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REDUCING LAND USE IN THE CONSTRUCTION SECTOR AS AN IMPORTANT CONTRIBUTION TO SUSTAINABLE CLIMATE PROTECTION

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Abstract: *Land use and the resulting land degradation is one of the major challenges for the coming decades worldwide and in particular in the EU Member States. This publication analyzes the environmental impacts of excessive land use and the measures that the construction sector needs to take, in line with the EU Land Strategy, to reduce these impacts and make a significant contribution to climate change mitigation. Demand for housing, including second homes, can be seen as one of the main drivers of land use. The principle of sufficiency, which aims to use land resources sparingly, is particularly important. In densely built cities, per capita land consumption is lower than in rural areas. Depending on the type of dwelling/settlement, more or less land is required. The combination of many efficient measures must help to reduce land consumption in the construction sector while promoting sustainable and liveable cities and communities. Sustainable construction in the future cannot be achieved without careful management of the soil ecosystem. The public sector is called upon to promote sound, energy-efficient and environmentally friendly construction and to support socially acceptable uses.*
Keywords: *Construction sector, climate protection, EU Soil Strategy 2030, zero net land use, soil function*

INTRODUCTION

Land use and land speculation are major obstacles to climate-friendly and socially acceptable spatial development. In Europe in particular, land use and soil sealing are among the major environmental challenges. With rising energy prices and increasing demand for land for food and biomass production, productive soils are becoming increasingly important in the EU. Throughout Europe, economic growth and land use are closely linked. New sustainable approaches to decoupling economic growth and land use, such as the EU Soil Strategy 2030, to be presented by the European Commission in November 2021, are therefore needed. In line with the European Green Deal, it proposes to achieve "net zero land use" in EU Member States by 2050. In particular, the EU Soil Strategy 2030 aims to protect soils, manage them sustainably and restore degraded soils, with the first priority being to avoid additional land consumption and soil sealing. As a next step, land re-use will be sought. Where new land use is unavoidable, it must be kept to a minimum. Where land is used or sealed, compensation and mitigation measures must be taken to minimize the loss of ecosystem services. Soil is an essential but finite resource. Population growth means that, on average, there is less and less fertile soil available per person. Soil is the most biodiverse habitat on earth. It is vital to human survival. Soil consumption and soil sealing are among the major

environmental challenges across Europe. Economic growth and soil use are closely linked across Europe. Soil plays an important role in climate change mitigation: as a carbon sink, as an area for reforestation, and for the production of carbon-neutral fuels. It can mitigate the effects of climate change such as droughts, heavy rainfall, and floods. It is time for soil protection to be taken more into account in development and transport planning in the European Union. Insufficient protection of key soil functions will further reduce the availability of fertile soils. The negative environmental and economic consequences of soil sealing are manifold. When soil is sealed, all biological functions are lost. This process is difficult to reverse. Unsealing soil is a costly and time-consuming process. It should also be remembered that soil regeneration is a slow process taking 100 to 200 years to build up 1 cm of humus. Worldwide, 25 percent of soils are considered degraded, meaning that their vital functions are severely impaired (Lena Luig 2024). Soils in Spain, southern France, and Italy are at risk of desertification due to drought, as we know from other continents. In Austria alone, people use about 11.5 hectares of additional land every day, more than half of which is sealed, and building and traffic areas have grown by 53 percent since 1995, while the population has grown by only 12 percent. In Austria, generous building permits for supermarkets on the outskirts of villages, with their huge car parks, have led to the concreting over of village edges in recent decades and the irreversible destruction of the transition between settlement and agricultural areas. At the same time, this misguided development has led to the desolation of many town centers. Historically, most settlements have been located in areas of fertile agriculture land. The expansion of settlements therefore automatically leads to a further loss of productive land.

RESEARCH METHODOLOGY

The research methodology consists of first demonstrating the urgent need for a massive reduction in land use based on its impact. It then analyses and categorises measures to combat excessive land use and assesses their future development in the construction sector.

RESULTS

How does the construction sector use soil as a resource?

Soil as a resource is used by development as an area for settlement and transport, essentially as subsoil as the deepest structural element of a building, and as a source of building materials. Soil is used in two ways. On the one hand, land is needed for the construction of buildings (direct use). As a result, the land is transformed and is no longer available for other uses. In addition to this direct use of land as a site for buildings, land is also required for the extraction of building materials, for their production or for the disposal of waste (indirect land use). The construction sector has been the largest land user in recent years.

More specifically, land use is differentiated as follows.

Sealed areas

Areas used for settlement, transport, industry, commerce, trade, mining, etc. are partially sealed. Sealing means covering the soil with a layer that is impermeable to water and air, thereby killing soil life. Sealing therefore means the permanent loss of biologically productive soil for settlement and transport purposes, but also for intensive recreational use, landfills, mining sites, industrial plants, and similar intensive uses. Once a soil has been used, it is very difficult to restore it to its original state, as it takes a long time for soil-forming processes to restore soil functions (Umweltbundesamt 2022).

Unsealed areas

Undeveloped and unsealed areas are a prerequisite for agricultural and forestry production and the extraction of biogenic raw materials. They ensure the diversity of flora and fauna, contribute to

climate protection and adaptation to climate change through their function as carbon and water reservoirs, and are part of risk and protection management in the event of natural hazards. They are recreational and natural areas and a feature of the cultural landscape, making them a valuable resource for tourism.

What are the negative impacts of land use on our environment?

1. Soil is removed from agricultural use.

Soil is the basis of food production. Soils that have the natural capacity to produce high yields in a regional and local context are particularly important for food security. Climate change is also expected to lead to a significant reduction in yield capacity. This will lead to production losses in food production.

2. Threats to biodiversity.

Landscapes are fragmented, preventing the migration of plants and animals. Any use of natural space disrupts the natural balance, affecting ecosystem services and biodiversity. It should also be borne in mind that soil regeneration takes a long time, as it takes 100 to 200 years for 1 cm of humus to form.

3. Increased flood risk

Increased run-off is a major contributor to flooding and low water levels. Preventing the infiltration of water through the soil prevents the filtering of pollutants from the water and increases the need to channel surface water through a sewer system, which can increase the risk of flooding.

4. Loss of dust binding

Dust binding is a natural process by which fine particles (dust) are held in the soil. Soil sealing, particularly through the use of impermeable materials such as concrete, asphalt or buildings, can disrupt this process and lead to a loss of dust binding. Sealed soils can no longer bind dust particles. Unsealed soils contribute positively to air pollution control in urban and peri-urban areas. The loss of dust binding capacity due to soil sealing can lead to a deterioration in air quality. Particulate matter released into the air can cause respiratory and other health problems.

5. Increase in noise pollution

Sealed surfaces such as concrete, asphalt and buildings reflect sound waves more than unsealed surfaces. As a result, noise sources such as traffic, industry or human activity can be amplified and noise pollution increases. The consequences of noise include chronic fatigue, reduced performance and an increased risk of heart disease.

6. Urban heating effect

Water cannot evaporate from sealed soils. In urban areas with a high degree of sealing, this leads to a change in the microclimate and an increase in local temperatures. The microclimate, especially in urban areas, depends on how densely built or sealed an area is.

7. Sealed soil is lost as a CO2 sink.

Fields, meadows, bogs, and forests are important reservoirs of carbon. Achieving climate goals depends largely on how soils are used. Soils are an essential part of the carbon cycle and the largest carbon store on Earth. Increasing soil sealing increases emissions and destroys important CO2 sinks.

8. Building on the environment disrupts the natural water balance.

Soil sealing reduces groundwater recharge. Soil sealing alters the local water balance and the functionality of water bodies.

What strategies lead to a reduction in land use?

Demand for housing, including second homes, can be identified as a key driver of land use. It should be noted that land use does not depend directly on the size of the population, but on settlement density and household size. The trend towards single households and the increase in living space per

person require additional land. Sufficiency, which aims to use land resources sparingly, is particularly important.

In densely built cities, per capita land consumption is lower than in rural areas. Depending on the type of dwelling/settlement, more or less land is required. An apartment block generally requires much less land per capita than a detached single-family house. The latter use a lot of natural space, mainly for infrastructure, roads, and car parks. They use about five times (!) as much natural space as denser housing and many times as much heated space. Compared to single-family homes of the same standard, multi-storey buildings require about half the resources to build and operate. Apartment blocks of 3 storeys or more require about the same number of resources and space. It is therefore important to prioritize construction projects that do not require new infrastructure (roads, sewers, etc.) (Stejskal et al. 2011). Their moderate height has a positive effect on the urban space, especially when combined in a perimeter block development.

Achieving net zero land use requires a multi-faceted approach that recognizes the complexity of the issue. The following section presents a wide range of approaches that need to be implemented to reduce land use in a sustainable way.

1) Utilization of areas already developed in terms of infrastructure and designated as building land Vacant land revitalization campaign.

According to the principle of "recycling", a campaign for the revitalization of vacant land is necessary, consisting of subsidies on the one hand and a tax on vacant land on the other. The first step in activating vacant land is a comprehensive and area-wide survey of vacant land and continuous updating of the vacant land register. Only when all vacant land, including land reserves and buildings, has been capitalized can further land be brought into use. It is often difficult to find a suitable alternative use, especially in the case of structural vacancies. Interim use with incentives (e.g. low rents) can identify opportunities for new uses. In addition, the users contribute to the revitalization and upgrading of the neighborhood.

- Use of brownfield sites close to the city center-land recycling.

The use of so-called brownfield sites, inner-city wastelands of former industrial, commercial and railway areas (land recycling). These sites are usually centrally located and therefore offer low development costs and the opportunity to incorporate circular economy considerations. Conversion of these sites or buildings can create attractive residential and commercial areas close to the city center.

- Denser city centers

Frequency generators such as shops, restaurants, kindergartens, retirement homes or public buildings should be located in the city center to create an attractive and lively city center. Walking and cycling will become more attractive in compact settlements that allow 'short distance' villages and towns. Socially acceptable densification should be achieved both in terms of development and use – including multiple or mixed use – with sufficient (public) green and open spaces and other amenities.

- Mobilization of Brownfield and Dedicated Land

Land mobilization involves the more efficient use of already developed or dedicated land. Local areas suitable for infill development are often difficult to mobilize and are often hoarded.

- Renovation before demolition

Renovation and adaptation of existing buildings should be intensified, and the overall share of renovated and adapted buildings should be significantly increased. The longer a building is in use, the more sustainable it is. The renovation or adaptation of existing buildings is not only advantageous in terms of direct resource consumption compared to demolition and new construction,

but also has a direct impact on land use by reducing the amount of land required for raw material extraction and landfill.

- Infill development

Brownfield land is developed land with existing planning permission. In many central locations, it represents significant development potential. Brownfield sites should be used not only to increase the density of development, but also to create unsealed areas for increased infiltration, retention and evaporation, with a significant increase in the number of trees in the urban area. On the other hand, where possible and appropriate, undeveloped areas should be used to create cold air corridors (including opening up piped streams and rivers) and for leisure and recreational functions.

1) Legislative measures

- Empty property tax

The problem of empty property needs to be tackled. Land and buildings need to be removed from the speculative market. A vacancy tax, an offer of use and a right of first refusal for the municipality can contribute to this. However, as the reasons for vacancies are very heterogeneous, the measures need to be broader and more specific.

- Legal facilitation

Legal barriers make it difficult to convert and renovate existing buildings. Appropriate simplifications for the construction or conversion of existing buildings (e.g. regarding required room heights, accessibility, clearances, lighting, commercial law aspects) are necessary to make the activation of existing buildings economically competitive and possible.

- Fiscal control

Taxation of land use is a useful tool for steering the careful use of land. Revenue from this should be used for the reuse of existing commercial and industrial brownfield sites.

- Promoting housing

Priority should be given to the promotion of compact, space- and energy-saving construction methods, as well as space-saving alternative housing models, forms of housing, mixed use and densified forms of construction in designated areas.

- Mobilization of suitable land reserves

Suitable and necessary building land reserves, especially in inner areas, should be brought into use quickly and hoarding of building land should be avoided.

2) Spatial planning measures

- Compatible densities

Higher densities make it possible to provide more residential or commercial space in a limited area without using additional land. This helps to reduce land consumption, as less land is needed for the same number of buildings or uses. It is important to find the right balance between density and quality of life to create a sustainable and livable urban environment.

- Efficient land use

High quality and resilient densification (structural and functional) and compact settlements with increased structural density improve land efficiency. Future development should, wherever possible, take place within existing settlement patterns and in compact development patterns.

Efficient measures are detailed below.

– Avoiding unnecessary land consumption through intelligent and efficient land use planning;

– Reducing land consumption per person (inhabitants or jobs);

– Increasing the potential for re-use through flexible floor plans, so that space can be used for longer;

– Ecological compensation, e.g. through green roofs;

– The functions of green roofs for recreation, food production (urban gardening or urban farming) and rainwater retention, as well as photovoltaics and solar thermal energy on roofs and facades;

– Combinations of uses that give individual building components multiple functions or allow multiple uses to be combined in one building;

– Developing or infilling land as efficiently as possible;

– Use of already sealed areas;

– Use of existing infrastructure;

– Avoid unnecessary sealing through intelligent mobility concepts (e.g. through the use of public transport or car-sharing concepts).

Efficient land use requires integrated urban planning that takes into account environmental, social and economic aspects. Urban sprawl, rather than compact urban development, also increases energy demand. This energy consumption is detrimental to the environment and the climate and, not least, places a financial burden on residents.

- Minimizing soil sealing

Makes a valuable contribution to preserving natural soil functions and minimizing the impact on the natural water cycle through:

– Permeable traffic areas;

– Infiltration and rainwater harvesting systems;

– Storm water retention and infiltration;

– Unsealing of sealed surfaces;

– Local infiltration systems.

- Reuse concepts and scenarios

– Development of reuse concepts and consideration of reuse scenarios;

– Measures: Develop use scenarios and flexible floor plans at the design stage; provide load reserves and adapt clear room heights and fire protection concepts where necessary; plan for extensions in advance.

– Examples: Conversion of office buildings into apartments, conversion of industrial halls into lofts/studios

- Incentives for unsealing

Especially in densely built-up residential areas, the possibilities of unsealing and subsequent greening (green courtyards and green walls) should be investigated and implemented as far as possible in order to ensure an appropriate level of attractiveness and resilience to rising temperatures. Large-scale unsealing schemes should be developed on this basis.

- Compensation for land use

Compensation and offsetting measures must be provided for large-scale land use with urban sprawl effects to compensate for the loss of natural areas. Significant degradation caused by land use should be offset, thereby contributing to the EU Soil Strategy's target of “net zero land use by 2050”.

- Land management

Implementing effective land management through spatial development plans and building regulations. Clear regulations and effective spatial development plans can promote the careful use of land.

3) Planning measures

- Smart urban planning

Efficient and sustainable urban planning can minimise land consumption by focusing on compact, mixed-use developments.

- Smart city concepts

Integrating digital technologies to increase efficiency in areas such as transport, energy and waste management can help minimise the need for new infrastructure.

- Land recycling management

Soil deposits are used as raw materials in many industries, such as sand, gravel or clay for the construction industry. However, soil formation is so slow that care must be taken in its use. Prioritising circular land use over new development will reduce the acute pressures of soil sealing and land consumption.

The combination of these measures can help reduce land consumption in the building sector while promoting sustainable and liveable cities and communities. It is important that these approaches are considered in a holistic context and implemented in cooperation with different stakeholders.

CONCLUSION

The loss of soil resources due to urbanization and landscape change is one of the greatest environmental challenges facing Europe. Urgent action is needed to manage this valuable resource more carefully and preserve it for future generations. Europe is the most urbanized continent in the world. Every year, 1000 km2 (an area larger than Berlin) is built on, much of it sealed. If this trend continues, in 100 years we will have built over an area the size of Hungary (EUROPEAN COMMISSION 2021). Sustainable building in the future cannot be achieved without careful management of the soil ecosystem. In the face of increasing soil degradation, further use for settlement and transport must be avoided. More efficient and responsible land management is therefore the order of the day. Overall, a drastic reduction in land use in the construction sector requires an integrated approach that takes into account environmental, social and economic aspects. Avoiding unused and vacant buildings, building less, building what little is available in a sustainable and compact way, demolishing uneconomic buildings, converting, and extending a lot must be the future. The public sector is called upon to promote solid, energy-efficient and environmentally friendly construction and to support socially acceptable uses. It is important to promote sustainable building practices to minimize negative environmental impacts and maintain the quality of life in urban and rural areas.

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НАМАЛЯВАНЕТО НА ПОТРЕБЛЕНИЕТО НА ЗЕМЯ В СТРОИТЕЛНИЯ СЕКТОР КАТО ВАЖЕН ПРИНОС ЗА УСТОЙЧИВОТО ОПАЗВАНЕ НА КЛИМАТА

Резюме: *Използването на земята и произтичащата от това деградация на земята е едно от основните предизвикателства през следващите десетилетия в световен мащаб и по-специално в държавите – членки на ЕС. В настоящата публикация се анализират екологичните въздействия на прекомерното използване на земята и мерките, които строителният сектор трябва да предприеме в съответствие със Стратегията на ЕС за земята, за да намали тези въздействия и да допринесе значително за смекчаване на последиците от изменението на климата. Търсенето на жилища, включително на втори дом, може да се разглежда като един от основните двигатели на земеползването. Особено важен е принципът на достатъчност, който цели пестеливо използване на поземлените ресурси. В гъсто застроените градове потреблението на земя на глава от населението е по-ниско, отколкото в селските райони. В зависимост от вида на жилището/селището се изисква повече или по-малко земя. Комбинацията от много ефикасни мерки трябва да спомогне за намаляване на потреблението на земя в строителния сектор, като същевременно се насърчават устойчиви и удобни за живеене градове и общности. Устойчивото строителство в бъдеще не може да бъде постигнато без внимателно управление на почвената екосистема. Публичният сектор е призован да насърчава разумното, енергийно ефективно и екологосъобразно строителство и да подкрепя социално приемливите начини на използване.*

Ключови думи: *строителен сектор, опазване на климата, стратегия на ЕС за почвите до 2030 г., нулево нетно използване на земята, функция на почвата*

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