumulated knowledge in combination with new insights on forests, forest management, wood material, refining processes, fibre properties, special natural molecules and how these can best be used and combined to tackle some of the challenges and seize some of the opportunities that humanity faces.

Long-term research with a major impact on the forest-based bioeconomy is run in Sweden at locations including the Umeå Plan Science Center at SLU and the Wallenberg Wood Science Center at KTH Royal Institute of Technology, Chalmers and Linköping University. Academia and industry have worked with public and private funding bodies to create Treesearch – a national platform for research into new materials and special chemicals from the forest. Its primary task is to deliver, within a ten-year period, 250 people trained to postgraduate level who are ready to take development further in industrialising research results from academia.

Research is building knowledge and methods for better plant breeding, e.g. through better resistance to pests and plant diseases. It is assumed that this will become more important in the light of climate change. Other fundamental research areas in which academia and industry are working together are understanding of nutrient uptake, impact on the land from forest transport, remote mapping/measurement of forest holdings, their development and need for action.

The boundless potential of the forest: from home to health

The concept of new material from the forest spans wood fibre for new areas of application, including micro- and nanocellulose fibrils, lignin e.g. for adhesives (glue, epoxy, etc.), carbohydrate complexes comprising the sugar structures of the wood

used as building blocks in chemical systems or plastic-like material, as well as various new combinations of the wood-based components to tailor, for example, formability, surface structure, and barrier, nutrient and health properties.

Continued needs-driven and knowledge-driven development of engineered wood is leading to new construction solutions in which the carbon footprint is considerably lower than that of traditional solutions in steel and concrete. The physical and chemical properties of the wood fibre offer many new opportunities, often with the help of new knowledge and insights which mean that the renewable wood fibre can once more be used for applications that in recent decades were temporarily taken over by fossil-based materials. Plants in general, and trees in particular, have their own biological defence systems that protect the plants from harm and attack. The mechanisms and molecules that build up these systems also have the potential to be used in health applications. Today there is a limited range, e.g. of wound and skincare products based on the extractive substances of trees, such as fats and rosin acids. One of our tall oil customers has worked with an animal feed producer to develop a pine rosin product that replaces antibiotics in feed. This natural application based on the biological defence mechanism of the pine tree offers major potential to reduce the use of antibiotics in chicken rearing and egg production.

What do we expect of the future?

Our direction is clear and it is leading us, step by step, to replace fossil raw materials and materials with solutions from the forest that provide equal or better properties but are based on a renewable raw material, can be recycled and are part of the natural ecocycle of carbon, oxygen and nutrients.

Besides the products we are now seeing emerge from research and development, we are convinced that active building of innovative ecosystems around our value chains will give rise to exciting and relevant new opportunities. Such ecosystems may, for example, consist of customers for the main products or by-products of a processing plant engaged in conversion to new applications. Customers may very well be start-ups or SMEs operating in niches in which their specialist expertise is an excellent complement to the knowledge and operations of the host industry. It is also likely that some by-products will form the raw material for biological processes that produce protein-rich products for human and animal needs.

The development of the circular economy will also drive the emergence of technologies, solutions and new products that we, our customers and our partners will see as quite amazing, while also being less demanding in terms of resources and remaining sustainable for the planet, the forest and humankind.

About Stora Enso

As part of the bioeconomy, Stora Enso is a leading global supplier of renewable solutions in packaging, biomaterial, wood products and paper. Our customers include packaging manufacturers, brand owners, paper and paperboard manufacturers, publishers and newspapers, retailers, printers, converting companies, joinery businesses and construction companies.

Our fibre-based material is renewable and recyclable. Our products offer eco-friendly alternatives to fossil-based products and other non-renewables. We think that everything that is made from fossil-based materials today could be made from trees tomorrow.

We are doing our utmost to use the whole tree in our products and for bioenergy. We work for carbon neutrality in our production as far as this is technically and commercially possible. We advocate and practice sustainable forest management and work to ensure that more trees are planted than are harvested.

Stora Enso has about 26,000 employees in more than 30 countries. In 2018 our turnover was EUR 10.5 billion, with an operating profit of EUR 1.3 billion. Stora Enso's shares are listed on Nasdaq Helsinki Oy (STEAV, STERV) and Nasdaq Stockholm AB (STE A, STE R).

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Softwood kraft lignin. Photo: Lasse Arvidsson

Diversified farming systems can contribute to sustainable intensification of future crop production

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Can agriculture help to attain the global Sustainable Development Goals?

Agriculture has an impact on basically all the Sustainable Development Goals in the 2030 Agenda. The major challenge for agricultural research is to simultaneously tackle the ecological, economic and social sustainability aspects. The Sustainable Development Goals are interlinked and often support and strengthen each other, but there are also examples of trade-offs and prioritisations that must be made. For example, the way crops are grown and animals are reared is currently the cause of a large proportion of greenhouse gas emissions. However, different types of land use also enable us to bind more carbon in the soil and in the vegetation, especially if we grow perennial crops and include trees and other woody plants in the agricultural landscape. Biodiversity in the cultivated landscape is strongly linked to grazing animals, while the most important types of animal from a biodiversity standpoint, ruminants, produce high emissions of the greenhouse gas methane. Future cropping systems therefore need to be designed so that they are multi-functional and produce several products and services at the same time, thus helping to meet sustainability targets in the short and the long term.

Challenges for farming

Safeguarding food supply for all, while simultaneously meeting the Sustainable Development Goals and complying with international agreements on climate and biodiversity is a huge challenge for farming *across the globe*. To improve the capacity of farming to produce enough, while preserving biodiversity, the climate and the environment, Swedish agriculture needs to be developed as part of a global food system. The relative advantages and disadvantages of Swedish agriculture seen from the perspective of global and national sustainability must be taken into account in designing political instruments.

Climate change is already causing more frequent and more intensive extreme weather events. We need to take steps to adapt to climate change to ensure sustainable agriculture and guarantee our food supply. These steps must at the same time lead to a reduction in greenhouse gas emissions and be carried out in a economically and socially sustainable way, at the same time ensuring that short-term profitability for the farmer does not diminish to the extent that production falls or ceases altogether.

Regardless of how we produce our food, the environment will be affected. The impact, however, is not always negative. Much of our biodiversity is a direct consequence of food production and arises where land is cultivated or in the borderland between agriculture and

other land use. Grazing animals are particularly important, but have decreased in numbers in Sweden over the years. *In pursuing rational forestry and agriculture, land use has become more homogenous, fields larger and biodiversity reduced.* This has consequences, e.g. in that pests spread more easily when the same crop and variety grows over large areas and where pests have fewer natural enemies, leading to an increased need for and use of chemicals in farming. The pests then become more resistant and the need for higher doses and new chemicals increases. The problem is similar to that of the use of antibiotics in people and animals.

The importance of biodiversity within species is something that receives less attention than species diversity, but it is also extremely important. Breeders are constantly working to improve crop varieties. In the long run, however, few varieties reach the stage of practical cultivation and of these, very few end up dominating. The most resistant varieties produce good yields and so become popular, with the result that their resistance is weakened fairly rapidly and the hunt for new resistant varieties continues.

Many consumers are unwilling to buy food and other products produced with the use of chemicals and we must find alternative ways of combatting weeds and pests in an environmentally friendly and energy-efficient way. Otherwise there is a major risk that measures that are positive from a climate viewpoint, such as cover crops and reduced tillage, will be replaced with more mechanical tillage, which demands a great deal of energy and increases the breakdown of organic material, i.e. has a negative climate impact.

Faba bean. Photo: Chloë Raderschall

Measures that tackle the challenges

The measures needed to tackle the various challenges can sometimes contradict each other and solutions are therefore not always easy to find. To achieve high, diversified and stable production, farming must be run intensively, and doing this without causing environmental problems means *resources must be used efficiently and we need to know how local conditions and inputs can be used to steer towards the desired goals*. Like society in general, the food system needs to be planned as a circular system. Sustainable farming cannot be created in an unsustainable societal structure. Consumption patterns, food waste and sewage treatment are examples of parts of the food system that have a significant impact on agricultural sustainability.

Animal production and arable farming need to be better integrated to ensure that the positive contribution made by animals in farming systems, such as perennial pasture, recycling of manure, and maintaining grazing land, contribute towards resource efficiency and maintain biodiversity. The direct emissions of greenhouse gases and other sustainability issues linked to animal husbandry and fertilisation with nitrogen-rich material in general also need to be tackled by research and developing technical solutions that make them part of the circular economy in the form of usable resources. The system perspective is important in evaluating what is good and bad from a sustainability standpoint. There is a need for better developed models for how local systems can be optimised in a global context.

Water is another critical production resource that we need to be better at managing and using more efficiently. There is great potential in increasing access to water during critical

Kernza–a perennial wheat. Photo Linda-Maria Mårtensson

periods by using or establishing ponds and watering systems. Ponds can also be used to prevent nutrient-rich water flowing out into the oceans and instead becoming a resource for growing crops. In the Swedish climate, much of the arable land needs to be drained so that roots can reach deeper, making the crop less sensitive to drought, and the water that is drained away can be re-used for watering later in the season.

Diversified farming systems are the key to many of the challenges and can contribute towards sustainable intensification of future crop production. This can be done by increasing crop biodiversity in terms of time and area while benefiting wild biodiversity. Traditionally, agricultural land in Sweden is characterised by little growth during much of the year, and this needs to be changed. With the help of what are termed cover crops, e.g. different species of clover sown together with the main crop such as wheat or barley, or sown after harvest to grow in autumn and possibly early spring, it is possible to bind carbon dioxide in the soil long term while reducing the risk of erosion due to heavy rainfall and increasing soil fertility. These cover crops can also prevent the leaching of plant nutrients from the soil and if they are nitrogen fixing, contribute nitrogen from the air to benefit subsequent crops. Used wisely, they can also control pests and compete with weeds.

Another way of increasing resistance to extreme weather events is to increase the proportion of perennial crops. These make better use of plant nutrients, reducing the risk of leaching. They protect the soil more effectively than one-year crops, use the growing season well and store more carbon in the soil than cover crops and the one-year crops combined while reducing the need for tilling the soil and for chemical pesticides, thus also reducing emissions of carbon dioxide and other burdens on the environment. There is a need to develop products from *perennial crops* such as grass and clover that make them profitable to grow, and to develop more expertise on how cultivation should be planned to ensure that the ecosystem services of perennial crops can be provided as optimally as possible. At the same time, there is a need for plant breeding to develop perennial varieties of for example wheat and barley. Reduced soil tillage also benefits the diversity of organisms above and below ground.

Technology development improves opportunities to achieve the changes that are needed in agriculture. Today it is possible to gather huge amounts of information about the environment and cultivation practices that are useful in determining how crops can be managed more effectively. What needs to be developed is knowledge of and tools for how this information is to be used to support decision-making and help to steer cultivation measures to optimise the use of resources to provide different products and services. Today we have GPS, image analysis and the ability to manage large amounts of gathered data, making land management considerably more precise than it would have been without these technologies.

The farming of the future 2030

The farming of the future in Sweden can help to attain the Sustainable Development Goals by 2030 through greater diversity with a much bigger range of perennial crops, higher soil coverage during the year, e.g. by sowing cover crops, or the following crop, and by grazing animals being part of the farming landscape. We need to reduce the regional separation and concentration of animal husbandry versus arable farming.

Perennial crops, greater soil coverage and the use of grazing land demand less tillage, and a transition to green fuels will enable arable farming to become climate neutral, and in some cases even produce energy. The development of climate-smart livestock farming with good feed, minimised greenhouse gas emissions and where the production of energy, e.g. biogas from fertiliser and waste plant materials is an integrated part, is also part of the agriculture of the future. The abandonment of farming in forested and mixed landscapes is a main driver behind the reduction in biodiversity, with social and economic consequences as a result. Increased crop and livestock farming in these areas would thus increase our capacity to attain the Sustainable Development Goals.

We face a new generation of both producers and consumers who are driving sustainable development. There is a great interest among farmers today in developing and testing new cropping systems and methods. At the same time, many people are changing their lifestyles and have new consumption patterns, which is an opportunity for farmers and other growers to produce and sell more protein and oil-rich plant products together with cereals, potatoes, vegetables and fruit. Arable farming and livestock farming need to be better integrated, if not always on the same farm, through collaboration within regions to increase the use of crop and crop residues as feed and to produce energy (e.g. biogas) and the re-cycling of plant nutrients which can be reincorporated into farmland.

This trend in agriculture and food production as part of Sweden's green industries requires both initiatives from consumers and business actors and political decisions on instruments (policy) to promote local and national initiatives, international collaboration and trade.

About SLU

The Swedish University of Agricultural Sciences (SLU) conducts research and educates students in biological natural resources on land and in water. The University works on the sustainable development of rural areas, seas and cities and seeks to improve the quality of life of humans and animals. SLU produces world-class research in a number of areas and is ranked as the third best agricultural university in the world (2019). SLU contributes towards sustainable development in a changed climate at local and global level and is committed to contribute to the 17 Sustainable Development Goals of the 2030 Agenda.

www.slu.se

Svenska
FAO-kommittén

The Swedish FAO Committee was formed in 1950, the same year that Sweden became a member of FAO. The task of the Committee is to assist the Government in its work for food security for all, while taking account of global development and the preservation of biodiversity in the areas of agriculture, forestry and fisheries. It is also to spread knowledge about and raise interest in the work of FAO in Sweden. The Committee consists of 12 members and its chair.

Swedish FAO Committee
www.svenskafaokommitten.se