URBAN SMS Soil Management Strategy

# Identification of scientific and practical needs for consideration of soil issues in planning processes

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## Introduction

Within Action 1 of WP3 a SWOT analysis of selected policy and legal instruments was carried out (see SWOT Analysis - Analysis of Strengths, Weaknesses, Opportunities and Threats of (policy) instruments regarding the protection of soil from the partners of the CENTRAL project "Urban SMS"). It provides information about characteristics of these instruments and related requirements concerning soil protection.

This report supplements the SWOT Analysis by providing needs from a scientific as well as practical point of view. From the perspective of environmental protection and concerned municipalities, specific needs for integration of soil protection in planning procedures are collected.

The needs are grouped into four types of needs:

- General needs, which are helpful for several specific needs thereafter,
- Conservation needs, which are dedicated to protect soils for conserving specific functions of soils as well as soils of certain quality,
- Needs for evaluation of impacts on soils, assessment of opportunities and for specific actions to reduce soil consumption,
- Action needs to steer soil use according to the suitability of soils considering priority setting, economic and social costs.

All needs are described in the same way, following a common template. First of all a short definition of the need is provided followed by a rational why it is necessary. Finally a proposal for the implementation of the need in terms of spatial planning is given.

## General needs

### Soil concept with monitoring

Definition

With the help of comprehensive technical information, the qualitative and quantitative inventory of local soils has to be identified and on this basis sustainable objectives for their protection can be derived. This can be presented and (politically) implemented by using a soil concept.

Rationale/purpose

In the planning process it must be possible to measure, manage and predict the utilisation of soil by using a soil concept. Intention is the conservation of natural or semi-natural soils with high performance and to guide the encroachments on low valued soils. A monitoring about the usage of soil quality is important to check if the aims will be achieved.

Proposal for implementation

With the introduction of a score system soil losses or gains may be objectively determined. This only works if the entire qualitative and quantitative inventory of soil, e.g. for a municipality, will be collected by using index points. Then it is also possible to define targets for a sustainable safeguard of soil and to guide the planning.

### Basis for soil evaluation and indication of impacts on soil quality

Definition

Scientific basis for the evaluation of soils and their natural functions (site for natural and cultural vegetation, regulation of water balance, filter and buffer for pollutants) must be available to make losses or also gains of soil quality caused by planning measurable and predictable.

Rationale/purpose

The assessment should be easy to handle, because in the planning process many different environmental factors must be taken into account.

Proposal for implementation

A soil quality map with an aggregate evaluation in e.g. 6 levels (0 = none to 5 = very high) is useful.

### Provision of soil data for planning processes

Definition

On a platform all soil relevant basic data should be offered.

Rationale/purpose

Many aspects have to be considered during a planning process. The probability for consideration increases with the possibility to use updated data in an easy way. Currently many aspects are not considered because data are not available or not exempt from charges.

Proposal for implementation

All soil relevant basic data should be offered for free on a platform. These data should be actualised at least all 5 years. The simple knowledge where natural grown soils are situated in a planning zone may help to protect them.

### Awareness and acceptance

Definition

In urban planning political criteria play a major role. Therefore it is vitally important to reach awareness and high acceptance for soil protection among responsible decision-makers.

Rationale/purpose

The best way to achieve awareness is to deliver concrete and understandable information about an environmental compartment and make proposals for goals to vote in the city council. To delineate areas for soil preservation, where the planning is restricted from the outset, reduce empirically the acceptance. If a higher authority may be able to establish areas for soil preservation (e.g. Baden - Württemberg: in regional plans according to the land planning act), it would be easier for the municipality to avoid construction on high quality soils.

Proposal for implementation

In a municipality it is the most important thing to convince the local council with arguments why it is so important for this city to preserve high quality soils.
And if there is willingness, it is necessary to show them a flexible way to implement soil conservation in urban planning. This would be possible with a concept like the Stuttgart Soil Protection Concept BOKS.

## Conservation needs

### Reservation of areas for agricultural production

Definition

In each region with natural conditions for agricultural production a defined area should be reserved for the land use of agricultural production. Usually cities have areas which are managed as agricultural land. Suburban agricultural areas with high quality may be protected not only for biomass production but also for soil functions keeping.

Rationale/purpose

Land consumption is continuously ongoing in Central Europe. Mostly the agricultural land is consumed, often that with high natural quality. In order to conserve sufficient agricultural land for food and feedstuff production as well as the potential for other purposes like energy crop production certain areas should be kept as agricultural land. Recovery of the agricultural potential will not be possible if the best lands are consumed for construction. Beside the biomass production these soils can also offer a lot of other functions like water filtration, groundwater recharge, carbon sequestration and others. The objective of this tool should be determination of these areas and their subsequent protection.

Proposal for implementation

These areas should be explicitly defined within the urban planning (e.g. in the land use plan). Therefore the need to define them should be implemented in regional development programmes and/or regional or national spatial planning law. The criteria to delineate such areas should be based on natural soil fertility and site conditions relevant for agricultural management. The agricultural land could be graded in five classes. First class includes the most valuable soils (by judging in the climate regions) which may be exempted from the agricultural fund only as an exception. The second class contains the above standard productivity soils (within the climate regions). The third protection class includes the soils with average productivity and medium protection level that may be used for construction. The fourth class compounds the soils with mostly below average productivity. The fifth class includes the remaining land representing the soils with very low productivity, dispensable for agricultural purposes. The delineation result as a digital layer should be superimposed with a digital layer of the urban zoning plan. The amount of areas needed should be calculated based on needs for food and feedstuff supply and energy crop production.

In Slovakia areas with high soil quality are protected in sense of their laws. If this agricultural land is used for construction purposes developers must pay.
In Czech Republic the soil exemption from the agricultural fund is being charged by the government. Pursuant to the Act No 334/1992 Coll. the payments are calculated. Among others the manner to define the payments for the agricultural land exemption shall be amended. The main reason for change is the inflation process in Czech Republic that begun in the nineties. The rate schedule was prepared back then and doesn't reflect the current tendencies. Another reason is the fact that the payments as an economic tool do not sufficiently fulfill their function any more. The payments are designed so that calculation is based on the official price of the agricultural land.
Eventually the amount of charges is affected by the level of impact to the environmental protection system and the quality of exempted soil (expressed by the protection classes). The soil exemption basic payment rates are multiplied by an ecological weight of the corresponding environmental factor effect or by a sum of these weights.

**Conservation of multifunctional soils for ecosystem functions**

Definition

High quality soils with a high potential of multifunctionality should be protected within and around cities.

Rationale/purpose

Remaining unsealed soils are of different quality. Some soils are especially valuable since they may fulfil many functions in urban ecosystem, including retention, buffering and filtering or biodiversity functions. Such multifunctional soils are, generally, those of high organic matter content, high clay content and not acidic. These soils should be protected against urbanization in order to establish adequate areas for ecological functions. Important soil functions to be considered in planning processes are natural fertility, regulation of water balance, filter and buffer and habitat for specific natural vegetation.

Proposal for implementation

The need for delineation and protection of the multifunctional soils should be implemented in the regional spatial planning law. These soils should be delineated within and around each city based on soil maps with available soil characteristics (organic matter, pH, particle size distribution) or soil quality classes in terms of soil functions. More details about the methodology are given in the Annex.

**Protected areas within and surrounding the city**

Definition

Usually each city has certain areas that are used for recreation. This can be city owned forests, playgrounds, green areas, etc. These areas are necessary for healthy and satisfied residents.

Rationale/purpose

Some areas are already protected by mainly nature conservation laws, whereas many are not. These areas need to be protected in order to avoid soil consumption and sealing.

Proposal for implementation

Protection of these recreation areas by law (like for nature protection) and designation of additional areas with high quality soil, when developing the city. This also includes the city infrastructure to connect these areas with the rest of the city.

**Soil quality increase on urban areas through green area conservation**

Definition

The higher proportion of impervious built surfaces instead of pervious vegetated surfaces leads to an altered hydrological regime in urban areas, increasing the rate and volume of surface water runoff. Climate change and lowering of C cycling (C sequestration and C storage) is another direct driver of change in ecosystem services.

Rationale/purpose

There are a growing number of research studies on the beneficial impacts of urban green space on micro-climate, air quality, hydrology, reduction of energy consumption in adjacent buildings, carbon storage and sequestration, as well as biodiversity. Green infrastructure offers significant

potential to help adapt urban areas to climate change through moderating micro-climates and reducing surface water runoff. The management of land use and land cover can help to facilitate climate adaptation of the city.

Proposal for implementation

A good understanding of both land use and surface cover is required for a careful planning of the future design of green areas (also based on expected climate change e.g. the increase of temperature in an area during next 10 years) and to improve the C storage in urban areas. Maps containing all green spaces (public and private), cadastral data, aerial pictures are needed. The knowledge of this information can be used to establish reference values such as size of green areas on total urban area considered.

**Green fields protection**

Definition

In the city of Prague there is deficiency of areas filled by parks, children playgrounds and other green fields (for relaxation or recreation). These must be protected and the contamination of these areas should be prevented.

Rationale/purpose

The areas mentioned above deserve systematic monitoring to prevent its destruction or contamination. The threat of contamination could be caused of excessive use of salts due to treatment of pavements and roads during winter time. Contamination by heavy metals and polyaromatic hydrocarbons due to very dense traffic is also very important. In the case of children playgrounds there is also possible contamination by dogs and cats excrements and parasites.

Proposal for implementation

In this case is suggested regular monitoring system and regular analysis of soil (sand) samples.

**Protection of children playground areas**

Definition

Each city has areas which are used as playgrounds for the youngest urban population till 15 years – kindergarten and schoolyards. These sites require a specific protection because of immediate contact with contaminated soil or parasites from animal excrements.

Rationale/purpose

These areas are only weakly protected in sense of laws in Slovakia, some direction of EU are involved in the legislation. The main reason is establishment of practical implementation of EU direction, and proposal for monitoring and measurement of all playgrounds and kindergarten sites. First of all areas occurring in adjacent industrial or dust-producing plants should be

recognized and monitored. The procedure includes inventory of all active playground sites and proposal for revitalization or closure of them.

Proposal for implementation

A geo-referenced land use database of the city with delineating of playground and kindergarten areas and sources producing plants can be serving as the base including soil contamination database and other auxiliary sources. Radius of impact will be calculated according to some factors like wind blowing, terrain constellation etc. The map of risk areas for children playground location can be illustrated on the large scale. It can provide primary information for following revitalization or closure procedures of these sites.

**Reduction of suspended particulate matter in urban areas**

Definition

Bare soils are subject to wind erosion which may cause an increase in airborne suspended particulate matter. In urban soils wind erosion can cause spread of contaminants.

Rationale/purpose

In urban areas there are uncovered surface sites susceptible to wind erosion. Maintaining a homogeneous coverage of these areas (by herbaceous or woody plants) can help to reduce suspended particulate matter and diffusion of potential contaminants that are bound to the soil fine particles. The spatial structure of branches and twigs and the shape of leaves and needles play a key role in the interception properties of a plant.

Proposal for implementation

Using data on urban air quality and the densely populated areas it is possible to plan the constitution of new green areas. A conversion index between green space and reduced particle size matter can be useful to establish a direct connection.

**Management of water retention within city area**

Definition

Soils with high retention potential should be protected in cities with a flood risk.

Rationale/purpose

Many cities, especially these densely urbanized, are under a recognized risk of flood. One day heavy rainfall in the region of the city often results in flooding of several villages. Soils with high water retention capacity serve as a sink absorbing excess of rainwater. Thus there is a need for exclusion of soils with highest water retention capacity among the remaining soils from urbanization process, especially in cities with a flood history or cities with low share of unsealed land.

Proposal for implementation

The soils with high water retention capacity have to be delineated based on such soil characteristics as organic matter content and particle size distribution. Poland has got the needed information in a digital format. Some countries may use their classifications with high, medium or low quality soils since they are generally based on the same principles.
The required area to be protected can be modelled based on soil data and amounts of water to be retained in case of extreme rainfall. The threshold for soil consumption should be calculated in order to sustain water retention capacity within the given city area.

### Procedure for planning of subsurface constructions

Definition

If subsurface constructions are built a procedure should be fixed to preserve or restore soil functions.

Rationale/purpose

After subsurface construction works like building underground garages under parks the surface is rebuilt. The quality of this rebuilt area depends on the possibility of tree growth, soil –water-capacity and others. These parameters are aspects of soil functions. Defined procedures should be used to build and rebuild the lost green area and soil.

Proposal for implementation

The procedures may contain a minimum thickness of 1,65 m and the use of authentic material. The use of this described procedure should be required in any legal instrument. If it is not planned in the first stage of detailed planning, it is not possible to reach the necessary depth.

## Evaluation needs

### Quantification of impact of soil quality on local climate, air and water quality

Definition

Relationship between quality of urban soils and local climate, air quality and water quality should be studied and quantified.

Rationale/purpose

There is a raising awareness on the role of soils for local climate in urban zones. It has been recognized that within urban areas with poor soils as dominating soil cover or very high density of sealed surface, noticeably higher temperatures and much bigger temperature fluctuations are observed. In summer period, in densely built-up areas residents are exposed to higher temperature than in zones where high quality soils were saved for green areas and recreation purposes. Such vegetated areas with species diversity have ability to accumulate heat and therefore alleviate thermal extremes. Lack of protection of the best quality soils leads to a loss of

land ability to hold water which decides on microclimatic conditions (low quality soils retaining small amounts of water are not able to effectively accumulate heat).
However the relationship between soil quality or spatial distribution of soils with different quality and local climate is not quantified. Thresholds for soil consumption that would not have a negative effect on microclimate are also not defined.
Similarly, the relationship between soil cover within urban areas and air and water quality is not recognized.

Proposal for implementation

The relationship between the soil quality/cover and recorded temperatures in cities can be assessed. Local microclimate performance might be modelled for different scenarios of soil consumption based on spatial soil information.

**Environmental quality assessment and delineation**

Definition

Each city has areas which are immediate environment for urban population. There are open green areas, ornamental gardens, urban parks, tree solitaires etc. They can contribute to the healthy living standards and quality of life in cities.

Rationale/purpose

These green areas are not protected in sense of any laws, for example in Slovakia. There is evidence only like brownfield areas are potentially contaminated sites. Open green areas which are environment for urban population are not under any protection. These sites are not monitored, not measured for potential risk elements. The risk from contaminated sites e.g. from neighbouring industrial sources of contaminants and dust is not regarded (maybe only in some EIA projects). The reason for this tool implementation is delineation of areas functioning as a source of contaminants and delineation of areas suffering by neighbouring of contaminated sources. Results are expected as digitized map of environmental hazards.

Proposal for implementation

The methodology is described in Sobocka et al. 2007: Urban soils (a case study of Bratislava city). It provides primary information about soil contamination in the cities and their impact on urban population. It describes various ways of soil contact with human and generally delineates areas which could be risk to live there. Digitized map of environmental hazards can be serving as a tool for correct decision of new urban planning activities. The methodology is based on wide range of data referring to soil properties, soil functions and risk assessment.

**Loss of soil resources including sealing rate**

Definition

Each city has areas which are daily consumed for non-agricultural purposes. Sealing rate can be calculated from the soil consumption to impermeable layer covering.

Rationale/purpose

Control of sealing rate is very important tool in such a density inhabited cities like Prague. In the case of high rate of sealing the natural functions of soil are almost lost. Especially the ability to keep excessive water in case of rainstorms and the local flooding follows. The reason for assessment is to delineate areas mostly consumed and mostly sealed for building construction including the rate of this consumption.

Proposal for implementation

Using statistical yearbooks the rate of agricultural land consumption can be calculated. The problem is to localise the areas which were consumed. The database can be provided by cadastral office or by Regional land office. Based on a digital geo-referenced database of the city areas with categorized rate of consumption and rate of sealing can be illustrated. The determination of rate of sealing requires certain methodology for sealing areas measurement and delineation. The use of cadastral maps is envisaged. Also orthophoto maps and its evaluation might be useful too.

**Identification of brownfields and their alternative use to reduce soil consumption**

Definition

Brownfields should be identified and assessed for remediation action needed and potential use for urbanization process

Rationale/purpose

Brownfields might be used as areas for urbanization as alternative to remaining agricultural soils or soils with high value for the ecosystem. On the other hand, some brownfields may pose a risk related to soil contamination. The brownfields must be geographically identified and the spatial information layer containing this information should be produced. There is a need to assess the brownfields regarding the environmental, economic and social problems related to them. Special focus should be given to contamination in order to define risks related to current or planned use or actions needed for restoration of the area. Brownfield areas might serve as a source of land for urbanization, both commercial/industrial and residential if there is no risk for population. Restoration of brownfields into other functions is important also from aesthetic point of view.

Proposal for implementation

There is a need to implement a requirement of brownfield identification and classification in the law. The spatial information layer containing brownfields locations and borders should be produced. The brownfields should be classified into different categories to be used in spatial planning: uncontaminated ready for urbanization, contaminated that need remediation before being urbanized, contaminated that should be remediated but rather should not be urbanized with residential buildings.

**Demand of compensation**

Definition

In the planning process usually the loss of soil quality and also the compensation requirement has to be determined. Therefore concrete indications about the stock of soil quality (soil functions) and its changes during the planning are required.

Rationale/purpose

The purpose should be that the compensation measures costs are covered by the developer, when using high quality soils. The demand of expensive compensation measures or payment could steer the intention of planning on alternative areas with less loss of soil quality.

Proposal for implementation

The demand of the compensation requirement with index points has to be calculated in a quantitative and qualitative matter. For example calculations of surface gravel mines that are renaturalised can serve as a basis for the calculation. Also experiences from highway constructions and compensation measures like removal of sealing or application of topsoil for improvement or restoration of soil functions can provide reference values.
Practical approach for compensation payment: The developer has to put back money in a deposit on an account that will be used in the case, if the developer gets shipwrecked and a fallow land with buildings remains. This also ensures the planning authority a financial basis for compensation and does not relieve the developer from his responsibility.
A survey of potential areas that are suitable for compensatory measures with positive effects on soil in order to propose them to the planners should be carried out. If there are none, there must be calculated a payment for the loss of soil.
As the actual regulations are usually not satisfying regarding soil (measures without relation to soil are possible, amount of compensation payment is too low and not committed by building legislation), a separate regulation especially for soil should be developed. It should be allowed to use the funds of compensation payment for measures to strengthen inner urban development.
More details about the methodology are given in the Annex.

**Identification of potential areas for urban development**

Definition

A cadastre with available potential areas to build on has to be elaborated. These are areas which are not or just slightly used like building gaps or with a potential for development like brownfields (e.g. industrial wasteland, old railway station or switchyard) and contaminated sites. Also meaningful are areas with capability for optimising the utilisation where there is a possibility to establish a “qualified density”.

Rationale/purpose

The purpose is to steer the planning on areas with low soil quality as well as to promote inner development. Barriers for the usage of adequate areas must be eliminated or minimised. Barriers for the usage of adequate areas must be eliminated or minimised. The hoarding of these areas and the economic venture needs to be unattractive. These are important requirements to safeguard high quality soils in the outside area and to avoid urban sprawl.

Proposal for implementation

Implementation should follow a sustainable construction management like in Stuttgart (www.stuttgart-bauflaechen.de) or a sustainable city development management like in the city of Vienna (http://www.wien.gv.at/stadtentwicklung/step/step06.htm). The cadastre should be a layer in the information system for planning decisions. A map with available potential areas to build on is recommended to be elaborated. Without a building gap cadastral no land use plan with greenfield development should be accepted.

The main three components are:

- Establishment of a current review of existing potential building sites. These areas should be typed according to their specific characteristics and for all sites with potential building land so called “area passes” should be created,
- Development of an information platform (GIS and database-driven) and on basis of this, building of an internet presentation,
- Elaboration of strategies and approaches to activate in particular potential private construction sites.

Therefore identifying the possibilities of municipalities to act and the necessary inputs for the rapid and timely building, such as removal of infrastructural deficits, establishing the necessary planning law conditions and investigation of existing contaminated sites should be carried out.

Also very helpful to support the development of the areas described above and to avoid sealing high quality soils are subsidies. In Baden-Württemberg several instruments exist, e.g. Land Remediation and Development Program (Landessanierungs- und Entwicklungsprogramm), Development Program for Rural Space (Entwicklungsprogramm ländlicher Raum/MELAP), Directive for subsidy of the treatment/remediation of contaminated sites of the Federal Land of Baden-Württemberg (Förderrichtlinie Altlasten).

**Urban growth on areas of low soil quality**

Definition

Cities should have a comprehensive policy for the provision of building land. Current practice of spreading of cities on the most accessible agricultural land on the fringe of cities should be prevented and guided to soils of low quality, in particular in terms of soil functions.

Rationale/purpose

Many cities, especially in the new EU member states, have no comprehensive development policy and are expanding sealing mostly on the best available (and cheapest) areas for the construction which are in many cases also the best agricultural areas for food production. This is partly also caused by the requirements of investors and developers who want flat land, close to the settlement areas, along with a good transport infrastructure in the immediate vicinity (e.g. highway, railway terminals).

Proposal for implementation

European and national legislation should be necessary to regulate and define the importance of open green space and agricultural land, as so far in practice is often too much failure to the investors and is too easy to change the land use into building land. Cooperation between spatial

planners and agricultural experts should be necessary. Before land use change the ratio between unbuilt areas within the city borders and in a radius of 2 km from the current limit of sealing should be calculated. Any encroachment on this land (in city outskirts) instead within the city should evaluate the % of reduction of the ratio and the appropriate compensation of this unnecessary loss of land charged to the developer. The exact formula should be defined and integrated in spatial development documents and municipalities, of course depending on the open surfaces at the city/region/country level. In order to consider the soil quality in more detail a comparison of areas considering the aggregated valuation of soil functions is recommended. More details about the methodology are given in the Annex.

## Action needs

### Priority of undissected soil areas

Definition

The places where it is allowed to situate buildings and seal soil surfaces should be restricted in zoning plans. This restriction should lead to less sealing and undissected soil areas.

Rationale/purpose

During the planning of built up areas often the aspects of quantitative soil protection are not considered. The placement of buildings on a building lot influences the sealing rate on the surface area. If buildings are situated near the entrance and backyards remain as undissected areas sealing is minimised by short accommodation roads and more soil remains undisturbed. Another example is if buildings are situated along water bodies (streams and lakes). These soils should remain unspoilt.

Proposal for implementation

Restrictive designation of building lines limits the possibility of building placement. This should be considered in the zoning and building plans with the aim of soil conservation. Also soils along water bodies may be protected generally.

### Economic and social cost related to works impacting on soil

Definition

The environmental assessment of any work having impact on urban soil (e.g. construction works, soil movement, excavation) should consider the economic and social costs in its implementation and in the management phase.

Rationale/purpose

The high complexity of the different functions of soil and the variety of existing instruments used to soil protection and soil management should also take into account the related economic and social impact.
The evaluation of the current economic value of the considered area is important to establish an indicative assessment of the incurred costs.

The social costs should evaluate the historical background of the people living in the area, and the purpose of the work and how it is perceived by the local community. Implementation of these concepts will help the social awareness and approval of the operation. As a consequence overall success is increased.

Proposal for implementation

Economic assessment of urban soils investigated can be done through market research, sector studies, and cadastral data.
The social impact assessment can be verified through questionnaires, public debates (e.g. Agenda 21) and different strategies of communication for urban soil.

**Selective expansion of cities depending on the suitability of soil**

Definition

Spatial planners should take into greater account a wide range of soil and green areas functions and their multifunctional role in the ecosystem, not just their value/price which is calculated from the land use status. In the case of already polluted agricultural soils interventions/sealing on them should be possible easier.

Rationale/purpose

Urban sprawl in recent decades and the reduction of forest cover have led to changes in space and the environment, in particular to significant reduction of the best agricultural land and forests. Together with climate change it has led in recent years to more frequent floods, which are partly attributable to the outflow of water of built-up areas. Sometimes the old classification of agricultural land hinders interventions on them, even though investigations have shown that they are not suitable for agricultural production. It would make more sense to expand the cities to this areas, if a spread of cities to new areas is needed.

Proposal for implementation

In the case of urban sprawl, building of infrastructure on new areas investors should be bound by spatial documents to make a study of impacts of sealing on ecological and hydrological conditions in the area and evaluate the results also from the economic point of view in order to charge potential investors, if they persist on interference to the new area, for economic loss which will make possible land improvements elsewhere. In the case of land which is less environmentally appropriate (e.g. due to pollution) the rank of suitability for sealing should be automatically increased, provided to carry out rehabilitation in the manner specified for the separate type of pollution.

## Synopsis

From the perspective of environmental protection and concerned municipalities, specific needs for integration of soil protection in planning procedures from a scientific as well as practical point of view were collected and listed in the previous chapters. These needs give an overview and were grouped into four types of needs which can be characterised as follows:

Looking at the **general needs** it can be stated that planners and stakeholders need to be aware of the importance, quality and quantity of soil for urban planning processes. This provides at a later stage a higher acceptance of the environmental good soil. All decisions need to be based on existing soil data as much as possible, but monitoring of soil serves the necessity to know about future soil conditions. An evaluation can validate these monitoring assumptions and indicators for the impacts of soil quality in urban development can be developed and applied in future planning decisions.

The **conservation needs** highlight possibilities to protect good quality soil and specific functions of soil. This can be achieved via diverse sectors like agriculture, water or nature conservation giving the priority to protect these areas and thus avoid soil consumption. On the one hand, the quality of life of urban citizens (e.g. ecosystem and recreation functions via protected and green areas, reduction of wind erosion and improved air quality) and the supply of agricultural products from short distances can be improved and assured. On the other hand soil can be protected and secured in a long-term perspective. Also within urban areas, areas for play grounds, green fields and water retention need to be conserved. If subsurface construction has ceased, there is the need to set it back to the original state of soil.

As e**valuation needs** environmental quality assessment and delineation are seen as very important. Also the loss of soil, including the sealing rate and alternative uses of brownfields need to be evaluated. Based on this evaluation and the estimated demand of compensation, which is seen as an important evaluation need from diverse partners, potential areas of urban development and growth shall be identified, especially areas of low soil quality. As not only the soil itself is affected by change of land uses also the impacts on other environmental compartments is recommended to be assessed. The quantification of impacts of soil quality on local climate, air and water means a transdisciplinary approach, looking at interactions between several environmental matters.

The proposed **action needs** should be based on the previous needs. Through the consideration of these conservation and evaluation needs in zoning plans the available area for construction can be defined and priority can be given to undissected, low soil quality areas. Also looking at the economic and social cost related to works impacting soil is needed. Finally the expansion of a city shall, as already stated in the evaluation needs, depend on the suitability and quality of soil.

For the fulfilment of these needs several proposals for implementation were given. Beside legislative framework conditions the development of computer tools are regarded as helpful for practical implementation. Regarding the proposed needs tools for the evaluation of quality and functions of soil under different land use and impacts on other environmental compartments will be helpful. Also tools to assess the loss of soil resources, in particular by soil sealing, seem to be necessary. Furthermore for collecting and compiling of soil data from different sources tools should be developed. Such tools should be made accessible via internet.

## Annex

## Identification of scientific and practical needs for consideration of soil issues in planning processes according to the system used in the federal land Baden-Württemberg (Ba-Wü)

Land consumption is continuously ongoing in Central Europe. In Austria and Germany the daily rates of land consumption are clearly exceeding the national goals. Mostly the soils consumed are soils of a high quality, particularly of high natural fertility under agricultural usage. The ongoing consumption of these soils shows clearly, that soils and their functions which they fulfil in the ecosystem and for human beings, are still not considered in planning processes in an adequate manner.

Therefore, an adequate consideration of soils in planning processes has to take two aspects in to account. Beside the goal to minimize the land consumption in general, the soil consumption, that cannot be avoided, has to be steered on soils with a low performance regarding their natural functions.

From the above it follows the necessity to define the most important soil function and to develop a clear and comprehensible valuation of soil functions as a base for decisions in planning processes. The most important soil functions to be considered in planning processes are: “Natural fertility”, “Regulation of water balance”, “Filter and buffer” and “Habitat for specific natural vegetation (biodiversity)”. A practicable and in planning processes manageable classification of the performance could be a 5 step scale: 0 (no functionality, sealed soil) up to 4 (very high performance).

For the valuation of the soil functions in the federal Land Baden-Württemberg two methods are available: Valuation based on parameters from soil mapping or: Valuation based on the “Bodenschätzung” (German soil evaluation).

In the following at first the four soil functions are described, second possibilities for an aggregated assessment will be given and third the implementation of the assessment in to planning processes will be discussed.

The recommendations for the valuation of soil function are based on the draft version of the actually revised “Guideline for the assessment of soils according to their performance” (Bewertung von Böden nach ihrer Leistungsfähigkeit). [Ministry of Environment Ba-Wü, 1995]

The recommendations for measures to compensate encroachment in soils are based on the guideline “The environmental compartment soil in the compensation regulation according to nature legislation” (Das Schutzgut Boden in der naturschutzrechtlichen Eingriffsregelung). [Ministry of Environment Ba-Wü, 2006]

The recommendations concerning inner urban development are based on the guideline “Land management for municipalities” (Kommunales Flächenmanagement). [Landesanstalt für Umweltschutz Ba-Wü, 2003]

## 1. The most important soil functions to be valuated and considered in planning processes

### Natural soil fertility

Rationale/purpose

Food production and therefore the food supply, particularly with staple food of the world population strongly depends on the availability of arable land with soils of high fertility. As the world population is still increasing, intensive and not adequate usage of soils and the climate change are reducing the availability of arable land, the cultivation of energy crops competes for soils and the price for fertilizer is increasing, it is obvious that a protection of soils with a high fertility will become more and more essential.
In a globalized world, with a globalized food market every municipality that is responsible for spatial planning, has the moral commitment to safeguard the resource soil for food production.
Beside the moral commitment regarding the global food supply, the possibility of local food supply facilities for the resident population should also be taken in to account as an advantage for the local markets and the citizens.

Valuation based on parameters from soil mapping

The valuation of the natural fertility can be based on the available water capacity.
Proposal:

| Available water capacity | Valuation |
|---|---|
| Sealed soil | 0 |
| < 50 mm | 1 |
| 50 - 140 mm | 2 |
| 140 - 200 mm | 3 |
| > 200 mm | 4 |

Additional the slope inclination can be considered: 12 - 21 % max. 3; > 21 % max. 2

Groundwater or stagnant water influenced soils should be valuated separately.

Valuation based on “Bodenschätzung” (German soil evaluation)

The valuation of the natural fertility can be based on the “Bodenzahl”.
Proposal:

| Bodenzahl | Valuation |
|---|---|
| Sealed soil | 0 |
| < 35 | 1 |
| 35 - 59 | 2 |
| 60 - 74 | 3 |
| > 74 | 4 |

Consideration of slope inclination: see above

**Regulation of water balance**

Rationale/purpose

In all project partner countries, probably enforced by climate change, heavy flood disasters occurred in the last years - sometimes locally, sometimes area wide. Soils, especially soils with a high water storage capacity are able to reduce the surface run off and minimize flooding hazards. By contrast soil sealing strongly increase the surface run off and demands often complex and expensive compensation measures like water retention systems or dams. Some of these measures often shift the flood risk downstream. In order to minimize the own risk of flooding and to avoid high expenditures for technical measures soils with a high water storage capacity should be protected by the municipalities.

Valuation based on parameters from soil mapping

The valuation of the "Regulation of water balance" can be based on the infiltration rate and the water storage capacity.

Proposal:

| **Infiltration rate (cm/d)** | **Water storage capacity (l/m²)** | | | | |
|---|---|---|---|---|---|
| | > 50 | 51 - 90 | 91 - 140 | 140 - 200 | > 200 |
| < 7 | 1 | 1 | 1 | 1 - 2 | 2 |
| 7 - 15 | 1 | 1 - 2 | 2 | 2 | 3 |
| 15 - 30 | 1 | 2 | 2 | 3 | 3 - 4 |
| > 30 | 1 | 2 | 3 | 4 | 4 |

Stagnant water influenced soils should be valuated separately.

Consideration of slope inclination of > 21 %: Reduction of the value by 1

Valuation based on "Bodenschätzung" (German soil evaluation)

The valuation of the "regulation of water balance" can be based on the "Klassenzeichen" (Texture, parent material / genesis, state of development).

Proposal (Example with selected "Klassenzeichen"):

| **Texture** | **Material/ Genesis** | **State of development** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **Sand** | **W** | - | 3 | 2 | 2 | 2 | 1 | 1 |
| **Loam** | **Lo** | 4 | 4 | 4 | 3 | 2 | 2 | 1 |
| **Clay** | **W** | - | 2 | 2 | 1 | 1 | 1 | 1 |

W: weathered; Lo: loess

Consideration of slope inclination of > 21 %: Reduction of the value by 1

**Filter and buffer**

Rationale/purpose

Basic requirements for human health are unpolluted food and drinking water. Soils are able to filter particulate pollutants and to adsorb soluble pollutants by clay minerals and organic matter. Without these properties the risk for a contamination of groundwater and the risk for an uptake of harmful substances by crops would be significant higher. Therefore, the protection of groundwater resources to supply the citizens with clean drinking water requires also the protection of soils, particularly soils with a high filter and buffer capacity. Especially in urban areas with higher air pollution, the importance to safeguard these soils, regarding groundwater protection and food production is evident.

Valuation based on parameters from soil mapping

The valuation of "Filter and Buffer" can be based on the pH-value and the content of organic matter (OM) and clay.

Proposal:

| **OM content (kg/m²)** | **Clay content (kg/m²)** | **maximum pH-Value in control section (max. depth 1 m)** | | | |
|---|---|---|---|---|---|
| | | **< 4.2** | **4.2 - 5** | **5 – 6.9** | **> 6.9** |
| **sealed** | | 0 | | | |
| **< 13** | **< 100** | 1 | 1 | 1 | 2 |
| | **100 - 300** | 1 | 1 | 2 | 3 |
| | **> 300** | 1 | 2 | 2 | 3 |
| **13 - 25** | **< 100** | 1 | 1 | 1 | 2 |
| | **100 - 300** | 1 | 1 | 2 | 3 |
| | **> 300** | 1 | 2 | 3 | 4 |
| **> 25** | **< 100** | 1 | 1 | 2 | 3 |
| | **100 - 300** | 1 | 2 | 2 | 3 |
| | **> 300** | 2 | 2 | 3 | 4 |

Groundwater influenced soils: valuation only above groundwater saturated horizon

Valuation based on "Bodenschätzung" (German soil evaluation)

The valuation "Filter and Buffer" can be based on the "Klassenzeichen" (Texture, parent material / genesis, state of development).

Additional the parent material is considered. In carbonate areas the valuation accords to the values in the table below, in silicate areas the values have to be reduced by 1.

Proposal (Example with selected “Klassenzeichen”):

| Texture | Material/ Genesis | State of development | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sand | W | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Loam | Lo | 4 | 4 | 4 | 4 | 4 | 4 | 3 |
| Clay | W | - | 4 | 4 | 3 | 3 | 3 | 2 |

W: weathered; Lo: loess

**Habitat for specific natural vegetation (biodiversity)**

One aim of nature conservation is to safeguard the biodiversity in particular by preserving species that are rare or even in danger of extinction. Preconditions for many rare species are often extreme soil properties (e.g. wet, dry or low nutrient availability). Caused by soil consumption and also by agricultural usage, soils with extreme properties have become also rare. Wetlands have been drained; animal breeding and the usage of mineral fertilizer increased the nutrient supply.
Therefore, soil protection can support the aim to safeguard biodiversity by protection of soils with the mentioned extreme properties. The benefit for municipalities is not only the preservation of biodiversity but also, under certain conditions, a support of tourism and the recreation of the citizens.
In contrast to the other soil functions, only soils with really extreme properties (value 4) should be disclosed in maps or reports for the consideration in planning processes. Additional a representation of soils with a value 3 could be helpful regarding impact and compensation regulations.

Valuation based on parameters from soil mapping

The valuation of “Habitat for specific natural vegetation” can be based on pedological moisture steps or the mechanical depth or on pedological specialities.

Proposal:
“Moisture”: Extremely dry or very dry and very wet conditions
“Depth”: More than 75% coarse material below 0.15 m
“Specialities”: Podsols and Regosols

Valuation based on “Bodenschätzung” (German soil evaluation)

The valuation of **“**Habitat for specific natural vegetation” can be based on the “Bodenzahl” or on the “Klassenzeichen” (Genesis and state of development) or on special explanatory notes in the soil evaluation.

Proposal:
“Bodenzahl”: Soils with “Bodenzahl” below 24
“Klassenzeichen”: “7 Vg” (State of development 7, weathered soil, high coarse material content)
“Notes”: “Hu” (only useable as very extensive pasture) or “Ge” (very low yields achievable)

## 2. Possibility for an aggregated assessment of soil quality in planning processes

In regional or local spatial planning the planning authorities and planning bureaus have to consider a lot of different issues as infrastructure, nature protection, air, wastewater, water supply, socioeconomic issues and more. And soil is just one of them. Therefore, for the planners and the decision makers, it is important to reduce the information concerning only one subject as far as possible, to keep the planning process and especially the maps manageable and clear. And it could be assumed, that, the well defined the demands concerning the soil are, the better the acceptance and the consideration will be.

Therefore an aggregation of the valuation of the different soil functions is necessary - and it is possible without a loss of too much information.

As the valuations of the three functions “Natural fertility”, “Regulation of water balance” and “Filter and buffer” are extensively aligned, it is acceptable to sum up the valuations to generate a over all assessment. Based on the arithmetic mean the aggregated values can be determined as follow:

| Arithmet. mean | aggreg. Valuation |
|---|---|
| 1.0 – 1.4 | 1 |
| 1.5 – 2.4 | 2 |
| 2.5 – 3.2 | 3 |
| 3.3 – 4.0 | 4 |

Because the valuation of the function “Habitat for specific natural vegetation (biodiversity)” is in opposite to the valuation of the three other functions, it is necessary to handle it separately. As the consideration of this function concerns only areas with a high value, it is not comprehensive and therefore it should be manageable in planning processes.

As result of the soil assessment two different subjects have to be taken into account in planning processes: A comprehensive and aggregated soil value and, only selective, soils with a very high performance regarding the function “Habitat for specific natural vegetation”.

## 3. Proposal for implementation

As there are two different main goals to be achieved (reduction of land consumption in general and the steering of the consumption) the approaches to reach these aims are also different.
For an appropriate steering it is absolutely necessary to consider the soil quality whereas for the reduction of land consumption instruments without a consideration of soil quality are also reasonable.

Therefore, in the following, firstly the instruments and possible measures for steering and secondly some instruments, that might help to minimize land consumption will be discussed.

**Protection of high quality soils by steering the land consumption on soils with low performance**

To reach the aim to steer soil consumption on soils with a low performance, it is reasonable to pursue a dual strategy:

- Wherever the legal framework of spatial planning offers the possibility to define areas for a special protection of certain environmental compartments, the opportunity should be taken to protect soils with a high performance.
- Wherever soil consumption is not avoidable and if alternatives (different areas) exist, the alternative with the minor loss of soil functions should be chosen.
  In this context a methodology of an impact and compensation regulation should be established, to support the steering effect.

Proposal to delineate areas for soil protection

A delineation of areas for soil protection should rather be located on a regional planning level than on a local level (more objective weighing of interests could be assumed).
In the federal land Baden-Württemberg (Ba-Wü) there is, according to the "Landesplanungsgesetz" (planning act of Ba-Wü) the possibility (not the duty) to delineate in the regional plans areas for certain usage (agriculture, forestry) or nature conservation and explicit for soil preservation (§ 11 (3) Nr. 1, (7) LplG).
Responsible for the regional planning are the regional associations (Regionalverbände).

The areas can be divided in two types with different restrictions for usage. In priority areas ("Vorranggebiete"), e.g. for soil preservation as no usage that would cause hazards for soils is allowed. In reservation areas ("Vorbehaltsgebiete") another usage is possible, but only after a weighing of the interests with a special consideration of e.g. soil preservation.

According to this legal framework a proposal could be to delineate priority areas for the preservation of soils with an overall valuation of 4 (very high) and to delineate reservation areas for soils with a high overall valuation (values 3).

As result a superordinate delineation of areas for soil preservation could impede the consumption of high quality soils by municipalities.

Steering soil consumption on soils with low performance

If there are alternative areas for a certain project, the question is which area should be taken if considering the soil quality. Based on the overall assessment of the soil functions (see chapter 2), a comparable calculation of the different values in hectare value units (haVU) can be easily achieved.

Example:
A community needs 5 ha for a new industrial area. For the project two different areas (A or B) are possible.

Comparison of the soil quality:

| **Area A (5 ha)** | | | **Area B (5 ha)** | | |
|---|---|---|---|---|---|
| area i. ha | aggreg. Valuation | ha Value Units | area i. ha | aggreg. Valuation | ha Value Units |
| 3 | 4 | 12 | 4 | 3 | 12 |
| 1 | 3 | 3 | 1 | 2 | 2 |
| 1 | 2 | 2 | | | |
| area Total | | **17** | | | **14** |

Concerning the environmental compartment soil, the project should be realised on area B, because the expected loss of soil functions is less (difference of 3 haVU). Demonstrated as equivalent of high quality soils (value 4) it means, that with area B the soil consumption would be 0.75 ha less than on area A.

As result of this method, planners are able to compare the expected loss of soil functions. They get clear and easy understandable information regarding the subject soil and are able to consider this information in the planning process.

Steering soil consumption by compensation regulation

For supporting municipalities and their planners to come to the best decision ("Area B"), the implementation of an impact and compensation regulation could be helpful. In order to reach the required steering effect the regulation must be based on concerned area and on soil quality. As both, area and quality are integrated in the above-presented calculation of value units, the calculation could be taken as a prerequisite for a compensation regulation.

The requirements for an impact / compensation regulation are:

- Soil assessment - actual state (see chapter 1 and 2)
- Definition of encroachments and valuation of the expected loss
- Soil assessment - target state (concerning the expected loss)
- Definition of compensation measures and valuation of the expected positive impact
- Calculation of the balance (Impact of encroachments - Impact of compensation measures)
- Method to calculate a compensation payment

Definition of encroachments:

Encroachments in soils should only be considered if the loss is obvious and calculable according to the soil valuation (see chapter 1).

This applies for the following encroachments (proposal for valuation of losses of performance included):

- Soil sealing: Total loss of soil functions, valuation: 0
- Abrasion (Exploitation, road cut): remaining performance: normally 1; loss: 1 - 3
- Landfills (Street dams, depositions of excess material): remaining performance depends on recultivation: normally 1 - 2; loss 2 - 3.
- Compaction by construction activities (e.g. construction tracks): after loosening measures lump-sum loss: 10 %

Definition of compensation measures:

Compensation measures have to restore or at least to improve soil functions. The improvement of soil functions has to be sustainable and measurable. Measures that are not able to fulfil these criteria should not be accepted.

Possible compensation measures and their valuations are:

- Removal of sealing: Depends on the soil, which is generated; value 3 is possible
- Application of topsoil : Maximum application of 25 cm; improvement 1 value unit
- Depth loosening: Only strongly compacted soils; improvement 1 value unit
- Direct recultivation of impacted areas: Depends on the soil, which is generated; total compensation is possible
- Green covering of roofs: Application of topsoil; minimum 10 cm; maxim. 1 value unit
- Liming: Only in case of strongly acidic soils; 0.33 Value units (only one function)
- Improvement of the infiltration rate: Conversion of arable land in a hillside situation and a silty soil texture (puddling hazard) into grassland or forest to improve the infiltration rate and therefore reduce the surface run off and the water erosion; 0.33 value units (only one function)

Calculation of the balance:

Considering the valuation of soil functions, the losses by encroachments and the values generated by compensation measures, it is easily possible to make up the balance.

Example:
Area B (see above) will be sealed on 4 ha, 1 ha is needed for a dam (noise protection). The top soil from an area of 4 ha is used to improve a soil (arable land) with a low performance. Other measures are not possible.

Balance

| **Functional loss by encroachment** | | | | |
|---|---|---|---|---|
| area i. ha | encroachment | Value before encroachment | Value after encroachment | loss i. ha Value units |
| 3 | sealing | 3 | 0 | 9 |
| 1 | sealing | 2 | 0 | 2 |
| 1 | dam | 3 | 1 | 2 |
| **total loss** | | | | **13** |
| **Positive impact of compensation measure** | | | | |
| area i. ha | measure | value before measure | value after measure | improvement i. ha Value units |
| 4 | topsoil applic. | 2 | 3 | **4** |
| **Balance** | | | | **- 9** |

In this realistic example a deficit of 9 ha Value units remains (about 70 % of total encroachment). Demonstrated as equivalent of high quality soils (value 4) it means a loss of 2.25 ha. In comparison, the same project realized on area A with the same compensation measure would cause an equivalent deficit of 3 ha. In most cases of soil consumption a deficit that cannot be compensated by measures will remain. Therefore a compensation payment should be implemented.

Method to calculate a compensation payment:

In Germany and in Baden-Württemberg an intervention and compensation regulation is implemented in the nature protection act as well as in the building act.
According to the nature protection Act of Ba-Wü (§ 21 NatSchG) the initiator of an intervention is committed to compensate the encroachments by compensatory or contingency measures. Compensatory means the recreation of functions, contingency means the substitution of functions in an equal manner and at least in the same regional landscape.
If there are no possibilities for compensatory or contingency measures, the initiator of an intervention is committed to a compensation payment according to the compensation payment ordinance of Ba-Wü.
According to the ordinance the payment is assessed by area in consideration of the impact of the encroachment and the value of the environmental compartment. The margin is normally 1.00 €/m² up to 5.00 €/m². For a calculation of the amount of a payment all environmental compartments have to be considered, not only the soil, even if soil is the only compartment with a compensation deficit. Therefore the amount of a payment depends not only on the loss of soil functions but also on the proportion of the environmental compartments among each other. In practice the payment for deficits concerning soil can never reach 5 €/m².

The described procedure according to the nature protection act, including the commitment of a compensation payment, has only to be applied in case of projects that are not regulated by building law (as the land use planning is). Those projects are e.g. street construction, railroad tracks, dumps or actual the use of agricultural areas for photovoltaic.

As for land and soil consumption the land use planning (industrial areas, housing areas) in responsibility of the municipalities is much more important the impact and compensation regulation according to the building act is more crucial.
Also the building act (§ 1a (3)) stipulates, that the intervention and compensation has to consider the regulation according to the nature protection act. The possible compensation measures are a subject to consideration and a compensation payment is not provided.

In practice the municipalities are making hard efforts, to compensate their encroachments. But as shown, concerning the environmental compartment soil, the possibilities for a real and reasonable compensation are rare, and therefore the municipalities and their planners have to deal with deficits regarding soil functions.
A proposal, suggested also from the soil protection administration in Ba-Wü is to monetize the deficits following the compensation payment ordinance. The amount is calculated based on 5 €/m² by considering the soil quality. Usually the money is spent to realize measures for other environmental compartments as water or flora and fauna. In fact the method to monetize “soil deficits” allows only the valuation of contingency measures but it is not helpful to achieve a restoration or improvement of soil functions.

Regarding the mentioned legal requirements and the proposals that have to follow these requirements, it is obvious, that for the environmental compartment soil as a not restorable and unlasting resource, the situation cannot be considered as satisfying because:

- de jure it is possible to compensate encroachments in soils with contingency measures without a direct relation to soil functions. For a not really restorable and unlasting resource as soil this is an unsatisfying situation.
- In comparison with e.g. the costs of a removal of sealing, the amount of the compensation payments seems to be too low, and therefore the steering effect is only small.
- The usage of compensation payments is restricted to measures which are able to improve, restore or safeguard functions of (other) environmental compartments. So it is not possible to support e.g. inner urban development.

Proposal for a reasonable compensation payment concerning soil losses (see also similar systems of Slovak Republic and Poland for agricultural land)

A reasonable compensation payment should support the goals “Minimization of soil consumption” and “Steering of soil consumption”. Therefore the amount of payments for the losses of soil functions, which could not be compensated by measures to restore or improve soil functions must be remarkable and the amount has to depend clearly on soil quality and not only on area.

To reach these aims, the calculation could be easily based on the “Calculation of the balance” and on the approximate costs of a complete and reasonable removal of sealing. The costs for the removal of sealing can be estimated with about 50 €/m².

As the calculated deficit includes already

- the performance of the soils regarding the soil functions
- the impact of encroachments
- the impact of compensation measures and
- the area of the encroachments

it is possible to calculate the compensation payment for soil losses by multiplying the deficit as equivalent of high quality soils (value 4) with the estimated costs for the removal of sealing of 50 €/m².

In case of the presented examples (Area A and Area B) a compensation payment would be calculated as follows:

Amount of compensation payment

| | total project area i. ha | loss i. ha Value Units | loss i. ha equiv. high quality soils | total payment based on 50 €/m² |
|---|---|---|---|---|
| Area A | 5 | 12 | 3.00 | 1,500 Mio € |
| Area B | 5 | 9 | 2.25 | 1,125 Mio € |

A compensation payment of 1,125 Mio € for 5 ha industrial or housing area and just for one environmental compartment – in this case the soil - might be considered as too high or even as illusionary. But without a real incentive to minimize soil consumption by e.g. using the possibilities of an inner urban development which might be also expensive, it could be illusionary to reach the goal of a soil consumption “net 0” as it is discussed for example in Ba-Wü (in 2008, the consumption in Ba-Wü was about 8 ha/d).

Proposals for the usage of compensation payments:

The funds paid for the loss of soil functions should be restricted to realize measures which are able to restore or improve soil functions and to support communities on their way to an inner urban development. In order to strengthen the incentive effect a subsidy should only be given if a community ensures to abandon greenfield development in the future or if an already planned housing or industrial area will be given up.
The subject “inner urban development” leads to the requirements that should be claimed to support the process of “inner urban development” with the aim to minimize soil consumption in general.

**Requirements for inner urban development and minimization of soil consumption**

In 2003 in Ba-Wü the guideline “Kommunales Flächenmanagement” (Land Management for Municipalities) was published. The guideline includes a comprehensive compilation of recommendations as e.g. for a reasonable treatment of soil material, the minimization of the sealing rate or the protection of soils with a high performance to be implemented in urban planning processes.
The most important recommendations to strengthen the inner urban development are to close building gaps and to mobilize the potentials of construction area, to optimize the usage value of areas and to reuse brownfields and remediate polluted sites.

Precondition to activate the inner urban potential of construction areas is the evaluation and the documentation of these areas in a building gap cadastre, which should include not only the classical building gaps (not used building ground) but also areas with a not adequate usage (old

buildings for farming or industry that are not used any more) and classical brownfields (railway territories, former industrial areas).
Based on this cadastre the municipalities should implement a building gap management in urban planning. Important tasks for the municipalities would be e.g. to offer a building gap marketplace and to negotiate with the owners of building gaps or not adequate used areas.
The building gap cadastre should also be used as a basis to evaluate the need of a greenfield development.

# URBAN SMS Soil Management Strategy

This paper belongs to the following section of URBAN SMS work plan: WP3 Soil management concept / 3.2 Framework for soil management / this report was originally not planned as separate document. It is contributing to the output 3.2.3

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