eco@work

April 2024

Sustainable reading
from the Oeko-Institut

Not without trees

Natural carbon sinks for climate change mitigation

Naturally supportive Interview with Tom Kirschey

Ambitious reductions come first, then natural sinks

Christof Timpe
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In this issue, we present an exciting topic and introduce a new face. Before you read on to discover a wealth of information about natural carbon sinks, the Oeko-Institut's research on this topic and external experts' perspectives in the following pages, I would like to briefly introduce myself: I took over from Jan Peter Schemmel as the Oeko-Institut's Chief Executive Officer on 1 January this year and, in this role, I am delighted to welcome you to eco@work.

This issue of our magazine focuses mainly on forests, peatlands and seagrass meadows – in other words, on ecosystems that can absorb and sequester carbon. They thus have a key role to play in mitigating climate change. However, they themselves are under threat from the impacts of climate change. A key point to note is that the first step in protecting the climate is always to reduce emissions as far as possible. But even in the most ambitious scenario, residual emissions remain – from agriculture, for example. These emissions can be offset by natural carbon sinks or by using technical options to remove carbon dioxide from the atmosphere. In the following pages, we look at natural sinks: the status quo, their potentialities, and the opportunities to strengthen their capacities.

I live in the area around Freiburg, with woodlands close by. I see a lot of wood from the forest being burned for fuel. Should we continue to use our forests in this way? I think not. The fact is that the combustion process releases the CO_2 that was previously locked away in the timber for decades. We have more efficient and more climate-friendly heating options available, as well as more sustainable uses for this precious resource – as insulation and building material, for example. More sustainable use of our forests can also strengthen their function as carbon sinks.

Preserving natural carbon sinks is a long-term task. A forest takes time to grow. Restoring a peatland also takes time and a great deal of planning. This means that if we aim to be climate-neutral by 2045, we must start strengthening the capacities of our natural carbon sinks right now. We must also keep the CO_2 that is already locked away in timber and soil out of the atmosphere for as long as possible. So next time you're in the forest, perhaps – after reading this issue – you'll appreciate not only its wonderful scent and calming tranquillity, but also the gift that the forests give us for the future.

Yours,
Christof Timpe

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"The more we delay, the more it will cost"

To restore and strengthen the function of natural sinks so that they are able to absorb carbon over the long term, thus combining nature conservation with climate action: this is a goal of the Federal Action Plan on Nature-based Solutions for Climate and Biodiversity, adopted by the German government in March 2023 (see also "A peatland can do it" on p. 4). The newly established Centre of Competence for Nature-based Climate Action (KNK) has been assigned a pivotal role in realising this goal – among other things, it informs all interested parties about funding programmes for the protection of forests, peatlands and green spaces, promotes relevant projects and supports stakeholder networking. The Centre is headed by Tom Kirschey. In this interview with eco@work, he talks about the current status of nature-based climate action, the measures being taken by the Centre of Competence, and how to ensure that they are effective in the long term.

Mr Kirschey, what does nature-based climate action need?
It needs us to stop thinking in silos and start thinking holistically. It needs all stakeholders to work together to restore the functions of natural ecosystems – and that doesn't just mean nature conservation. It needs us to ensure that these stakeholders also have opportunities and resources to achieve this goal.

Where do we stand with nature-based climate action?
Right now, emissions from agriculture and forestry are still increasing. This is becoming especially apparent in relation to peatlands: they emit around 54 million tonnes of greenhouse gases per year. That went unrecognised for quite some time. If we want to move closer to the 1.5˚C target, we must act fast to restore the natural carbon sinks. The more we delay, the more it will cost.

One of the first measures taken by the Centre of Competence was to set up a telephone advice line. Who can call you?
Any individual or institution with a question about nature-based climate action. It could be a specific idea about transforming a green space, for example. We would then provide advice on funding opportunities but we also want to encourage people to think beyond the context of the individual measures. For example, we attempt to network various authorities and civil society bodies. We need to move away from small-scale actions and look at the bigger picture.

How much awareness of nature-based climate action exists?
It has existed in the political sphere for some years, but it is not yet embedded within society. Certainly, this is partly because it is not self-explanatory. In addition, nature-based climate action is often seen as a means to accelerate nature conservation, but of course there's much more to it than that.

Which funding programmes are currently in preparation?
Some initial funding programmes are already in place – for example, for city and municipal authorities that want to undertake ecological upgrading of residential areas, or for businesses that would like to introduce more green elements at their company sites. And other funding schemes are being prepared for landowners, forest owners, municipal special-purpose associations and the farming community to support measures such as conversion to soil-conserving techniques. Within Germany's regional states, there will be climate managers for protected areas, who will develop appropriate measures. Land purchases will also be eligible for funding in some instances – for example, to enable more sites to be withdrawn from commercial use and converted into wilderness areas, thereby forming natural carbon sinks.

What can be done to guarantee that the natural sinks are then preserved for the long term?
The purpose of the funding programmes is to create the right conditions so that funding beneficiaries are able to make that commitment. Another option is to stipulate in the land registry that peatlands, for example, must permanently remain in a fully rewetted state – this can be achieved by ringfencing or imposing restrictions on use. At the same time, the Action Plan should also assist with follow-up if the source of a disturbance has been eliminated but the ecosystem is still not fulfilling its function.

Thank you for talking to eco@work.
The interviewer was Christiane Weihe.

Talking to eco@work:
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A peatland can do it

Natural carbon sinks and climate change mitigation

A peatland can do it. And so can a tree. And even seagrass does it. All of them are natural carbon sinks. So are forests and grassland, farmland and marine coastal ecosystems. Natural sinks remove carbon dioxide from the atmosphere and store it in plants and soil – a valuable climate service that we cannot dispense with on the path towards climate neutrality. However, these carbon sinks face multiple threats. Hot, dry summers are reducing the vitality of our forests, marine coastal ecosystems are suffering the harmful effects of industrial fishing, and intensive agriculture is impacting our farmland. How much potential do natural carbon sinks have to offer? And what do they need to unlock it? The Oeko-Institut is researching this topic in many of its projects.

Have you ever thought to yourself, my garden hedge will absorb the CO_2 anyway, so I can carry on driving my polluting combustion engine car? Think again! Granted, natural sinks have major potential for climate change mitigation, but we need them to absorb emissions that cannot be avoided – such as methane from digestive processes in cattle. "The first and most important step is always to cut emissions as far as possible," says Judith Reise, a Senior Researcher in the Oeko-Institut's Energy and Climate Division. "Natural carbon sinks are not a substitute for reduction targets."

Germany's Federal Climate Change Act requires the land use, land-use change and forestry (LULUCF) sector to meet clear CO_2 sequestration targets: at least minus 25 million tonnes of CO_2 equivalent (CO_2e) annually by 2030, minus 35 million tonnes of CO_2e annually by 2040 and minus 40 million tonnes of CO_2e annually by 2045. "In my view, achieving the 2045 targets is quite realistic," says Judith Reise. "But this also means that we must act now. The fact is that natural sinks do not appear overnight. It takes years to establish new tracts of forest, in particular, and rewetting peatlands also takes time to have an effect."

MULTIPLE MEASURES

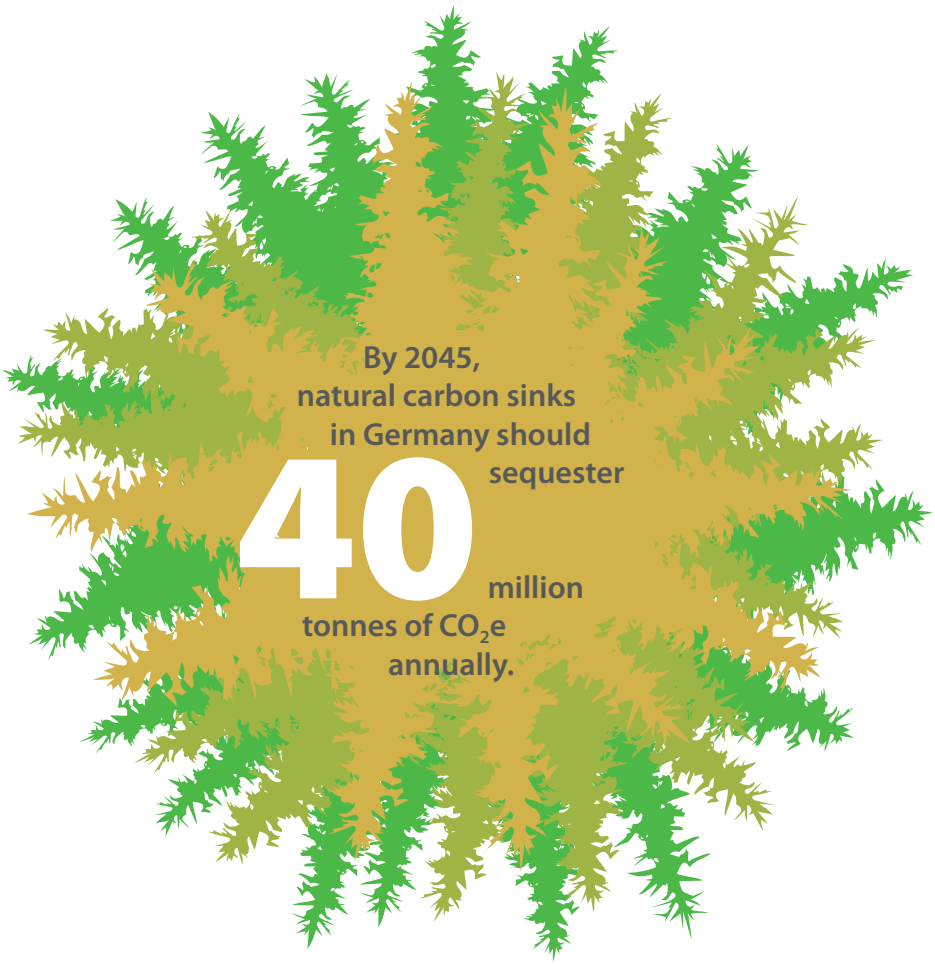
Natural carbon sinks and reservoirs are as diverse as the measures needed to protect and restore them. The Federal Action Plan on Nature-based Solutions for Climate and Biodiversity, adopted by the German government in March 2023, provides for an extensive package of measures (*see interview with Tom Kirschey on p. 3*). "These measures are broad in scope and identify the 10 key fields of action – from protection of peatlands and a near-natural water balance to nature-based climate action in settlement and transport areas," says Judith Reise. "However, policies on nature-based climate action are still lacking in detail in many respects. For example, there is still no clear proposal on how we intend to contribute to the target of planting three billion trees, which is set in the EU's Biodiversity Strategy." From her perspective, another question which remains unanswered is where the sites required for natural sinks are to come from. "There are very substantial user conflicts, because agriculture alone has a massive requirement for land – and, of course, it is reluctant to make concessions here. Simultaneously, we will need arable land, in particular, for actions such as forest renewal."

GREAT POTENTIAL

In the Transformation to a Completely Greenhouse Gas Neutral Germany (CARE) project on behalf of the German Environment Agency (UBA), the Oeko-Institut identifies to what extent natural carbon sinks and the conservation of natural carbon reservoirs have potential to contribute to the goal of climate neutrality by 2045. "We are also outlining the measures that are necessary to leverage this potential, as well as the timeframes in which they might take effect," says Judith Reise. Forests in particular have immense climate change mitigation potential: they could sequester more than 40 million tonnes of CO_2 equivalent annually by 2050.

From Judith Reise's perspective, it is useful to differentiate between forest types. For example, less well-adapted spruce monocultures at unsuitable sites should be converted to climate-resilient forest ecosystems, while in many deciduous mixed forests, there is scope to scale back the management regime and reduce felling in order to increase the timber stock and thereby boost the forests' sink capacities. Harvested wood should be used to manufacture goods that are as durable as possible, such as timber for the construction industry, in order to keep the carbon locked away (*for more information on forests and timber use, see "Trees have potential" on p. 8*).

However, the key measure, says Judith Reise, is to restore the water level in peat soils beneath farmland and grassland in order to preserve them as carbon sinks. "Peat soils have sequestered very large amounts of carbon over the course of millennia. On farmed post-bog soils with low water levels, the peat decomposes year on year and the stored carbon is released as CO_2. Simply by rewetting farmed peat soils, there is



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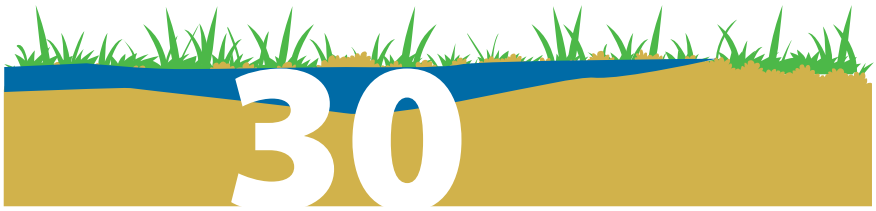

million tonnes of CO_2 equivalent can be avoided in Germany simply by rewetting peatlands.

potential to avoid emissions amounting to 30 million tonnes of CO_2 equivalent annually. Rewetting also supports species diversity and helps to maintain the landscape's hydrological balance at the same time," Judith Reise explains. However, a regulated approach to rewetting is essential; otherwise, peatlands can release large amounts of methane. "Various measures can be applied to prevent this, or at least to mitigate it significantly. One option is to remove a layer of turf prior to rewetting and avoid uncontrolled flooding of the peatland." It is also important, she says, to safeguard water availability, taking due account of the landscape hydrology as a whole – and to plan for periods when water is in short supply as a consequence of climate change. A multitude of peatland restoration projects are currently being initiated – and many are meeting with a positive response from the farming community, as Judith Reise explains. "Many farmers are finding it almost impossible to grow anything on these desiccated soils, so they have a positive attitude towards measures that raise the water level in their fields; they can then switch to new cultivation systems such as paludiculture. This change in the way land is farmed is essential for nature-based climate action."

Agriculture has countless opportunities to increase the potential of natural sinks. "For example, it is important to boost humus enrichment by intercropping and thus optimise the nutrient content in the soil. Agroforestry measures are also useful. This includes planting hedges and trees in fields: they absorb carbon dioxide and store it in their biomass. It's a quick and effective measure because fast-growing trees and shrubs can be utilised here," says Judith Reise. "Agroforestry measures can stabilise the water balance and protect against soil erosion. Native hedges in fields are also an important habitat for birds and insects and thus help to protect biodiversity." But climate action is not just for the countryside: planting trees in urban spaces also makes it possible to sequester CO_2. "However, this is mainly about enhancing public wellbeing – by cooling the ambient temperature, for example." Consumers have a role to play as well. It takes between five and 10 plant calories to produce one calorie of animal product. Decreasing consumption of animal products such as milk and meat leads to a reduction in livestock farming and shrinks the amount of land needed to grow fodder crops. "These sites can then be used to establish more forests, set up agroforestry systems, carry out rewetting of peat soils, or switch to forms of agriculture that are gentler on the soil."

CREATING INCENTIVES

Within the CARE project framework, the Oeko-Institut experts and various partners have also devised an incentive system that provides financial rewards for forest enterprises, with the aim of boosting the climate and biodiversity services that the forests provide. "In our view, promoting ecosystem services in the context of forest management is a sensible approach. This can be achieved with a system of market-based certificate trading, among other things," says Dr Klaus Hennenberg from the Energy and Climate Division. Under the project team's proposal, participating forest owners must first meet certain basic requirements relating to biodiversity, such as natural forest regeneration and maintenance of a healthy soil structure. Forest owners who meet additional requirements and opt to carry out further measures then qualify for supplementary funding from the state. "Anyone meeting the basic forest biodiversity requirements can additionally participate in forest certificate trading," Dr Hennenberg suggests. "In this market, certificates for the sink services provided by forests would be issued to private investors, who can then participate in financing nature-related climate action."

WIN-WIN-WIN

A peatland can do it, and so can a tree – and a seagrass meadow. But not to an infinite extent, and not without appropriate protection. At the same time, it is important to broaden the perspective: if we maintain natural carbon sinks, this not only benefits the climate. Far from it: there are numerous synergies with the conservation of biodiversity and ecosystem services. "Measures of this kind improve the landscapes' hydrological balance, protect us from storms and soil erosion, provide cooling in hot summers, preserve species diversity, improve soil fertility, and assist us to adapt to climate change, which is already happening," says Judith Reise. "They thus help us, no less, to safeguard the natural resource base on which our lives depend."

Christiane Weihe

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Trees have potential

Forests as natural carbon sinks

When we think about nature's capacity to absorb carbon, a forest is probably the first thing that comes to mind. And indeed, trees are very effective carbon reservoirs. In 2021, a German woodland the size of a football pitch had the potential to store an additional 1.8 tonnes of CO_2 on average. But in Germany, the forests' function as carbon sinks is under threat – from intensive use of wood and from the die-off of entire stands as a result of extreme weather events. The Carbon Inventory 2017 described our domestic forests as a carbon sink that removes 62 million tonnes of carbon dioxide from the atmosphere annually. However, researchers at the Oeko-Institut suspect that in the years from 2018 to 2020, the forests became a carbon source. Their research also aims to identify the forests' most severe stressors and determine how our woodlands can absorb and store more carbon again in future.

"The carbon sink service provided by Germany's forests is likely to have changed significantly since the last Carbon Inventory in 2017 – large numbers of trees died off between 2018 and 2020," says forest expert Dr Mirjam Pfeiffer from the Energy and Climate Division. This was caused not only by heat and drought, but also by infestations of pests such as bark beetles and beech splendour beetles, parasites and fungi. If trees are weakened by climate extremes, their immunity is reduced. "It therefore seems likely that in sum, the coniferous forests have become a carbon source. However, we won't know this for sure until the findings of the Fourth National Forest Inventory are published later this year."

MORE CONIFEROUS WOOD

So what is the situation with regard to the forests and their capacity to sequester carbon? And how is this impacted by the use of wood as a source of energy and material? A recent study by the Oeko-Institut and INFRO compared the projected development of Germany's forests to 2076 against expected demand for wood. It shows that demand for deciduous wood (hardwood) will decline, while demand for coniferous wood (softwood) will increase. "This applies particularly to wood from conifers such as spruce, which is used in a wide variety of products – in construction, furniture-making, packaging and paper," says Dr Mirjam Pfeiffer. "Our findings from forest modelling show that this high level of demand for softwoods is depleting the mature stands. This means that from 2035 onwards, it will only be possible to harvest regrowth. That leaves an annual gap of 20-25 million cubic metres of softwood, which will have to be imported." Demand for hardwood, mainly for energy production, can be met from domestic woodlands. "Indeed, we are expecting the amount of deciduous forest to increase significantly to 2050 as less hardwood will be harvested than regrows."

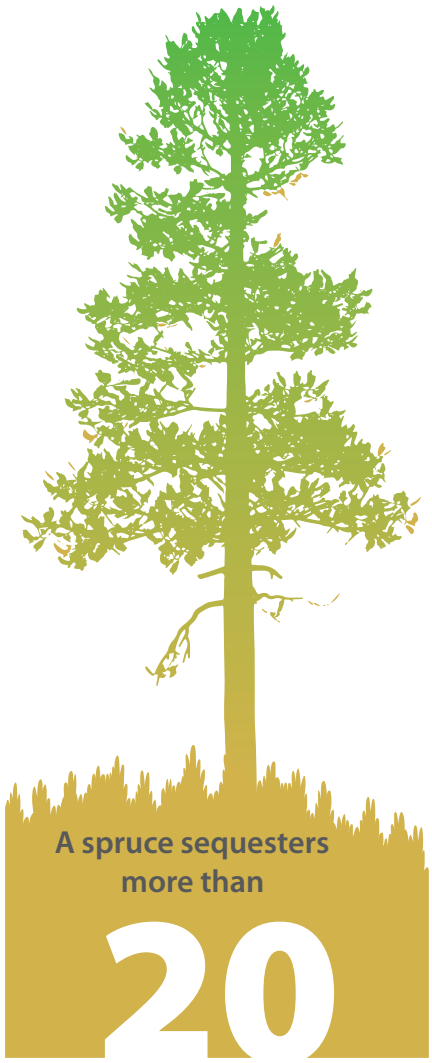
The project "BioSINK – Impacts of the energy use of forest biomass in Germany on German and international LULUCF sinks" on behalf of the German Environment Agency (UBA) applies a reference scenario and three different scenarios on the use of wood for energy. As well as considering the use of wood as a material, e.g. in construction, it examines various developments in wood combustion for energy, as well as three different assumptions relating to natural damage caused by factors such as drought, storms and beetle infestation. The reference scenario is based on the predicted development. With regard to the forests' capacity to sequester CO_2, the researchers anticipate that

million cubic metres of coniferous wood (softwood) will have to be imported from 2035.

in sum, coniferous forests will continue to be a carbon source until 2035. "On this scientific basis, policy-makers will be able to assess the forests' ecosystem services more accurately. This can also support the development of policy instruments relating to the use of wood and forest management and inform the National Biomass Strategy, for example," says Dr Klaus Hennenberg, a Senior Researcher at the Oeko-Institut. These issues are explored in more depth in the DIFENs project, supported by the Forest Climate Fund. "Here, we look at demand for wood and at climatic changes, as well as natural disturbances and forest development. But we also focus on policy requirements and possible responses from the forestry and timber sector."

EXPERIMENTS WITH THE FOREST

When it comes to our forests, we face major challenges, yet we have little experience of what lies ahead, says Mirjam Pfeiffer. "We are running headlong into a situation that cannot be compared to anything we have ever known. Extreme weather, growing pressure on resources, mass die-offs – never before have there been such major changes in such a short time. That's why there is no patent remedy for the necessary restructuring of the forests; a degree of experimentation is required here." One option is for forest research institutes to plant native trees of diverse origins to determine which of them exhibits the strongest growth. "But it is also worth looking at the genetics. If the beeches growing at a given site are suffering to varying extents, it is worth finding out why this is happening. In such cases, we should also place our trust in the process of natural selection to some extent." Another option that is frequently mooted is to plant more non-native species such as Douglas fir. "It grows a good 20 per cent faster than spruce and has outstanding timber properties," the forest expert explains. "From a nature conservation perspective, however, this is a controversial approach, because we are not able to predict how this will affect other ecosystem functions. So it's important to thoroughly weigh up the benefits against nature conservation goals; Douglas fir should only be planted in a mix with native tree species such as red beech."



LESS WOOD-BURNING

The Oeko-Institut's researchers have also reached a clear position on the question whether forest wood should continue to be used as an energy source. "This really should be phased out. In terms of greenhouse gas emissions, it is always better to keep the carbon locked away, either in forests – if they are healthy – or in durable wood products," says Dr Klaus Hennenberg. "What's more, wood-burning emits 367 kg CO_2 per kilowatt-hour of generated energy – far higher than the emissions from natural gas or heating oil, which amount to 202 and 288 kg CO_2 per kilowatt-hour, respectively. We need to exit fossil fuels first and then phase out wood combustion – also, incidentally, because it produces particulate matter, which is harmful to health." A good alternative to the use of wood for energy, he says, is a heat pump that runs on renewables-generated electricity.

WHERE DO WE GO FROM HERE?

As natural carbon sinks, forests offer major potential for mitigating climate change. "There is scope to build up the timber stock, principally in ecologically stable deciduous mixed forests at suitable sites. Spruce monocultures in unsuitable locations should be converted to climate-resilient forests. Harvested wood should be used to produce durable goods for which recycling systems exist," says Dr Hennenberg. Careful management of the forests benefits not only the climate but also biodiversity. "In mature and structurally diverse forests, there are more habitats available for endangered forest species such as beetles, bats, birds and fungi." And as Dr Mirjam Pfeiffer emphasises: "We don't have much time left – after all, forests do not spring up overnight. Not enough is being done to protect and restore the forests. And the action that is being taken is far too slow." To ensure that trees can unlock their potential as carbon reservoirs in good time and to the full, an appropriate policy framework is therefore also required.

Christiane Weihe

Geoecologist Dr Mirjam Pfeiffer joined the Oeko-Institut as a researcher in 2022. She works on topics such as climate stability of German forests, sustainable wood and forest use, and future development of forest stocks. Biologist Dr Klaus Hennenberg has been employed in the Energy and Climate Division since 2007. He focuses inter alia on sustainability criteria for biomass production, and modelling of developments in the LULUCF sector.
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