



eco@work

October 2023

Sustainable reading
from the Oeko-Institut

Holding our ground

Better protections for soils and lands

How are our soils doing? Interview with Ricarda Miller

An almost unknown world



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We know about as much about the world beneath our feet as we do about the oceans' depths which is to say: not really all that much. Many soil organisms, for example, have not yet been studied. We rarely turn our attention to this world. But what we do know for certain is that soil is key to our life and survival. We grow food, feed and energy crops on it, it serves as a carbon and water reservoir and maintains biodiversity, we build our settlements and infrastructure on it. Unsurprisingly, land has already become a scarce resource worldwide. In this light, it is alarming to see just how carelessly we treat our soils, how thoughtlessly we cover them up, and what quantities of polluting chemicals, fertilisers and pesticides we apply to them.

In order to correctly utilise this increasingly scarce resource, we need to at long last adopt a holistic approach to land use, not just in this country, but also abroad. After all, not all land is suitable for all uses. This new approach would also mean using the available land as efficiently and environmentally friendly as possible, for example by greening the cities, combining photovoltaics and agriculture on the same land or revitalising empty buildings instead of sealing up more ground for new ones. Precision agriculture, i.e. the use of digital technologies for optimised production, could also help to use soils more efficiently and sustainably in the future. But before its large-scale deployment, we need to learn a lot more about this farming system and also about its social impacts.

I grew up in a small town in Lower Saxony and can still remember when slurry was carelessly spread on grasslands on the town's outskirts – without any obvious sign of an awareness of the practice's damaging effects on soil biodiversity. My impression is that awareness of this issue has grown in the intervening years. But there is still far too little awareness of how important soil protection really is. The work of our scientists is helping to advance soil protection and land conservation. I hope that with this issue of *eco@work* we can also help a little to bring soil more into focus.

Yours,
Jan Peter Schemmel

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“Impervious sealing means total loss”

Valuable soils develop over thousands of years. We destroy them in a fraction of that time. We cannot continue to treat soils like this, says Ricarda Miller. The agricultural engineer carries out soil surveys and soil function assessments, assists with construction projects and always keeps a firm eye on soil protection. We talked to her about the most significant pressures on soils, the possibilities for regeneration and awareness of soil protection.

Ms Miller, what do we actually know about the soil?

It varies. We know a lot about the physical and chemical processes and also about the different soil types. But we know very little about many of the soil organisms. Many species are still unexplored. Our knowledge is particularly limited when it comes to soil microorganisms and the interactions between soil, organisms and plants. Incidentally, we also do not know enough about how climate change affects our soils. Drought stress and higher soil dryness will of course also change these interrelationships.

Can soils recover?

Soils develop over thousands of years and can be destroyed very quickly. Many people do not realise just how sensitive soils are. Impervious sealing, for example, entails a total loss because the soils' functions are destroyed when water and air can no longer penetrate. This is the case for 47 per cent of the soils that are newly converted every day for settlement, commerce and transport infrastructure.

Can soil be unsealed and thus made usable again?

Yes, that is possible and useful. It is possible to unseal soil and create soil space that plant roots can penetrate – but this requires soil experts. To achieve this, soil that has been excavated elsewhere is carefully spread. This allows for certain functions to be restored, such as the water regime or the cooling function. But you will never achieve the same value and functionality as with naturally grown soil. That is why we cannot continue to seal more and more soil surfaces.

So is impervious sealing the biggest problem for soils?

In Europe, yes. But there are many other problems and various types of soil degradation, such as compaction, salinisation or acidification. In some cases, farming also takes a heavy toll. And soil erosion – wind and water carrying away soil – is yet another problem.

Can anything be done about erosion?

Absolutely. Water can be stopped by erosion control strips and wind can be reduced at small scales, for example by hedges. In general, year-round soil cover is important, for example the cultivation of catch crops. These measures are long-term in their nature and will then also benefit the soil life, as they lead to improved nutrient turnover.

Are there ways to regenerate soils?

Yes, and they are already being implemented. In large-scale mining or extraction projects, such as for lignite or gravel, soils are recultivated, meaning that material is brought in from other sites and new soil is built up. Up to a certain limit, pollutant loads can also be removed and it is possible to remediate soils using plants that absorb heavy metals. In the case of severe compaction, plants can also help to increase soil pore volume again.

What is the level of awareness of soil protection in the farming sector?

In my experience, a large part of the farming sector sees the soil as worth preserving; it is their production base after all. And farmers know their soils very well. Nevertheless, soil conservation is not the top priority. Sometimes, however, the necessary knowledge is lacking, for example about the fact that planting a catch crop is worthwhile – but only after a few years. In my view, still nowhere near enough emphasis is placed on soil and water conservation in agricultural education. Yet it can be worthwhile to actually gear production towards these aspects, as many examples, including in the organic sector, have shown.

What are Germany's states and municipalities doing for soil protection?

There are numerous lighthouse projects – small-scale but big-picture – and good examples, such as municipal soil protection strategies. Stuttgart, for example, is a real pioneer. At the turn of the millennium, the city recognised that it was running out of land and took countermeasures by setting land consumption quotas. There are currently about twenty cities in Germany that have a soil protection strategy, including Berlin.

Thank you for talking to eco@work.

The interviewer was Christiane Weihe.



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A bustling ecosystem

Protecting soils

It is right underneath our feet, but we give it little thought. And so it is heavily polluted, for example with pesticides, or it has become imperviously sealed. A staggering 60 per cent of EU soils are now in an unhealthy state. Yet we need soil, and desperately so, for agriculture and forestry as well as for storing water and cooling the air. Regulation at the EU level and the amendment of the German Soil Protection Act (Bundes-Bodenschutzgesetz, BBodSchG) are intended to improve the way we treat our soils. The Oeko-Institut is also contributing its expertise to the question of how this can be achieved.

Our soils are absolutely bustling with living organisms. A single teaspoon of soil holds 120,000 fungi and one million bacteria. Earthworms, isopods and insect larvae live in the soil; millions of individuals of soil fauna can be found underneath one square metre of soil surface. All these organisms play an important role for the soils' natural functions: They decompose organic plant waste and thus release nutrients, break down pollutants and play an essential role in enabling soil water retention. "However, we still do not know nearly enough about soil life. Most of this highly complex system has not yet been sufficiently studied. Our knowledge about how to protect the soil ecology and prevent soil degradation is similarly insufficient," says Dr Laura von Vittorelli from the Oeko-Institut.

However, what we do know is that we are not careful enough in the way we treat our soils: They are sealed to carry buildings and infrastructure, their cultivation is often unsustainable, they are polluted by pesticides and damaged by heavy agricultural machinery. Pollutants or microplastics from tyre abrasion, for example, also do damage, as does deforestation. "All this is all the more incomprehensible because the strong competition for available land underscores that we really do need the

soil. We need it to grow food and other organic raw materials, for example. We also need it to provide ecosystem services such as cooling the ground or retaining water."

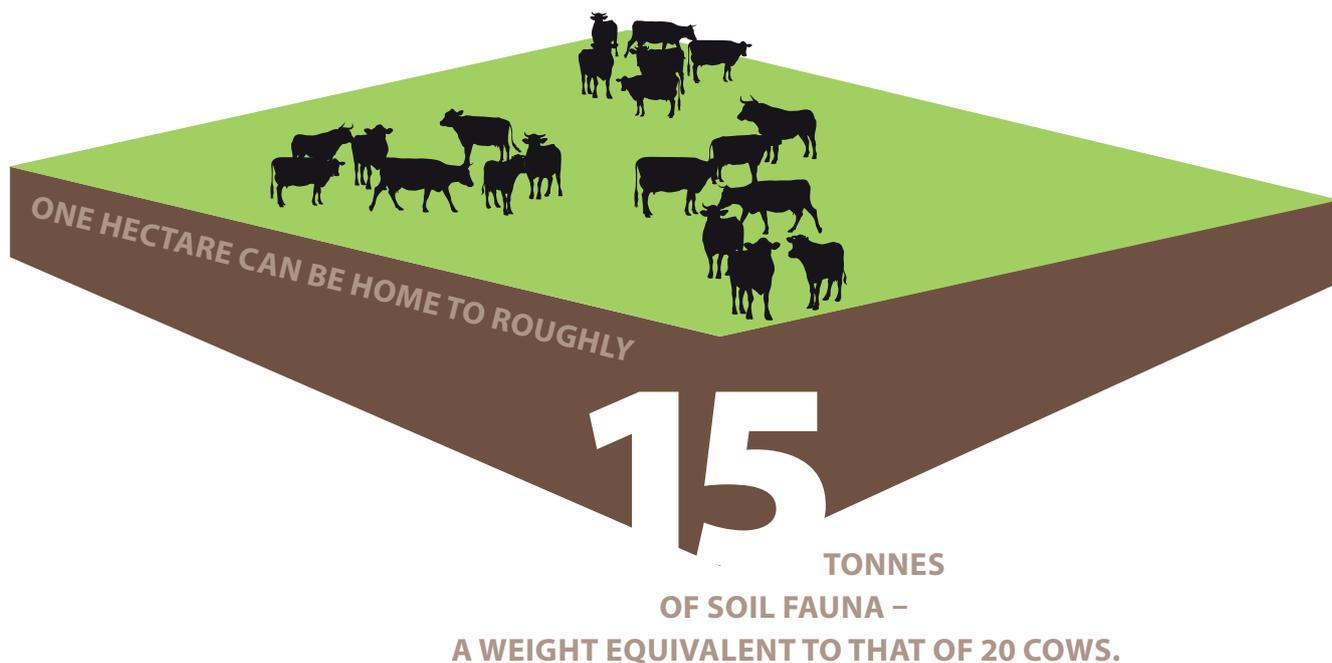
PROTECTING SOILS

Soils can be used much more sustainably than is the case today, for example through organic cultivation practices, which are associated with significantly lower environmental impacts, and organic livestock husbandry, which reduces ammonia emissions. "Valuable measures include the rewetting of peatlands and wetlands in order to bind more carbon in the soil, or the establishment of species-rich, structurally rich and climate-resilient forests." Reduced new land consumption naturally has the same positive effect on soils. (*For more details see "28,000 football fields. Reducing land consumption – sparing lands" on page 6.*) "In Germany, howev-

er, soil and land protection are treated separately in law. When it comes to soil, we therefore have to look at the Soil Protection Act and the Soil Protection Ordinance," says the Oeko-Institut scientist. The statutory soil protection regime is intended to safeguard or restore soil functions, but has so far focused mainly on legacy pollution, i.e. contaminated sites. "Moreover, there are other ordinances that have a bearing on soil protection, such as provisions in construction law, regional planning law and the Nature Conservation Act. So far, the Soil Protection Act has followed the principle of subsidiarity: if a matter is regulated by other legislation, it does not apply. As a result, soil protection as a regulatory matter is very much scattered across different pieces of legislation." In addition, there are different specifications and pilot projects at the regional state (Länder) level. "So far this is quite a patchwork."

The Oeko-Institut's scientists are now supporting the Federal Ministry for the





Environment and the German Environment Agency in amending the soil protection regime. The project entitled "Stärkung des Bodenschutzes und der Altlastensanierung durch Überarbeitung des Bodenschutzrechts" (Strengthening soil protection and remediation of contaminated sites by revising soil protection legislation) is led by the Ecologic Institute and carried out together with the Schnittstelle Boden engineering consultancy. "We analyse how soil protection has been regulated to date and what improvements could be made," says von Vittorelli. "To this end, we have already produced seven legal background papers. In doing so, we also look at the interfaces with other regulations of relevance to soil protection, such as legislation governing the use of chemicals or the agricultural sector."

One analysis, for example, deals with subsidiarity and proposes to adjust the application of this principle as it weakens soil protection. "This clause could be deleted so that soil protection legislation and the planned advancements can be utilised in the field and applied by the competent authorities. After all, other environmental laws such as the Nature Conservation Act also do without applying that principle." Another background paper addresses the specific criteria governing soil protection. So far, this has been defined such that

the soils' functions are to be protected, including with a view to the utilisation of soils. "The aim so far is to protect soil function but not the soil as a medium in itself. This gap should be closed," says the scientist. "From our point of view, it would be prudent to emphasise the fundamental protection of soils, to add further functions such as the sequestration of greenhouse gases and to add further protection objectives, as necessary. An example would be the achievement of good conservation status for soils by a specific year."

Pollutant inputs are a key factor when it comes to burdens on soils. The scientists are also addressing that topic. "From our point of view, it is essential to limit inputs of substances that can harm the soil. Similar to water law, one could, for example, include in the soil protection regime priority substances, such as those listed in Annex XIV of the European Chemicals Regulation REACH." Moreover, it would be important to continuously review the list of restricted substances and to expand it as necessary. "The legislative process is almost as complex as soil ecology itself," says Laura von Vittorelli. "Sometimes different soil types are located very close to each other. And it takes a lot of effort to survey their respective condition. This makes it difficult to set out overarching regulations."

AND WHAT DOES EUROPE DO?

There is also some movement on soil protection at the European level. So far, no corresponding law has been enacted there; this failed in part due to resistance by the prior German Federal Government. "Now a new draft is available. It is the result of the European Commission's soil strategy, which aims to ensure that all soil ecosystems in the EU are healthy by 2050," says the Oeko-Institut's law professional. That is a daunting task, considering that this is currently the case for at most 40 per cent of the EU's soils.

Christiane Weihe



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28,000 football fields

Reducing land consumption – sparing lands

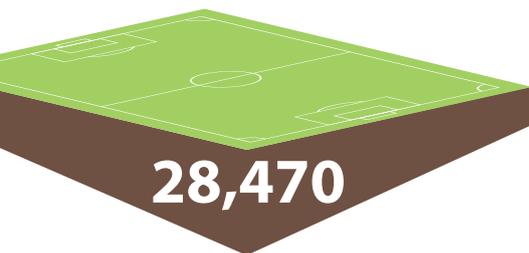
Every single day in Germany, land disappears under residential buildings, supermarkets or roads. On average, 55 hectares per day are sacrificed for housing developments and transport infrastructure. The equivalent of 78 football fields is covered up day after day after day. Things are no different in the rest of Europe, with an area greater than the size of Budapest getting sealed every year. Between 2012 and 2018 alone, 539 square kilometres of arable land and semi-natural or natural areas were lost. This has consequences for biodiversity and soil quality, among other things, and also for the climate. What approaches could help to curb this far too high level of land consumption? The Oeko-Institut is doing the research.





By 2030, the German Federal Government aims to reduce new land consumption to less than 30 hectares per day, as has been set out in the National Sustainability Strategy since 2016. According to the Climate Protection Plan, the aim is to even get to "net zero" land consumption by 2050 – in other words, a fully circular land economy. The EU has also set itself the same target in its Roadmap to a Resource Efficient Europe. "Such ambitious targets are good and important. But we must now also urgently consider how they are to be achieved," says Franziska Wolff of the Oeko-Institut.

An area the size of



28,470
football fields is taken by settlements and transport infrastructure in Germany every year.

The constant decline in open spaces is a major problem: These areas are no longer available for growing food and they can no longer absorb greenhouse gases. Moreover, sealed surfaces increase the risk of flooding. Landscapes get dissected and valuable habitats for flora and fauna are lost. As a result of urban sprawl, infrastructure becomes less utilised, resulting in higher servicing costs per individual. But why are we still consuming so much new land in the first place, when the country's popula-

tion is stagnating? "Private households are taking up more and more space and businesses want to expand into new locations," says Franziska Wolff, who heads the Environmental Law & Governance Division. "In addition, municipalities often have tax incentives to attract businesses and new residents. In contrast, land saving or land recycling and the associated possibilities for protecting the environment, climate and resources are not sufficiently taken into account in planning processes. Overall, there seems to be as yet little political will to spare land.

NEW OPTIONS

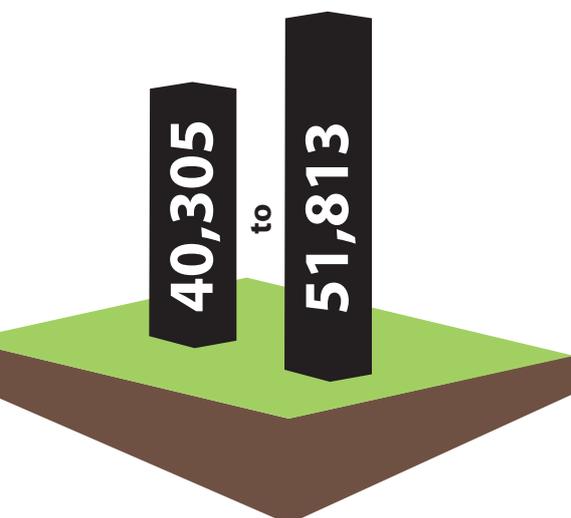
It is true that new land consumption is lower now than it was at the turn of the millennium – between the mid-1990s and the 2000s, more than 100 hectares disappeared every day under settlements and transport infrastructure. "But this far from resolves the issue. Existing efforts are not sufficient to achieve a circular land economy by 2050." For example, the Federal Nature Conservation Act contains an impact mitigation provision: where there is an unavoidable intervention in nature, this must be mitigated or offset by means of substitution or financial compensation. "But these provisions are of questionable functionality. After all, compensation does not create new, natural soil. Moreover, there is no obligation to remove impermeable surfaces or restore soils. And even if impermeable surfaces are unsealed, their former high ecological value cannot be restored," says Tobias Wagner, Senior Researcher at the Oeko-Institut.

In the project entitled "Handlungsoptionen zum Erreichen des europäischen Flächensparziels Netto-Null" (Options for action to achieve the European no net land take target), the Oeko-Institut is currently working together with the Helmholtz Centre for Environmental Research on the question of how land saving targets can be operationalised and achieved. The project team is screening ongoing European-level activities on

land sparing and soil protection for the German Environment Agency. "These include information systems and research projects, but also political instruments and implementation activities," says Franziska Wolff. "We analyse these activities and assess their relevance." Among these are, for example, the Copernicus Land Monitoring Service, which provides data on Europe's terrestrial areas, or the partnership on sustainable land use and nature-based solutions as part of the EU's Urban Agenda. "The partnership has developed a plan of actions on land-use indicators and how they should be taken into account in impact assessment processes. It also covers financing mechanisms for the rehabilitation of industrial sites, ways to identify and manage unused land and options for the reduction of urban sprawl. From our point of view, the action plan contains many interesting approaches." In addition, the scientists summarised individual measures taken in the EU Member States. Luxembourg, for example, is considering tradable land certificates; in the Austrian "climate check", land use also plays a role in environmental assessments; in Poland, the principle of a circular land economy and compensation for new land take were included in the National Spatial Development Concept 2030. "Some countries have already set quantified land saving targets. Others have not, and much work still needs to be done on operationalising such targets." The Commission's draft EU Soil Health Act of early July 2023 also does not include obligations for Member States to set land saving targets and underpin these with the requisite measures. "It is to be hoped that over the coming months the draft will signal greater ambition with regard to the land issue. Otherwise it will be difficult to achieve the 'no net land take' target."

Based on its analyses, the project team will support the German Environment Agency in the upcoming European dialogue. "Through several European workshops, our aim is to improve cooperation on this very complex challenge, which is also handled in very different ways across Europe."

Between 1992 and 2021,
the area used for
settlement and transport in
Germany increased from



square kilometres.

Choosing land protection over land take also contributes to climate change mitigation. In the project entitled "THG-Minderungspotenziale durch Flächensparen" (GHG reduction potential of reduced land take) for the German Environment Agency, the Oeko-Institut is therefore analysing the impact of land consumption on greenhouse gas emissions. "If less land is used, carbon sinks are preserved," says project manager Tobias Wagner. "Moreover, the construction of fewer settlements or less transport infrastructure further entails resource and additional greenhouse gas emissions savings." So far, however, there has been very little awareness of the greenhouse gas effects of land consumption – and also insufficient expertise. "Planners in cities and municipalities cannot readily quantify the greenhouse gas effects of new land take; they simply lack the tools to do so. Therefore, they usually do not take these effects into account."

GREATER AWARENESS IN THE MUNICIPALITIES

In order to create awareness among communities of the major impact of their actions and at the same time provide them with easily understood guidance, the scientists are currently developing a method that identifies and visualises the potential for greenhouse gas reductions from avoided land take. One focus is on the changes that occur in the soils' carbon stocks and vegetation. Together with the Gertz Gutsche Rümenapp – Stadtentwicklung und Mobilität GbR consultancy, the Oeko-Institut also looks at the emissions that result from the construction and use of buildings and infrastructure. "For example, just for the soil's excavation we assume a loss of 11 per cent of the carbon stored therein, even if the excavated material is only temporarily stored for the period of the construction works," Wagner explains. We already know that external development, such as the construction of new buildings on previously vacant land, generally has a greater impact on the environment and climate than internal development, where, for example, extra floors are added to existing buildings or buildings are reconstructed after demolition with more usable space in the same footprint.

The experts have already prepared a status report on the current state of knowledge and are now working on the calculation method. When the project is completed next year, they want to be able to calculate the level of potential greenhouse gas savings for every hectare that is not converted, down in scale to the level of the approximately 11,000 municipalities in Germany.

"We already gained many exciting insights in the course of the project to date," says the Oeko-Institut scientist. "For example, the major impact mechanisms in land conversion are becoming apparent, as well as many indirect effects." He recalls the "plate-or-tank" debate, which dealt with the fact that the cultivation of maize or rapeseed for

biofuel generation, for example, means that less land is available for food production in this country – and that the land needed to provide food is then taken up elsewhere in the world. "With new land take, I see a similar causal chain – only the trigger is different." Changes to surfaces, such as impervious sealing with asphalt, also have an impact on climate, he notes. "It's called the albedo effect. When sunlight hits a white ice surface or even green areas, it is reflected more strongly than, say, from dark asphalt. This too has an influence on global warming."

TIME FOR A RETHINK

Tobias Wagner hopes that showing decision-makers and planners in cities and municipalities the effects of expanding transport and settlement areas can lead to a rethink and perhaps even a reorientation of political action. "If we can clearly show municipalities the amount of greenhouse gases they are causing through their land consumption, this will hopefully persuade some of them to take land into account in their planning as an important resource of conservation concern that deserves their attention."

Christiane Weihe



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