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Land-use transition – Strategies and solutions for sustainable land use

How can we achieve a turnaround in land use, agriculture, food and forestry?

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Land is fundamental to our lives. We use it to grow food for ourselves and feed for livestock. We use it for forests that absorb carbon dioxide and yield timber. We benefit from its ability to store water and cool the air. And last but not least, we live and work on it.

Yet despite it fulfilling such key functions, we are neither prudent nor far-sighted in our use of the land base available to us. Around the world, at least 100 million hectares of healthy and productive land were lost between 2015 and 2019 alone. Only 17 percent of the global land base is protected. In theory, Germany has already met the EU Biodiversity Strategy's target of granting protective status to a total of 30 percent of terrestrial and marine areas by 2030. However, environmentalists criticise the fact that the level of protection offered by protected landscape areas, for example, is not sufficient to truly preserve biodiversity or ecosystems.

But the issue is about much more than creating nature reserves. It's about the way we treat the land as a whole. It is about soil sealing, substance inputs, land-use intensity and the efficient utilisation of biogenic resources. Day after day, huge areas are covered with impervious surfaces for settlements and transport infrastructure. The farming sector uses too many agrochemicals and fertilisers, damaging the environment and soils. Our food supply requires far too much land. And sustainable management does not pay off for forest owners.

A transition in land use is urgently needed, not least because of the fierce competition for land, both here and around the globe. Strategies and solutions in four key areas can foster more sustainable land use and thus advance land-use transition.

Turning talk into action

In recent years, various commissions have been established with a view to developing joint strategies involving farmers, policymakers and environmental representatives. Such processes have clearly shown that positions are not irreconcilable and agreement can be achieved. They include in Germany the Commission on the Future of Agriculture (*Zukunftskommission Landwirtschaft*, ZKL), the recommendations issued by the Competence Network for Livestock Farming (*Kompetenznetzwerk Nutztierhaltung*) and the recently published recommendations of the Citizens' Assembly on "Nutrition in Transition" (*Bürgerrat "Ernährung im Wandel"*). Even more important than the establishment of such commissions is their recommendations' genuine implementation, as was the case with the "Coal Commission" (the German Commission on Growth, Structural Change and Employment), for example. While the Commission on the Future of Agriculture is continuing its good work, not many of its recommendations have been implemented since the publication of its report in June 2021. Ongoing dialogue with stakeholders in all areas of land use is essential, but results should also be implemented swiftly.

For farmers and forest owners it is crucial to have a reliable framework for long-term operational planning that offers them economically viable prospects for deploying greener production methods. And this can't be funding that is suddenly dropped after three years due to shifting political priorities. The instruments discussed in this paper need to be embedded in a long-term, coherent framework with clear objectives.

Key recommendations for action

Land use

To reduce land consumption, it is necessary to

- consider land conservation and land recycling (brownfield redevelopment) in the planning processes of towns and municipalities,
- build awareness and expertise on the impact of land consumption, and
- focus more strongly on inner urban development.

This can be achieved by means of

- instruments that reduce external development, such as the abolition of subsidies,
- interdepartmental organisational structures for the protection of lands and effective land management, and
- specific planning aids for decision-makers in towns and municipalities.

Agriculture

A more sustainable farming sector needs to

- reduce competition for cropland due to livestock feed production by giving priority to grassland-based feeding for dairy and beef herds and increasing the use of crop residues in cattle fattening,
- reduce competition for land due to the production of energy crops by collecting more residual biomass and making better use of it for energy generation,
- increase the farming sector's climate resilience through wide crop rotations with a higher proportion of leguminous crops and the establishment of agroforestry systems,
- increase the proportion of land under organic management and of biodiversity areas,
- rewet peatlands for climate change mitigation,
- reduce livestock numbers and establish a new livestock husbandry structure that places greater emphasis on animal welfare and favours closed nutrient cycles, and
- reduce the use of pesticides as well as excess nutrients levels.

This can be achieved by means of

- adjustments to the EU's Common Agricultural Policy (CAP): fewer climate-damaging subsidies and extensive compensation for services to the public good such as biodiversity measures,
- additional national funding for the restructuring of agriculture, such as a surcharge/levy system modelled on the German Renewable Energy Sources Act (EEG),
- an obligatory linkage of dairy and cattle enterprises to a grassland base and of any livestock enterprise to an agricultural land base,
- adjustments to the legislation on fertiliser use, such as stricter maximum levels for nitrogen surpluses.

Food

To achieve a more sustainable diet it will be necessary to

- reduce the consumption of milk, meat and other livestock-based foods,
- initiate a shift towards a plant-based diet,
- avoid food waste, and
- focus on regional and organically produced food.

This can be achieved by means of

- the abolition of VAT on plant-based foods and an increase in VAT on livestock-based products with an overall net relief for consumers,
- award criteria in public procurement that promote sustainable and circular-economy-oriented nutrition,
- an educational campaign for sustainable nutrition,
- a federal programme for plant-based nutrition,

- greater support for regional value chains and the promotion of regional production, processing and marketing if these deliver social and environmental benefits, and
- environmental and climate labelling of food products.

Forestry

To achieve a more sustainable forestry sector it will be necessary to

- financially promote climate change mitigation in the forestry sector,
- diversify the income streams of forest owners,
- restrict the use of wood for energy generation, and
- conserve older deciduous tree populations.

This can be achieved by means of

- greater remuneration for ecosystem services,
- attracting private investors to finance forest conservation,
- the forestry sector participating in a certificate market,
- the promotion and testing of innovative ways of using wood,
- improved timber recycling, and
- greater priority for forest conservation.

1 Introduction: The land-use trilemma

Several global crises have a direct impact on our land use: The climate crisis brings drought, heavy rainfall events and wildfires, among other things. Natural ecosystems, agriculture and forestry may not be able to adapt rapidly enough, which in turn jeopardises global food supplies and the supply of biogenic raw materials. At the same time, land use contributes to greenhouse gas emissions and exacerbates the climate crisis.

We are also experiencing a biodiversity crisis: According to the United Nations, one million species of flora and fauna worldwide are at risk of extinction. In Germany, almost every third species is considered endangered. The loss of genetic diversity jeopardises sustainable and long-term food security.

And another system in crisis is the global food system: In 2023, 345 million people were affected by hunger. Increasing climate disasters are destroying crops, soils, livestock and livelihoods and more and more people are no longer able to feed themselves.

Taking a comprehensive view – leveraging synergies

Land is needed to tackle the climate crisis, the biodiversity crisis and the food crisis: for carbon sequestration, for a larger network of protected areas and for ecosystem restoration, as well as for global food security. It is therefore important not to pursue the achievement of the various objectives – i.e. climate change mitigation and adaptation, the maintenance of biodiversity and ecosystem services, and food security – in isolation and as competing goals, but to develop strategies that leverage synergies and contribute to solving all three crises at the same time.

Land use at an impasse?

These problems are also rooted in the way we use land. We are constantly converting lands, such as land under forest cover, into areas for transport infrastructure or settlements. Although land take (new land consumption) in Germany has been declining somewhat since 2004, an average of 55 hectares of land are currently sealed every day for settlements and transport alone. Moreover, while a productive farming sector is necessary to ensure food security, unsustainable practices are destroying the basis of food production. In Germany as elsewhere, we find soils degraded by erosion and compaction as well as high levels of nutrient pollution in ground and surface waters in some regions. Species of flora and fauna once common in agricultural landscapes had to be placed under special protection in many places. In addition, 15 percent of greenhouse gas emissions from private consumption in this country alone are attributable to the production and consumption of food.

There is no doubt that action is needed. But even though we actually know enough about ecosystems and the problems caused by land use, hardly anything has changed in recent decades. This is certainly not least due to the fact that land use is part of our culture. Every single person's actions have an impact on land use. And at the same time, every single person is affected by the consequences. In addition, we cannot simply replace land use with some new technology, as is possible when

switching from fossil fuels to renewable energy sources. What is needed is a profound change in the existing system.

Is there a way out of the land-use trilemma? And if so, where is it? We address these questions with a lens on land availability and competition for land, agri-food systems, and forest utilisation.

Further information on the land-use trilemma

- The Oeko-Institut's thematic web page on land-use transition: The sustainable management of forests, soils and waters has implications for our food, agriculture and forestry – and vice versa
- Report of the German Advisory Council on Global Change (WBGU): Rethinking Land in the Anthropocene: from Separation to Integration

2 Land availability and competition for land

55 hectares per day: We take too much

The declared goal in Germany is to limit new land take for settlement and transport purposes to less than 30 hectares per day by 2030; at 20 hectares, the Integrated Environmental Programme 2030 has an even more ambitious target. Moreover, the German federal government aims for "net zero" impervious sealing by 2050 in its National Sustainability Strategy. These are targets that seem almost unachievable. Every day in Germany, an average of 55 hectares or 78 football pitches disappear under settlements and transport infrastructure. While land consumption has been declining, the reduction is insufficient to meet the targets. Overall, areas under settlements and transport infrastructure have doubled over the past six decades, currently accounting for 14.5 percent of the country's total area. New land consumption is particularly high in rural regions, where land prices are significantly lower than in growth centres or conurbations. This is often fuelled by tax incentives such as the commuter allowance. Moreover, there is often a lack of awareness of the problem.

Fragmented landscapes, lost habitats

We need land not only for settlements and transport, but also for farming and forestry, for nature conservation, for renewable energy facilities or peatland rewetting and thus for climate change mitigation. Climate adaptation also requires land, for example in floodplains in order to buffer against increasing heavy rainfall events and for water reservoirs in periods of drought. Valuable habitats for fauna and flora are being lost outright or put at risk by landscape fragmentation. Soil sealing destroys soil functions, making it impervious to water and air. This also impairs soil fertility, as the soil fauna cannot survive. Furthermore, due to urban sprawl infrastructure tends to be underutilised, resulting in higher supply costs for individual citizens. In view of the limited amount of agricultural land available worldwide and the food crisis, the ongoing high level of land consumption has been unjustifiable for quite some time.

Land take and climate change

Moreover, land take has a direct impact on greenhouse gas emissions, as it destroys natural carbon sinks and goes hand in hand with resource consumption. Carbon emissions are particularly high when forests are cleared for settlements or transport infrastructure or when peatlands are converted into settlement areas.

The neglected role of land areas

Land conservation and brownfield redevelopment have not yet played a sufficient role in urban and municipal planning processes, even though they can help to protect the environment, climate and resources. Awareness and expertise as to the impact of land consumption and the associated greenhouse gas effects are also still underdeveloped. In addition, planners in towns and municipalities lack the necessary tools to quantify these impacts.

No compensation under the Federal Nature Conservation Act

At the same time, the Federal Nature Conservation Act and the impact mitigation provision it contains do not sufficiently mitigate the problem. The impact mitigation provision stipulates that where there is an unavoidable intervention in nature, this must be mitigated or offset by means of substitution or financial compensation. However, this does not mean that other areas are completely unsealed or restored to compensate for the intervention. Restoration does not match the high ecological value of untouched areas.

Greater protection for the land base – possible solutions

There is an urgent need to strengthen the inner urban development of existing towns and settlements in order to spare lands. This involves, for example, activating brownfield sites, adding storeys to existing buildings or rebuilding with more net floor area after demolition. Available instruments to this end must be better utilised and further improved, and obstacles to brownfield redevelopment need to be removed. At the same time, land take outside of the cities must be reduced, for example by abolishing the commuter allowance. The construction of new transport infrastructure should also be significantly reduced. Planners and decision-makers need to consider land as a key resource in their decisions. This calls for inter-agency organisational structures and effective land management. Soil protection strategies, which are already in place in some twenty towns in Germany, further help to reduce land take.

Further information on land availability and competition for land

- eco@work magazine, September 2023 edition: Holding our ground − Better protections for soils and lands.
- Thematic web page on the German Environment Agency (UBA) website: *Flächensparen – Böden und Landschaften erhalten* (Saving land – preserving soils and landscapes; German only)
- Thematic web page on the German Environment Agency (UBA) website: Brownfield redevelopment and inner urban development
- Municipal land base calculator on the website of the German Environment Agency (UBA) (German only)
- Article on the Oeko-Institut's blog: *Fläche vermittelt kein schützenswertes Bild* (The term land area does not evoke notions of conservation concern; German only)

3 Sustainable agricultural systems

Where does the agricultural sector stand?

Roughly half of Germany's land area consists of arable land, pastures and meadows. Farming therefore has a major impact on soil, water, air and species diversity. Its impact is further heightened by the intensity of agricultural land use. Moreover, strong cost pressures in the food industry and food retail sector have a far-reaching impact on the farming sector. As a result, farms are getting larger and more specialised in terms of their various enterprises. In addition, arable fields have been getting larger for years, structural elements such as hedgerows and field margins have been decreasing, and crop rotations are becoming narrower. These factors, in conjunction with the use of synthetic crop pesticides, are major drivers of species loss.

The extent of livestock farming is not sustainable

Livestock farming is an important economic factor in Germany. It is now mainly concentrated in the north-west and in the foothills of the Alps. The animals are kept in ever larger units and livestock husbandry requires a great deal of land: five million hectares of arable land are used to grow livestock feed, while 4.2 million hectares are used to grow crop plants for humans. In addition, there are roughly four million hectares of grassland, which is mainly used for livestock forage. The livestock industry also requires additional imported feedstuff.

In addition to the high land requirements for feed, livestock husbandry generates air pollutants and discharges nutrients into water and soil. Most greenhouse gas emissions from agriculture and land use − 83 percent of them − are attributable to livestock farming. They are caused by fodder cultivation, ruminant digestion and animal faeces. Another major source of greenhouse gases is drained peatland, which is now largely used as grassland to feed dairy cows and cattle.

A production base at risk

Intact ecosystems are the basis of agricultural production. Climate, resource and species protection are therefore essential for the farming sector. However, when it comes to nitrogen and phosphorus cycles, biodiversity and the climate, the carrying capacity of the global ecosystem is already considered to have been exceeded. Various environmental policy goals now take this situation into account. For example, the share of agricultural land under organic management is to be expanded to 25 to 30 percent and the proportion of biodiversity areas in the agricultural landscape is to be increased to ten percent. There are also reduction targets for pesticide use and nitrogen emissions.

The long-term climate mitigation objectives for the farming sector beyond 2030, however, are still largely unclear: energy-related emissions can be reduced through the use of renewable sources and greater energy efficiency. But emissions from land use and livestock farming cannot so easily be reduced. Technical options are limited and there is a high degree of uncertainty as to their long-term potential to deliver results.

Either way, since there will always be residual emissions, increased carbon storage in forests, peatlands or soils will be needed to make up for these. But one thing is certain: without further reductions, the remaining emissions will be too high to achieve carbon neutrality by 2045.

Solutions for ecologically compatible and climate-resilient agriculture

Farmers are already struggling with the impacts of climate change and need to adapt. Droughts have become more frequent; storms are jeopardising and destroying harvests. In our view, the solution lies in sustainable, ecologically compatible and climate-resilient farming systems. Diversification makes agriculture more resilient to the risks of climate change: carbon can be sequestered on the land by building up soil organic matter and adding small woody landscape features to farmland. Other useful practices include the establishment of diverse arable crops, the temporary shading of lands by means of agroforestry systems, and cautious water use to increase climate resilience and improve groundwater recharge on agricultural land. There should also be a focus on efficient nitrogen use and its optimum uptake. However, this will also entail a smaller land base and often lower yields being available for current uses. We need to scrutinise our consumption habits. Inefficient bioenergy crops of annual arable plants should largely be abandoned.

In addition, livestock husbandry needs to be restructured and also take animal welfare into account: In peatland regions and in areas with high livestock densities it would be prudent to reduce livestock numbers, and animal welfare should be improved throughout. The animals need more space, more exercise, more light and more behavioural enrichment. Moreover, their diet should be more grassland-based and include more crop residues. Closed nutrient cycles, such as those created through obligatory linkage between livestock production and forage area, are also valuable.

So what does that actually mean? The instruments

Evidently there is a great need for transformation in agriculture. To this end, policymakers must establish a reliable framework, for example by implementing a stringent and long-term funding policy and setting tangible, long-term targets that reliably guide farmers in their investments. This concerns trends in livestock numbers, climate-friendly dietary recommendations and possible residual emissions from agriculture in a carbon-neutral Germany.

Focus on behavioural changes

The key to all of this is consumer behaviour. After all, we only produce what is being demanded. Moreover, if there is ongoing demand for what is no longer produced in this country, it will be imported, thus shifting environmental impacts abroad.

Subsidies and supports

A crucial step will be to adapt the EU's Common Agricultural Policy (CAP), the central European agricultural policy steering instrument, which has enormous resources at its disposal and could therefore effectively foster circular agriculture. From an environmental perspective, the CAP has been criticised for flat-rate, area-based direct payments to agricultural holdings and a lack of ambition when it comes to “greening”. Subsidies that are harmful to the climate must be reduced and services provided to the public good must be comprehensively rewarded. This needs to include more direct remuneration of farmers for services rendered.

At the same time, additional funds should be made available to finance the restructuring of the farming sector. This could be achieved, for example, through national subsidies or a surcharge/levy system modelled on the German Renewable Energy Sources Act (EEG). Another important instrument is the obligatory linkage of

livestock enterprises to an agricultural land base and of ruminant enterprises to a grassland base as well as adjustments to the legislation on fertiliser use. For example, Germany's Ordinance on Substance Flow Analysis (*Stoffstrombilanz-verordnung, StoffBilV*) needs to be tightened with regard to maximum levels for nitrogen surpluses.

The German Competence Network for Livestock Farming (*Kompetenznetzwerk Nutztierhaltung*) and the Commission on the Future of Agriculture (*Zukunfts-kommission Landwirtschaft*, ZKL) already presented tangible recommendations for measures to improve livestock farming in 2020 and 2021 respectively. Livestock farming systems oriented towards animal welfare are costly; they call not only for investment aid for housing conversion but also for premia to compensate for higher operating costs, as farmers employing ethologically sound husbandry practices face ongoing higher costs.

Securing funding

New financing instruments are needed to cover these costs. One option would be, for example, an increase in VAT on meat products from the current 7 percent to 19 percent. This could also reduce meat consumption by around 11 percent. This increase would need to be part of a consistent "green" financial and tax reform, as a disproportionate price rise for livestock-based foods from certified organic livestock husbandry should be avoided. The aim of such a reform must be to reduce environmentally harmful subsidies and to reward services to the public good, such as soil-conserving soil management or cultivation systems that promote biodiversity. If the VAT on other livestock-based products was also to be increased, milk consumption for example could drop by 9.4 percent. The abolition or reduction of VAT on plant-based foods could offset the higher costs for consumers, who on balance would even be better off.

Another option for financing better livestock farming would be an animal welfare levy. The German Competence Network for Livestock Farming proposed a rate of 40 cents per kilogramme of meat and processed meat products, two cents per kilogramme of milk, fresh dairy products and eggs and 15 cents per kilogramme of cheese, butter and milk powder. This would yield €3.6 billion in additional revenue. Just like a higher VAT, this levy would have to come with socio-political safeguards. Such levy revenue must be ring-fenced for the intended purpose rather than subsumed into general tax revenue, an approach considered by many to be more reliable. What is particularly important with both options is reliable long-term funding to compensate for the higher costs incurred by farmers for welfare-friendly livestock production.

Further information on sustainable agricultural systems

- Publication for Greenpeace: *Gesundes Essen fürs Klima. Auswirkungen der Planetary Health Diet auf den Landwirtschaftssektor* (Healthy eating for the climate. Impact of the Planetary Health Diet on the agricultural sector; German only)
- Analysis and policy recommendations on behalf of the German Environment Agency (UBA): How much climate action is offered in the first pillar of the CAP?
- Update of the impact assessment for the current CAP funding period on behalf of the German Environment Agency (UBA): *Klimawirkung der Öko-Regelung zu Agroforstmaßnahmen* (Climate impact of the agroforestry measures as part of the eco-scheme; German only)
- Study funded by the federal state of Baden-Württemberg: *Instrumente und Maßnahmen zur Reduktion der Stickstoffüberschüsse* (Instruments and measures to reduce nitrogen surpluses; German only)
- Short paper, funded by *Stiftung Zukunftserbe*: *Ausgestaltung der neuen GAP und Ansätze für eine Minderung der Stickstoffproblematik* (Design of the new CAP and approaches to minimising the nitrogen problem; German only)
- Study for Greenpeace: *Landwirtschaft auf dem Weg zum Klimaziel. Maßnahmen für Klimaneutralität bis 2045* (Agriculture on the way to the climate target. Measures to achieve carbon neutrality by 2045; German only)
- Final report for the German Environment Agency (UBA): *Sichtbarmachung versteckter Umweltkosten der Landwirtschaft am Beispiel von Milchproduktionssystemen* (Visualising the hidden environmental costs of agriculture using the example of milk production systems; German only)
- Discussion paper: *Übertragbarkeit des EEG auf Landwirtschaft und Ernährung* (Transferability of the Renewable Energy Sources Act EEG to the agrifood sector; German only)
- Podcast "Wenden, bitte!" [All change, please!], Episode 19: What can be done to make farming more climate-friendly? (Transcript)

4 No land-use transition without a food transition

Food should be healthy − for both people and the planet.

There is that saying, “You are what you eat”. But our food choices also shape our environment, influence the climate and impact biodiversity. The way we eat today has a significant impact on the global environment, contributing 20 to 25 percent of greenhouse gas emissions and up to 80 percent of biodiversity loss. The consumption of livestock-based foods in particular causes significant damage to the environment and climate. Consumers in Germany currently consume roughly 52 kilograms of meat per year as well as a range of other livestock-based foods such as almost 80 kilograms of fresh dairy products. There is a need to drastically reduce the consumption of livestock-based products and replace these with plant-based foods.

The Planetary Health Diet

A varied and healthy diet should of course always be guaranteed, and this can be achieved within the planetary carrying capacity. The EAT Lancet Commission proposed a Planetary Health Diet, which has also become the basis for the German federal government's nutrition strategy currently under development. The Planetary Health Diet is designed to enable all people worldwide to enjoy a diet that meets all their basic needs while respecting planetary carrying capacities.

In our view, it is not yet entirely clear how the Planetary Health Diet can be comprehensively implemented. Among other aspects, there is still a need for more research on the current state of nutrition and on various plant-based protein sources and their potential. At the same time, our food value chains need to be made more resilient in order to establish food security. Regional supply structures and a high level of diversity in crop cultivation and marketing are crucial to this end.

Approaches to a more sustainable diet

What's on the menu?

Nobody wants to ban meat consumption, but we do need to drastically reduce it – from around 52 kilograms per person and year to between 15 and 30 kilograms. In turn, the plant-based portion of the diet needs to increase significantly, by adding more pulses, fresh fruit and vegetables for example. The festive Sunday roast has its place, but vegetarian and vegan dishes can greatly enrich the menu. Creative players in community catering as well as gastronomy start-ups are already showing how this can be achieved.

No more throwing out!

There should be a focus on avoiding food waste. This can be accomplished through changes in consumption, for example. However, it is not just about consumers doing a better job at planning their shopping and thus preventing food from ending up in the trash. Along the entire value chain and at various stages of the food life cycle far too much food spoils or is thrown out. There are many ways to counteract this. Technical solutions for improved food preservation, for example, are just as sensible as adapted retail guidelines. The orange is not big enough? The pepper is not red enough? The cucumber is not straight enough? That shouldn't stop us from eating such otherwise perfectly good food. And there should also be other ways of utilising lower quality foods than to throw them into the bin.

Regionality entails sustainability

When it comes to more sustainable diets, time and again there is a focus on regionality. If it goes hand in hand with smart logistics concepts, transport routes are shortened, less infrastructure is needed and greenhouse gas emissions are reduced. Moreover, a regional diet makes it easier to reuse raw materials such as those used as transport aids, to avoid food waste and to preserve cultural landscapes of high biodiversity value. Focussing on regional, plant-based and organic food goes a long way towards supporting the necessary transformation. This is because it not only goes hand in hand with a more resilient food system, but also enables consumers to democratically shape their diet and experience a sense of self-efficacy in the process, such as in “prosumer” schemes. An example would be cooperatives that supply their members with vegetables.

However, one should not overlook that regionality can also have negative effects. Small-scale cultivation or processing, for example, can result in reduced efficiency. A focus on regional products and value chains should therefore always assure environmental and social added value.

Motivation is good. More time is better.

New research has shown that the way we organise our diets depends primarily on social norms and emotions, but also on routines and convenience. While it is our view that more research is needed in this field, the findings indicate that the amount of time we can devote to nutrition and our opportunities for self-regulation have a greater influence on restructuring our diet than aspects such as motivation, attitude or nutrition literacy. Plant-based foods, for example, must therefore be easily accessible and the altered diet should not be more laborious.

So what does this mean in practical terms? The instruments

There are numerous valuable approaches to sustainable nutrition.

Better public procurement, more knowledge

There is great potential in public procurement. Communal catering in schools, care facilities, hospitals and canteens could be made significantly more sustainable and healthier. Contract award criteria for schools or state institutions, for example, could conceivably be designed such that they foster sustainable nutrition and circular agriculture. Quotas for certified organic products and criteria for biodiversity-promoting procurement − such as a focus on foods with a low environmental footprint − would also be useful. To this end, a suitable financial framework must be in place.

Focus on plants!

What consumers buy and eat is hugely influential. We therefore recommend an ongoing education campaign on sustainable nutrition and preventing food waste. This would include, among other aspects, the integration of nutritional knowledge into school curricula and information provision via digital channels. At the same time, there should be a much greater focus on plant-based diets than there has been to date. Where consumers buy food, what food they buy and how they prepare it − all of this can indeed be influenced in nutritionally relevant settings such as supermarkets or canteens. Examples would be the prominent placement of plant-based foods and associated advertising efforts, an appealing design of portion sizes and recipes, or favourable pricing.

Federal programme for plant-focussed nutrition

Political instruments can also help to encourage consumers to eat more fruit, vegetables and pulses. The objective of achieving a plant-focussed diet should be integrated into political strategies and programmes, at both national and local levels. For example, a federal programme for plant-focussed nutrition could make a significant contribution by promoting research projects with a practical focus, urban development concepts with a focus on plant-based nutrition, or knowledge transfer to relevant stakeholders, such as those in the “out of home” food sector. Other important actions include the integration of plant-based nutrition into the training and professional development of chefs and the development and expansion of plant-based value chains.

Support is needed − in the region and along the value chain

Moreover, if regional value chains are to be established, these will require ramped-up support, which could come, for example, in the form of model eco-regions, “food cities” or the establishment of “organic cities”. It is also valuable to support decentralised processing companies such as mills, dairies and bakeries, as well as the food pre-processing sector catering to the needs of commercial kitchens.

In addition, consumers should be well aware of the impacts on the environment and climate exerted by the different food categories. Such awareness could be fostered by means of environmental labelling or information on the positive health effects of a

more plant-based diet. The latter is significant because fears of adverse health outcomes still prevent some consumers from lowering their intake of livestock-based products. A mandatory national label that covers climate, animal welfare and health aspects is one of the core recommendations of the Citizens' Assembly on "Nutrition in Transition" (*Bürgerrat “Ernährung im Wandel”),* which were presented in January 2024.

Further information on sustainable nutrition

- All publications of the STErn project entitled "*Bausteine für die Transformation zu einem nachhaltigen Ernährungssystem*" (Building blocks for the transformation to a sustainable food system) for the German Environment Agency (UBA); German only
- STErn project website: Socio-ecological Transformation of the Food System
- Publication as part of the STErn project: *Die Rolle des Finanzmarkts für die sozial-ökologische Transformation des Ernährungssystems* (The role of the financial market in the socio-ecological transformation of the food system; German only)
- Model Germany Circular Economy brochure for WWF Germany: A comprehensive circular economy for Germany 2045
- Model Germany Circular Economy study for WWF Germany: *Modellierung und Folgenabschätzung einer Circular Economy in 9 Sektoren in Deutschland* (Modelling and impact assessment of a circular economy in nine sectors in Germany; German only)
- Working paper as part of the TRAFO 3.0 project: *Umweltwirkungen fleischbetonter Ernährungsweisen, eine zusammenfassende Auswertung wissenschaftlicher Studien* (Environmental impact of meat-based diets, a summary and evaluation of scientific studies; German only)
- Policy paper as part of the TRAFO 3.0 project: *Gestaltung des Strukturwandels in der Schweinefleischproduktion – zur Zukunft von Schweinezucht und Schweinehaltung in Deutschland* (Shaping structural change in pork production – on the future of pig breeding and pig farming in Germany; German only)
- Short paper as part of the TRAFO 3.0 project: *Die Bedeutung von Fleisch im Lebensmitteleinzelhandel für eine Transformation im Sinne einer nachhaltigen Produktion und eines nachhaltigen Konsums von Fleisch* (The importance of meat in food retailing for a transformation towards the sustainable production and consumption of meat; German only)
- Short paper as part of the TRAFO 3.0 project: *Der deutsche Export von Fleisch und seine Bedeutung für eine Transformation im Sinne einer nachhaltigen Produktion und eines nachhaltigen Konsums von Fleisch* (German meat exports and their significance for a transformation towards the sustainable production and consumption of meat; German only)
- Final report for the German Environment Agency (UBA): *Sichtbarmachung versteckter Umweltkosten der Landwirtschaft am Beispiel von Milchproduktionssystemen* (Visualising the hidden environmental costs of agriculture using the example of dairying systems; German only)

5 Forests need protection

Forests have been dying for decades

Our forests have not been doing well for decades. The term "forest dieback" was coined back in the early 1980s and led to intense discussions about controlling air pollution. Forests around the world are still in poor condition today. In Germany, the main problems are droughts and pest infestations associated with climate change. As a result, spruce stands in particular are collapsing, while deciduous forests so far appear to be more resilient. In how far they will be able to withstand the impacts of climate change is not yet clear. A total of 285,000 hectares of forest have already died off in Germany, while almost three million hectares − a quarter of the national forest estate − are considered at risk.

Forest owners on the horns of a dilemma

Anyone who owns a forest in Germany has so far only made money from the sale of timber. Those who manage their forests more ecologically than prescribed by law, whose focus is not so much on mass production and who therefore employ gentler harvesting methods and harvest and sell less timber, often earn less money.

We consume far more wood in Germany than the global average: 1.5 cubic metres per capita, compared to just 0.5 cubic metres worldwide. In addition, Germany consumes more timber than it produces. Every year, 80 million cubic metres of wood is logged in this country. Fifteen million cubic metres are used directly as firewood and are burned without first transitioning through other uses. As much as 60 percent of hardwood is used directly for energy generation. This means that the German forest cannot add to the long-term carbon storage pool, as every cubic metre of wood removed reduces around 0.6 to 1.7 tonnes of CO_2 from the forest's carbon store.

International deforestation

The forests' poor condition is an international problem and they are under pressure around the world. In 2021 alone, 6.8 million hectares of forest were destroyed worldwide, an area the size of the Republic of Ireland. Moreover, this amount of forest loss represents enormous amounts of greenhouse gas emissions − a total of 3.9 gigatonnes CO_2 equivalents. If deforestation was to be completely halted by 2030, it would need to be reduced by more than ten percent per year. However, it is declining at a much slower rate: In 2021, deforestation decreased by only 6.3 percent compared to the period of 2018 to 2020. In the humid tropics, losses of irreplaceable primary forests decreased by a mere 3.1 percent.

Not an infinite resource

Even though the protection of forests and their long-term ecological use have a direct impact on climate change mitigation and biodiversity conservation, there is as yet no financial compensation for such practices. There is therefore an urgent need to provide financial support for climate change mitigation in the forestry sector and to diversify income generation options for forest owners so that they are not solely dependent on the timber market.

Using timber for construction can help to sequester the CO_2 the trees have stored in their wood for a long time. But it is also true that increased timber construction puts further pressure on forests. We therefore need a general shift away from the short-lived and non-recyclable use of timber towards durable and reusable products made from renewable raw materials.

Only burnt once

While wood is a renewable resource, it is not an infinite one. It can be reused many times, including in products that help to reduce energy consumption in the long term, but it can only be burnt once. And only a living tree absorbs CO_2. Anyone who uses wood for energy generation, on the other hand, releases its stored carbon. Therefore the use of wood for energy should be restricted in future − not least because there are already alternatives that have significantly lower emissions, such as heat pumps. Moreover, in the interest of climate protection and nature conservation, older stands of deciduous trees should not be felled, especially if they can only be used for firewood or short-lived products.

When calculating greenhouse gas balances, the dynamic nature of forests' storage capacity should be taken into account. Otherwise, there is a risk that significant sources of CO_2 will not be accounted for and a false picture will emerge as to the global warming potential of wood products.

Numerous alternatives. The instruments

While forest policy in Germany is a matter for the federal states, there are so many policy areas that are indirectly connected to the forest estate that something like a national forest policy should be feasible. There could be increased remuneration for ecosystem services under federal programmes. Another possibility would be to attract private investors to finance forest conservation, which could be achieved by involving the forestry sector in a certificate market. This should cover ecosystem services in general and less so carbon storage alone, so that biodiversity preservation, general nature conservation and climate change mitigation objectives align rather than compete.

It is also important that we use our timber in more innovative ways. We should, for example, address the question of how durable products could be manufactured from lower-quality wood. Wood recycling must also improve, while disposable products made from wood or paper should be reduced. In addition, forest conservation must be given priority, especially over the expansion of infrastructure such as motorways.

Further information on forest protection

- Website by the Oeko-Institut: CO_2 Storage Balance - Making CO_2 emissions from wood use visible
- Article on the EURACTIV website: Why burning primary woody biomass is worse than fossil fuels for climate
- Publication by GCB Bioenergy: Closing an open balance: The impact of increased tree harvest on forest carbon
- Partial report for the German Environment Agency (UBA): *Aktuelle Nutzung und Förderung der Holzenergie* (Current use of and supports for wood energy; German only)
- Podcast "Wenden, bitte!" [All change, please!] Episode 15: Can the Forests still be saved? (Transcript)
- Oeko-Institut blogpost: *Wald: Mit Klimaschutzleistung Geld verdienen statt nur mit Holz* (Forests: generating income from climate protection services instead of just timber; German only)
- eco@work, Edition 01/2019: Forests: For climate and biodiversity

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The Oeko-Institut is one of Europe's leading independent research and consultancy organisations working for a sustainable future. Founded in 1977, the Institute develops principles and strategies for realising the vision of sustainable development at global, national and local level. The Institute has offices in Freiburg, Darmstadt and Berlin.
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