

Chapter 4

Sustainable Land Use – Example: Land Take for Settlement and Transport in Germany

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4.1 Introduction – The German National 30-hectares Goal for the Year 2020

Amongst the environmental targets set by the German Government in the framework of the national sustainable development strategy (BReg. 2002, p. 99–100), the main target for sustainable land use – reducing *Land Take for Settlements*¹ and Transport Infrastructure (LTST) to 30 (hectares) a day by 2020 – has caused a great deal of discussion, criticism and even excitement. The 30 (hectares) goal was first proposed in 1998 by then minister of environment Angela Merkel and was subsequently adopted by the Federal Government in 2002.

Compared to the baseline situation with an average LTST of 120 ha per day during the period from 1993 to 1996 (Destatis 2010), the target for the year 2020 signifies a reduction of the speed of LTST by a factor of 4 (Fig. 4.1).

In discussion papers, the German Council for Sustainable Development (RNE) as well as the German Advisory Council on the Environment (SRU) added the vision that by 2050, LTST should be reduced to zero (see RNE 2001, p. 2 and SRU 2005, p. 113).

In order to further stimulate the discussion and to encourage early action, the Federal Environment Agency (UBA) proposed an additional intermediate target for

¹In this publication, the term “settlement” means housing areas, industrial zones, commercial areas and other built up sites like hospitals. It includes sites for non transport infrastructures, e.g. electrical plants, plants for waste water treatment or facilities for leisure activities such as public greens, parks, children’s playgrounds, campgrounds, tennis courts and other kinds of sports fields. Also included are areas for photovoltaic parks on greenfields as well as on brownfields.

Not included are sites for wind power plants erected on fields and meadows which remain in agricultural use.

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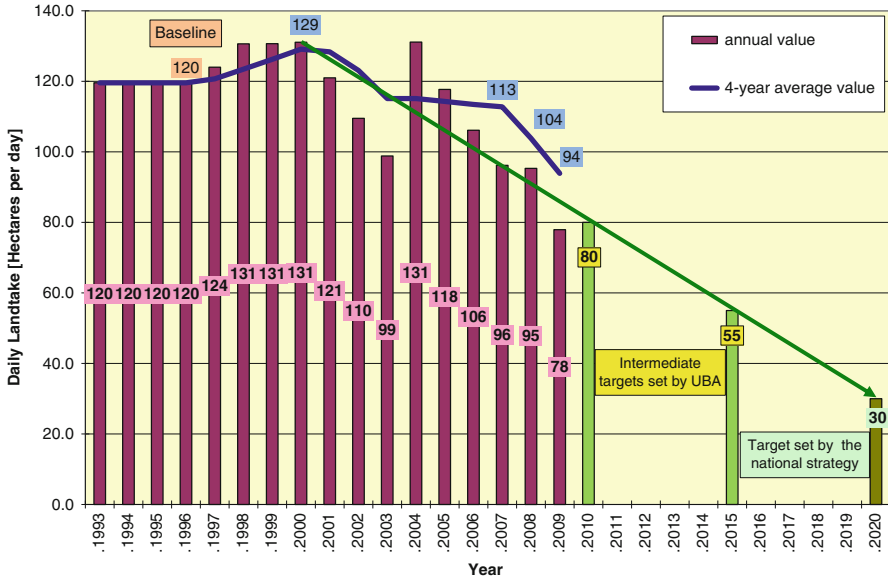


Fig. 4.1 Daily land take for settlements and transport infrastructure (LTST), 1993–2009, and targets set for the years 2010, 2015 and 2020 (Data source: Destatis 2010)

the year 2010 of 80 ha a day in a strategy paper (UBA 2003). If land take were further reduced linearly from 2010 to 2020, this would result in an additional intermediate target of 55 ha per day by 2015.

The impact of LTST on sustainable development, driving forces and the actions to be taken in order to slow down LTST will be discussed in the following chapters.

4.2 Why Is It Crucial for Sustainable Development to Reduce the Speed of Land Take?

Some people argue in what they think is a quite sophisticated way that LTST is no problem at all because the land does not vanish by changing land use. In their views, land remains available to us for future use, no matter how it has been used in the past. But this way of thinking is quite short-sighted.

For the land use change linked to urban sprawl and expanding infrastructures is one basic element of our present lifestyle and economic patterns, which have severe environmental impacts and depend on enormous inputs of energy and raw materials. Given the fact that – in a global perspective – mankind is still growing in number whilst the stock of natural resources is not, the excessive per capita consumption of resources by the population of developed countries is far from sustainable.

Therefore, settlements and transport systems should be transformed in a way that not only increases resource efficiency in relation to Gross Domestic Product (GDP) but that also requires substantially lower total resource inputs.

Unfortunately, efforts to move towards higher resource efficiency are further hampered by the fact that in a growing number of German regions the population is shrinking – due to regional economic decay and demographic change – and the specific resource consumption (i.e. the necessary resource input per capita of the population) to keep the system running will grow steadily, even if LTST could soon be slowed down.

Finally, we should not forget that land take by settlements and transport infrastructures is an irreversible process which progressively diminishes the quality of fertile soils and degrades or destroys natural habitats or potentials for biodiversity in landscapes and which may lead in the end to an irreversible destruction of natural resources through extinction of populations and loss of genetic information.

4.2.1 Environmental Impact and Energy Consumption Induced by Land Take

Urban sprawl and the expanding network of transport infrastructure are consistent parts of rapidly spinning vicious circles, fuelled for many decades by abundant quantities of fossil energies offered at low prices. Motorised vehicles enabled people to move into newly constructed, more comfortable dwellings far from town centres, and – as land is cheaper in the outskirts – many of them not only offering more room inside the house but also large private gardens. The reduced density of land use increases the distances to all relevant destinations – including access to public transport – and increases the probability that finally private cars will become the only acceptable mode of transport.

Cheap motorised transport also favours the spatial concentration of many kinds of private companies, allowing for extra profits by “economies of scale”.² This spatial concentration of single functions may induce transportation on a regional, interregional or even global scale.

By these mechanisms, motorised traffic and the number of traffic jams increase, demanding more transport infrastructure. The expansion of transport infrastructure

²The term “economies of scale” means e.g. that in large plants, with the aid of automation or efficient organisation, fewer workers can get more work done in less time, which reduces labour costs considerably. This is true not only for many types of production units, but also – on local or regional level – for retailers. For instance, large shopping centres are the result of the desire to minimise the costs for buying merchandise, for labour and for the final distribution of the merchandise. The latter costs have been shifted to the consumers, who readily make use of their own private cars to go shopping – creating significantly more traffic on a regional scale. Furthermore, large retailers can make use of or even abuse their market power by purchasing from producers at low prices.

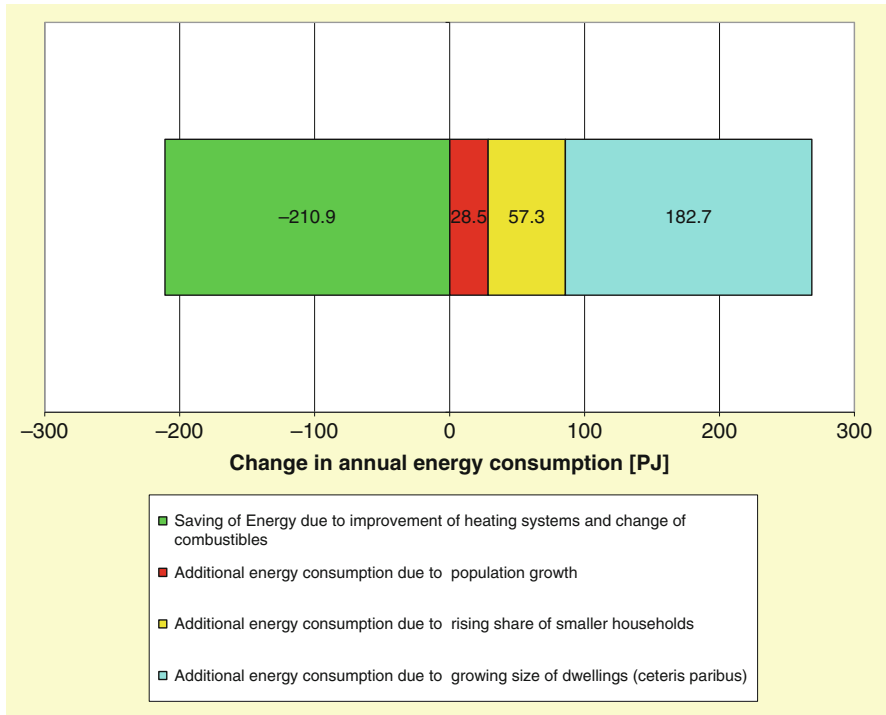


Fig. 4.2 Change in annual energy consumption for the heating of private dwellings, 1995–2004, and reasons for changes in energy consumption (Data source and presentation: UGR* 2006)

*UGR: Umweltökonomische Gesamtrechnungen (Environmental Economic Accounting), is periodically published by Destatis; UGR presents special data on the environmental impacts of the economic framework and the activities of households and industries in Germany; <https://www.destatis.de/DE/Publikationen/Thematisch/UmweltoekonomisheGesamtrechnungen/ThemaUGR.html>; <https://www.destatis.de/EN/Publications/Specialized/EnvironmentalEconomicAccounting/EnvironmentalEconomicAccounting.html>

in combination with low fuel prices further encourages urban sprawl and the concentration of economic structures, which in turn again increases the need for transport. The impacts of this vicious circle on the environment are obvious, e.g. emissions of greenhouse gases, pollutants or noise, the fragmentation of landscapes or the sealing of soil and its impacts on water resources or on the risk of flooding.

Furthermore, additional buildings and infrastructures require huge inputs of materials and energy – not only during construction but also throughout their entire lifecycle, e.g. for maintenance and repair, for renovation and regular cleaning, for heating in winter, cooling in summer and illumination at night. In Germany, the rise in the number of households and in living space inside dwellings which took place during the decade from 1995 to 2004 caused annual energy consumption by private households for room heating to increase by 268.5 PJ (UGR 2006, p.23).

This is an increase by 13.1 %, whilst the population during that time period grew only by 1.3 % (Fig. 4.2).

During the same decade, large amounts of public subsidies and private money were invested in order to increase the efficiency of heating systems in old buildings by modernisation and to further reduce the emissions of carbon dioxide by a change of combustibles, replacing coal by natural gas. These activities resulted in annual energy savings of 210.9 PJ (−10.3 %). As a result of the growth in floor space, annual energy consumption for space heating increased in total by 57.6 PJ (+2.8 %)³ despite all the investments in energy efficiency improvement. Energy consumption per capita grew by 1.5 %.

Thus, the excessive activities to expand the building stock and infrastructures in order to accommodate the population which in Germany at that period of time was still growing (mainly by immigration), led to an increase in total energy consumption as well as to an increase in specific energy consumption on individual level.

Given that per-capita energy consumption in Germany as compared to the global level of energy consumption is far from sustainable, every action which further increases the individual need for energy consumption is clearly a step in the wrong direction. Of course, it is recognised that housing is one of the irrefutable human needs that has to be supplied. But it is time to discuss which level of supply is really necessary and appropriate and how to improve the resource efficiency of the appropriate supply.

4.2.2 *Input of Materials – Especially Mineral Construction Materials and Products*

Data from the Federal Statistical Office shows that, in Germany, the stock of material resources bound inside the “technosphere⁴” has been steadily rising during the last decades (UGR 2010). Though the speed of growth in the material stock has slowed down lately by 25 % from about 850 million tons p.a. in 1995⁵ to 634 million tons p.a. in 2008, the speed of accumulation of materials inside the technosphere still remains high.

Figure 4.3 shows that the increase of the material stock in the technosphere is due in large part to the input⁶ of mineral construction materials and products (=“*minerals*”). In 1995, the fresh input of *minerals* of 779 million tons caused about 92 % of the

³Energy consumption by private households for the heating of private dwellings 1995: 2057 PJ; 2004: 2115 PJ.

⁴“Technosphere”: The realm of human habitat created by modern civilisation.

⁵As the Federal Statistical Office (StBA) changed in 2004 some details of the methods dealing with recycled mineral waste from derelict sites, the author has stratified the data on increase of material stock for the time before 2004.

⁶In this chapter, input of *minerals* into the technosphere is defined as the result of domestic extractions of mineral raw materials plus imports of construction materials and products minus exports.

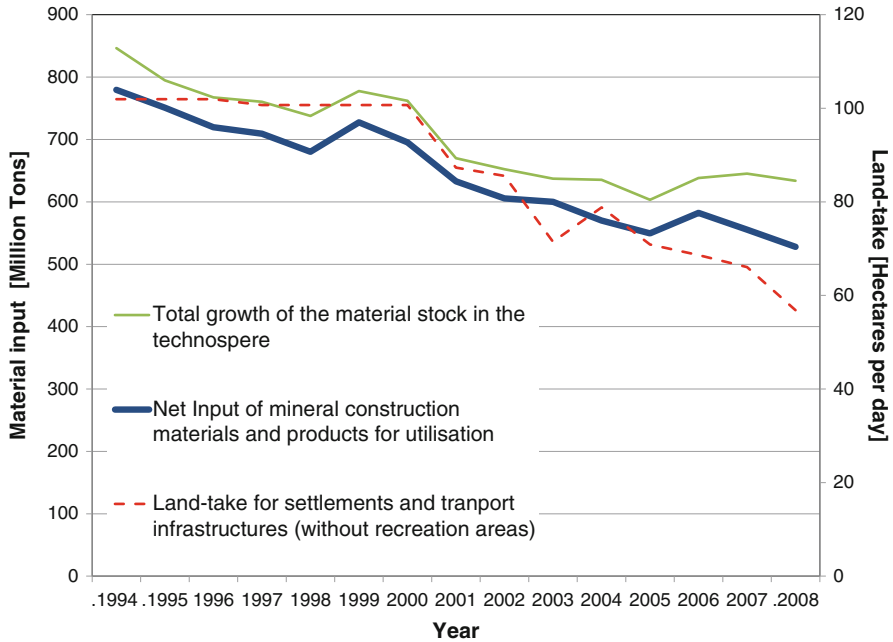


Fig. 4.3 Contribution of the net input of mineral construction materials and products to the total growth of the domestic material stock in the technosphere and comparison with the speed of land take for settlements and transport (Data sources: UGR 2010; BGR 2009)

total increase in the material stock. As construction activities have slowed down somewhat since then, the share of *minerals* in the increase of the total material stock fell slightly, to 528 million tons (83.3 %) in 2008. The figure also shows that material input declined at roughly the same rate as the relevant parts of LTST.⁷

Most *minerals* utilised in Germany are extracted from domestic sites. This exerts considerable impacts on landscapes. 552 million tons of mineral construction materials were extracted in Germany in 2008, disfiguring landscapes in an area of 1,420 ha p.a. or 3.9 ha a day.⁸ The area affected by the extraction of *minerals* even exceeds the areas affected by the extraction of lignite (760 ha p.a./2.1 ha a day) and peat (400 ha p.a./1.1 ha a day) taken together.

As mentioned above, the net input of *minerals* in Germany due to construction, enlargement or repair of buildings or infrastructures amounted to 528 million tons in 2008. It is an interesting question what exactly this material might have been used for.

In a first step, in a *top-down approach* the author correlated the total annual net input of minerals with parameters linked to the construction of buildings or

⁷Except recreational areas which mostly consist of non built up areals.

⁸Author's own calculations are based on data from the Federal Institute for Geosciences and Natural Resources BGR (2009, p. 86), from which the data on mineral extraction for the industrial production of glasses and ceramics ("Quarzsande", "Tone (Feuerfest und Keramik)", "Rohkaolin") was omitted.

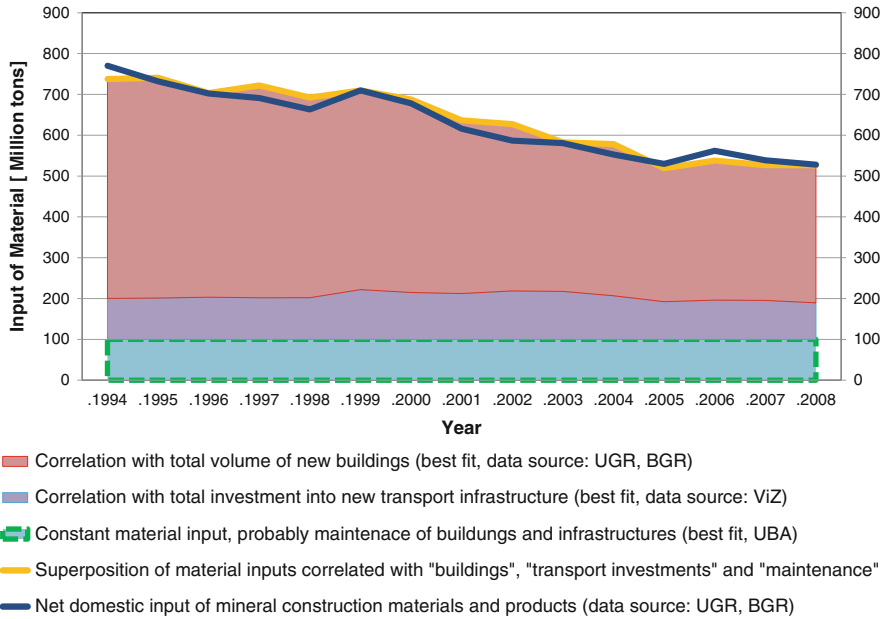


Fig. 4.4 Correlation of annual net domestic input of mineral construction materials and products [t] with the superposition of total annual volume of new buildings [m³], annual investments into transport infrastructures [€] and an additional constant material input for maintenance [t] (Data sources: UGR 2010; BGR 2009; ViZ 2009; IÖR 2010; WI 2011)

infrastructures, such as number of buildings, number of apartments, volume or floor space of buildings, land take for settlements, land take for transport infrastructure or the budget of public investments into transport infrastructures etc. (Data sources: Destatis 2010; ViZ 2009).

As mentioned before, the downward trend in net mineral input into the technosphere during the last decade roughly corresponds with the decrease in LTST. But still better correlations with material input were found by using a linear combination of the following three items (Fig. 4.4): *the volume of new buildings*, *the budget of public investments into transport infrastructure* and a parameter remaining *invariable over time*, which should roughly represent the rather steady annual material input for *maintenance activities*.

In a second step, in a *bottom-up approach* the results of two different research projects (IÖR 2010; WI 2011) on material input into the different types of buildings and several types of infrastructures were consistently compiled by UBA.

1. For the most relevant types of buildings, IÖR had calculated the material inputs into the shell of a typical building of that kind (including the basement). The data for these types of buildings given by IÖR was multiplied by UBA with the number of buildings of this type that have been erected every year since 1994, in order to get the total annual material input into the construction of new buildings.

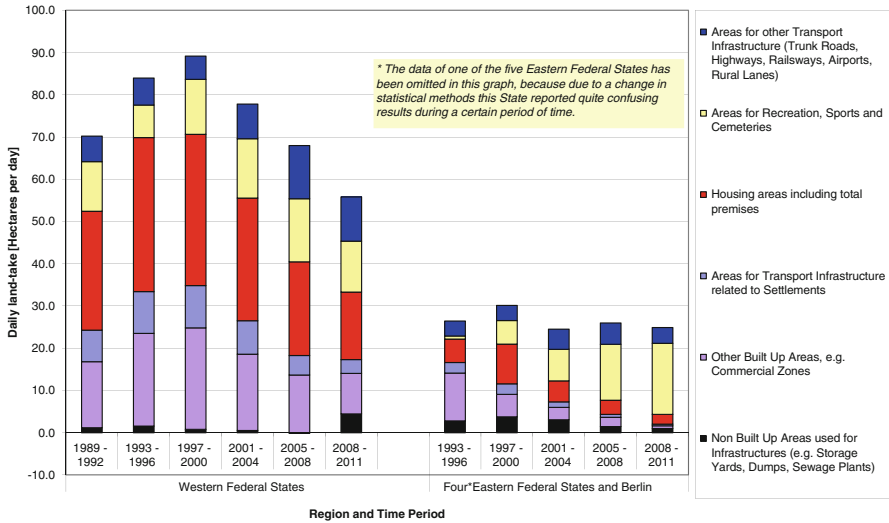


Fig. 4.5 Total domestic net input of mineral construction materials and products und known and unknown purposes of their utilisation (Data sources: UGR 2010; BGR 2009; ViZ 2009; IÖR 2010; WI 2011)

2. Based on data for the year 2004, WI had compiled the annual material input into a choice of most important infrastructures. In order to expand these results to the whole time period from 1994 to 2008, UBA varied the annual material inputs into the different types of transport infrastructures according to the annual investments into the construction of every type of transport infrastructure. As for infrastructures, closely related to settlements, UBA varied the material input according to the expansion of LTST for built up areas.

The following Fig. 4.5 shows the combination of the results of the top-down approach with the bottom-up approach described earlier.

The results of IÖR and WI have been supplemented by the author with an assessment for two additional items (red-rimmed areas):

- material input for construction of the surface of regional and local trunk roads *WI only considers the surfaces of federal highways, railways and federal waterways*
- material input for construction of the surface of new parking lanes, bicycle lanes and pavements on roads to accompany the enlargement of settlements by new building sites

WI only considers the surfaces of new lanes for motorised traffic and new public infrastructure like water or gas pipes or power supply lines inside the streets (including their imbedding into stratum of sand) and the construction of centralised infrastructures like waste water treatment plants

The findings of these two bottom-up projects show that the most important purposes of utilisation of minerals identified so far are material inputs into

- *the construction of new buildings*, though it declined with the slowdown of construction activities from 139 million tons in 1994 to 52 million tons in 2008 (three intense green stripes in the centre of the graph),⁹
- *the construction of new infrastructures for new settlements* (electricity, water etc.) including their imbedding into stratum of sand, which declined with the slowdown of settlement activities from 52 million tons in 1994 to 32 million tons in 2008 (grey stripe beneath the green ones),
- *the maintenance of all infrastructures inside and outside settlements*, which probably remained quite stationary at a level of 80 million tons per year (dark brown stripe at the bottom).

Other purposes like the construction or the enlargement of the *surfaces* of new roads, railways and waterways or the construction of the *surfaces* of roads in new settlements only give small contributions to the total input of minerals into technosphere. As a result, the combination of both methods, top-down and bottom-up, indicate that

- roughly estimated by the top-down method, 100 million tons of mineral construction materials might be utilised every year for maintenance work of all kinds on existing buildings and infrastructures, of which 81 % can be explained by the WI bottom-up method while 19 % remains unexplained (narrow yellow stripe right above the brown stripe at the bottom of the graph).
- deduced by the top-down method, in the year 2008, 90 million tons of mineral construction material might have been used for the construction or expansion of trunk roads and other important linear transport infrastructure outside settlements, of which only 15 % (14 million tons) can be explained by the WI bottom up method for the surfaces of federal roads, rails and channels and another 20 % (18 million tons) by the supplemental assessments of the author (UBA) for the surfaces of regional roads outside settlements, whilst 65 % (58 million tons) of this material input remains unexplained (second yellow stripe from the bottom of the graph).
- Finally, there remains another *mineral* input in 2008 of 338 million tons. As has been deduced by the top-down approach, this material input might be connected with the construction of new buildings and the corresponding new settlement infrastructures such as roads, gas pipes, water pipes including their bedding into stratum of sand. Alas, the findings of the bottom-up approaches by WI und IÖR¹⁰ explain only 109 million tons (32 %) of this material input, with equal shares for the building shells and the accompanying public infrastructure, whilst an input of 229 million tons (68 %) remains unexplained (light green and yellow stripes at the top of the graph).

⁹The reasons for the decline of building construction consisted in the breakdown of the market of apartment houses (–48 million tons), the reduction of construction of family homes for demographic reasons (–31 million tons) and the slowdown of commercial projects (–7 million tons).

¹⁰Supplemented by the author with some minor inputs for parking lanes, bicycle lanes and pavements.

Just in order to try to get an explanation for a part of the latter unexplained material flow, the author did an assessment of how much material might have been extracted from the sites in order to make room for the basements of the buildings (light green stripe). This resulted in 38 million tons to be transported off the sites, which might perhaps have entered the statistics.¹¹ If it did enter the statistic, this would only explain where a small part of the unexplained material extraction came from but it does not yet explain where all this material ended up and for which purposes it might have been used.

Thus, the two topmost stripes in Fig. 4.5 (yellow and light green) distinguish another important part of the material input into the technosphere for which there is still no explanation at all. Some of the unexplained material inputs might be accounted for the infrastructures on the premises of settlements such as driving lanes, parking lots, footpaths, terraces, pools, pipes and their beddings or for the substructures of trunk roads, highways and railways. And there are still a lot of soil movement activities which have not yet been considered at all such as arise in the construction of dams alongside rivers and coasts.

In total, there are still large gaps in our knowledge of material streams which call for additional research.

4.2.3 Decline of Resource Efficiency and Economic Efficiency Through Demographic Change

Though there are still prosperous regions or communities in Germany, where the population is growing by migration (Fig. 4.6), the population in Germany as a whole stopped growing and began to shrink in 2003. Since, every further enlargement of the stock of buildings or related infrastructures will tend to further diminish the resource efficiency of the real estate sector. This holds true even if the national level of resource productivity in relation to gross domestic product (GDP) may be improving. In view of the fact that an increasing number of German regions face demographic change which has already resulted in a considerable depopulation of some regions during the last 20 years, the continuing urban sprawl even in shrinking regions will lead not only to ecological but also to severe economic and social problems.

In an increasing number of regions, the number of empty derelict buildings and also of rather neglected built up areas is growing steadily (Destatis 2011). Additionally, there are many residential and commercial buildings which are still partly occupied but are seeing a considerable decrease in occupancy, leaving empty locations between the occupied ones. Most probably, many of them will never be filled up again properly with new dwellers or commercial users.

¹¹ With this item, it is not quite clear, if or if not it did enter into the statistics of extraction of mineral materials at all. But if it did not enter, this means that additional amounts of material extracted are in want for the explanation what they were used for.

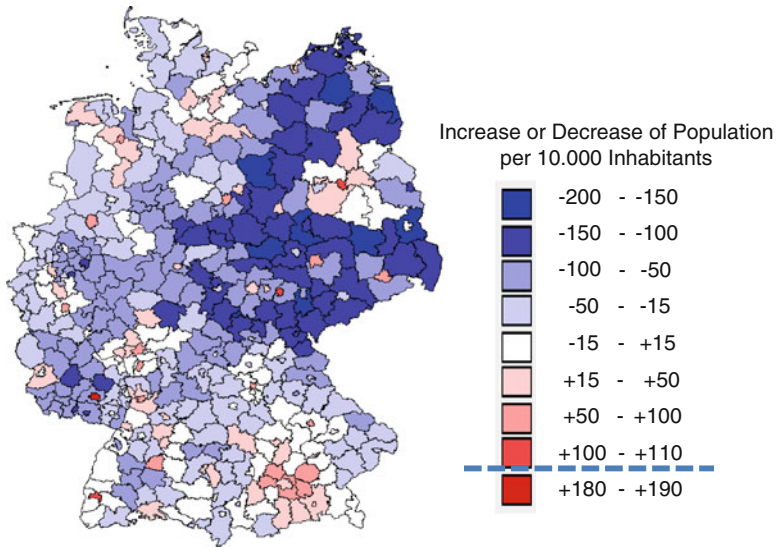


Fig. 4.6 Annual increase or decrease of population in German regions and towns, 2009 (Data source: Destatis 2011)

But while the number of users is decreasing, the running costs for maintenance of the existing infrastructures and the buildings still in use remain nearly constant. As a result, in shrinking regions, the costs per capita for maintaining buildings, infrastructures and public or private greens tend to be much higher than in regions where the population is still growing, where buildings are densely occupied and where infrastructure provision is sufficient but not overabundant. Thus, low efficiency in land use – eventually even aggravated by further LTST – endangers the competitiveness of shrinking regions in relation to growing regions.

As average incomes in shrinking regions in general are lower than in prosperous, growing regions, the social impact of high per-capita costs – on the individual subjects who have to pay as well as on the public budgets having to support those who can't – is substantial. As these costs are not affordable in the long run, the ultimate remaining option is to rededicate derelict settlements and infrastructures to agriculture or forestry purposes or to leave them to a process euphemistically called “natural succession”.

4.2.4 Preserving Fertile Soils and Biodiversity as Natural Resources

It has to be recognized here that “returning soils to nature” does not in any way mean a return to their initial state, as if nothing at all has happened to them.

This is because the former natural qualities and functions of soils at sites which have been released from utilisation for settlements or transport infrastructure cannot be restored quickly or only at high costs. Especially the natural fertility of soils, once it has deteriorated by sealing or compression, by pollutants or other impacts of human activities, may only recover after long periods of time, maybe thousands of years. So even if soils are “given back to nature”, they often will return in a rather downgraded state. This means not only that their productivity might be diminished, but due to pollution they might not be suitable at all for the production of food and feed. Slowing LTST decelerates the degradation of soils and helps to preserve them also for the benefit of future generations with all the options they may offer for the production of food and feed, renewable energies or renewable materials. The importance of fertile soils is further increased by the fact that the stock of fossil energies is declining and the need for biomass as a substitute is increasing. In view of global population growth and the limited stock of fertile soils suitable for the production of biomass, fertile soils are becoming a very scarce and valuable resource. Thus, it is not only ecologically sensible but also economically wise to preserve fertile soils.

Additionally, we have to save green spaces outside settlements which are dedicated to biodiversity. Preserving all the aspects of biodiversity including genetic variability also means to preserve existing and potential information about complex chemical substances, efficient energetic processes, sophisticated physical constructions or smart behaviours which nature has optimised over millions of years to improve the chances of survival of creatures under various circumstances. In the post-fossil era that lies ahead, it might be crucial to be able to resort to this treasure of natural wisdom in order to find paths to sustainable production of raw materials and energy. Not only useful substances but also good ideas for the solution of technical challenges or social conflicts may be gained from biodiversity. That’s why we should take utmost interest in preserving biodiversity as completely as possible.

4.3 Interaction Between the 30-ha Goal and Economic and Social Issues

LTST is the result of strong driving forces and the activities of many different stakeholders. To be successful, all strategies and measures aimed at slowing down LTST have to take into account the economic or social background of all the driving forces or actors. One important step will be to develop visions of successful and attractive future economic and social development minimising additional land take and other environmental impacts.

4.3.1 Driving Forces and Decision-Makers Pushing Land Take in Germany

Despite the targets set in 1998, the speed of land take even accelerated and peaked at 130 ha per day during the 4 year period from 1997 to 2000. As Fig. 4.7 shows,

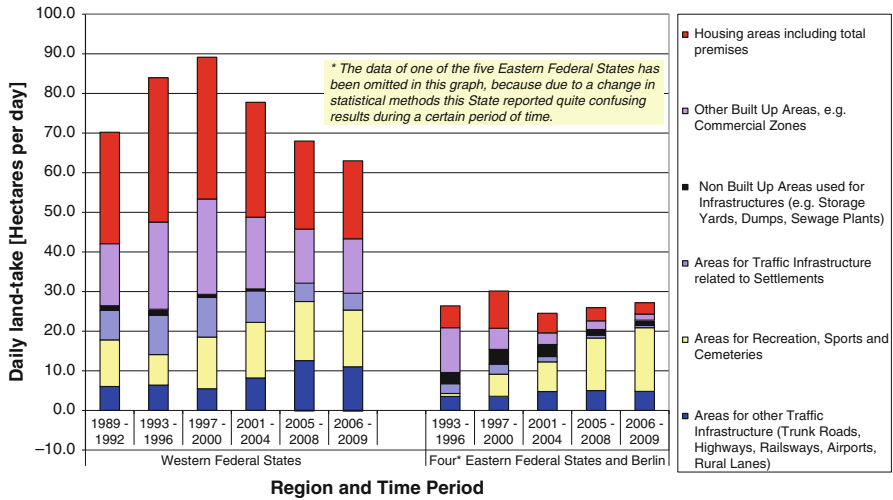


Fig. 4.7 Daily land take for different categories of settlements and transport infrastructures in western and eastern federal states, 1989–2008 (Data source: Destatis 2010)

the dynamics of this development and the different types of land use changes differed considerably between eastern and western federal states.

The driving forces for this boom, which started in 1990 and faded out after 2004, can be traced back to the coincidence of four factors:

1. *Economic boom in western Germany and large flows of migration from the East, increasing the need for commercial zones and housing.* The starting point was the unification of the two parts of Germany and the opening of the frontiers to Eastern Europe which resulted in a breakdown of eastern economies entailing high rates of unemployment.
2. *Domestic generation of baby boomers establishing their own households and, a few years later, buying homes, which accelerated land take.* This process was kindled by new subsidies for the purchase of family homes favouring the construction of new buildings – without any regional differentiation. This system of subsidies was started in 1996, cut somewhat in 2004 and abolished in 2006. In the final phase, the annual public expense exceeded ten billion Euros.
3. *Enormous federal subsidies for the development of new commercial zones and transport infrastructures in eastern Germany* as a political response to economic decay and unemployment. Except in the case of retail centres and logistic facilities, the construction of commercial zones was not fuelled by demand from enterprises. Most of these developments were driven solely by desperate hope for new jobs.
4. *Additional federal subsidies for real estate investments in eastern Germany, e.g. for the construction of new apartment and office buildings.*

As a result, additionally to brownfields from old industries, eastern Germany today offers a rich choice of freshly developed but only partly occupied commercial facilities and housing areas, which some people ironically call “illuminated

pastures". Further, in older settlements, the number of deserted apartments and family homes is increasing, for due to persistent out-migration and low birth rates, the population in eastern Germany is decreasing rapidly.

In western Germany, with the start of the new millennium, economic development slowed down a bit and immigration decelerated, too. The low rate of immigration now coincides with a young domestic population whose ranks have been depleted by a birth rate that has remained constantly low in western Germany for the last 40 years. Consequently, demand for housing and commercial zones started to fall significantly and in some regions an increasing number of empty dwellings and commercial sites can be seen. But LTST still continued on quite a high level, driven by:

5. *Globalisation of economies* leads to displacement of production sites and logistic facilities to the vicinity of long distance transport infrastructures such as highways, harbours and airports, occupying a lot of new greenfield sites. Accordingly, transport infrastructures have been enlarged to meet the new demand.
6. *Economy of scale, especially in the retail sector.* Large shopping centres and factory outlets offering large parking lots were set up on greenfields at the edge of towns.
7. *Common lifestyle and consumer preferences,* relying on private cars in general and propagating dwelling in single family houses.
8. *Developers and construction companies specialising* in the exploitation of greenfields and the construction of new buildings. These stakeholders form a powerful lobby in favour of subsidies and other policies spurring LTST.
9. *Gains in land prices* from the transformation of greenfields into housing areas or commercial zones. Landowners, who in many cases are not the active farmers, get nice profits from LTST and naturally try to influence planning activities to their own advantage.
10. *Competition between municipalities,* trying to attract new inhabitants or private companies from neighbouring municipalities, hoping for additional tax revenue and deliberately neglecting all future costs for necessary supplemental infrastructure.
11. *General non-transparency* of the costs and benefits of public investments in new infrastructures. Often the system of taxes and fees makes newcomers assume only part of the costs of the new infrastructures whilst the general public has to shoulder the rest.
12. *Weak application of the existing instruments of spatial planning* by the authorities of some federal states and regions. As a result, large differences exist between federal states not only in the prevailing density of settlements, which might have many historical reasons, but also (*ceteris paribus*) in fresh LTST per capita.
13. *Prevailing philosophy of investment in Germany.* Governments and administrations still take pride in the creation of new buildings and infrastructures. Over time, the investments into additional stock led to a huge stock of old public buildings and infrastructures needing maintenance. This philosophy also led to the neglect of all non-materialistic investments, especially in manpower for education and scientific research.

Today, 10 years and two global economic crises after the start of the millennium, immigration from foreign countries has slowed down further everywhere in Germany. Consequently, in 2007, the 4-year average of daily LTST finally sunk to below 100 ha. But it still remained above UBA's intermediate target of 80 ha per day for 2010.

4.3.2 Is It Possible to Achieve the 30 ha Goal Without Negative Impacts on the Economy?

Though it is very unlikely under current economic and demographic circumstances that LTST in Germany will accelerate considerably again, the present rate remains still at quite a high level, both in absolute terms and compared to some other European countries. This can be demonstrated by the following example: (von Haaren and Nadin 2003, p. 345–356; SRU 2004, p. 166)

Average land take in Germany during the 1990s was about 120 ha per day, which is equivalent to an annual land take of 52 ha per 100,000 inhabitants. The 30 ha goal would mean reducing LTST to an annual 13 ha per 100,000 inhabitants.

In England, where green belts and open spaces are under stronger protection, where the revitalisation of brownfields has some political priority and where the relevant planning authorities are to be found more at national or regional level than at local level, annual LTST at that time was about 14 ha per 100,000 inhabitants. This means that England had in fact almost achieved the German “30 ha goal” by the end of the 1990s.

It has to be noted that during this time period, the British economy was booming, which demonstrates that booming economies may become largely independent of LTST. This was certainly true of the type of highly developed economy of that period, which strongly relied on a powerful, but largely virtual financial sector. Alas, it has become quite obvious today that this kind of economy – though it did not need much material input or LTST – is not sustainable all the same.

But, do we have to conclude from this experience that economic systems in no need of additional land take and based on services rather than on production of goods can never be sustainable? The answer – hopefully – is no, as the following vision might suggest:

Independence of land take and low input of material and energy might also come true for highly innovative economic and social systems which – besides meeting basic needs such as food, clothing, shelter and security – are based on health care, wellbeing, social and political involvement, cultural performances needing but few resources (e.g. painting of miniatures), rising awareness of resource efficiency, education, training of skills, development of sciences and unending efforts towards technical innovation.

Technical innovation is the crucial point for the efficient production of renewable energies and materials on the one hand and on the other hand for minimising the need of the whole system for resource input by energy saving and efficient use and

recycling of materials, land and soils. One of the most important tasks in this context is to further develop and improve resource efficient technologies which allow safe storage and reliable global access to information of all kinds. Knowledge, culture and social interaction becoming virtual should not imply new manifestations of illiteracy but on the contrary, more people than ever should have easy access to virtual libraries available on command to every interested reader.

Efficiency in the use of physical resources means relying more than ever on the only resource which so far has proven to be nearly inexhaustible: Human commitment, human creativity and human intelligence. This kind of economy might even approach a development which could be called sustainable.

4.4 Consistent Strategies to Meet the 30 ha Goal

As sustainable land use comprises more topics than only quantities of land use change and as land use policy has the tendency to affect every area of life and economic activity, only systematic and consistent strategies directed at all relevant driving forces and stakeholders exerting influence on land use will be able to lead the way to sustainable land use. Some elements of such a strategy will be discussed in the following sections.

4.4.1 Intermediate, Regional or Sectoral Targets to Meet the 30 ha Goal

As already mentioned, UBA proposed an intermediate national target of 80 ha a day by 2010 and assumed a linear reduction of land take in subsequent years until the 30 ha target would then be reached in the year 2020. But setting national targets doesn't solve the problem of how to get there and how each region and each local government should contribute to the national goals. The National Strategy of Biological Diversity (BMU 2007) states that, by the year 2015, all German regions should declare which targets they have set for themselves.

As a mere starting point for the discussion, the KBU (Commission of Soil Protection at the UBA) has proposed a set of targets for each of the federal states (Table 4.1) (KBU 2009). Taken together these targets meet the national 30 ha goal. The targets have been calculated based on a mix of the following three criteria:

- the actual population (2007)
- the anticipated future population (2020)
- the rate of land take at the beginning of the millennium (2001–2004)

The third criterion takes into account the different historical developments and the different “planning cultures” of the individual federal states.

Table 4.1 Proposal for a set of targets at federal state level for the period 2007–2020 (Hectares per day), KBU (2009)

Federal state	Land take for settlements and transport		Intermediate targets		Targets to meet the national goal of 30 ha a day
	2001–2004	2004–2007	2007–2010	2012–2015	2017–2020
Berlin	0.29	0.28	0.50	0.68	0.85
Free Hanseatic city of Hamburg	0.79	0.77	0.68	0.59	0.51
Free Hanseatic city of Bremen	0.17	0.20	0.17	0.18	0.18
North Rhine-Westphalia	15.2	15.4	11.6	8.7	5.7
Saarland	0.72	0.75	0.57	0.44	0.31
Baden-Wuerttemberg	10.4	9.3	7.8	5.7	3.6
Hesse	3.9	3.9	3.1	2.5	1.8
Saxony	5.2	5.4	3.8	2.6	1.5
Rhineland-Palatinate	5.8	6.6	4.2	2.8	1.5
Schleswig-Holstein	8.4	6.7	5.8	3.6	1.4
Bavaria	18.0	16.9	12.9	8.8	4.7
Lower Saxony	14.4	13.5	10.2	6.7	3.2
Free state of Thuringia	2.2	1.6	1.6	1.2	0.73
Saxony-Anhalt ^a	12.8	16.1	5.6	3.5	1.4
Brandenburg	8.2	8.3	5.6	3.5	1.3
Mecklenburg-Hither Pomerania	8.7	7.2	5.9	3.5	1.2
Germany	115.1	112.8	80.0	55.0	30.0

^aDue to some artefacts in the statistical data, the rate of LTST in Saxony-Anhalt seems – in relation to population and economic development – exorbitantly high. Therefore, goals for the individual federal states were calculated making some reasonable corrections to the initial data

Additionally, it might be useful to define sectoral targets in order to identify the contribution of different thematic policies, e.g. the Federal Transport Infrastructure Plan (BVwP). In the context of a study to prepare a concept for the integration of Strategic Environmental Impact Assessment in the next BVwP, it has been proposed to reduce the speed of enlargement of the federal road network by 75 %. By the end of the last millennium, federal roads still grew by 2.5–3.0 ha a day. Until 2020, this rate should be reduced to about 0.75 ha a day (B&P 2010).

4.5 First Practical Steps to Reduce the Speed of Land Take

The UBA (amongst other institutions) has also proposed a consistent set of actions to be taken and new instruments to be applied (UBA 2003; TAB 2007). The UBA takes an active part in the public discussion on why it is crucial for sustainable development to stop urban sprawl and degradation of soils – not only in Germany

but also on a global scale. During the years following the UBA report, discussions continued in the framework of the National Strategy of Sustainable Development and some first actions were taken to slow down urban sprawl and at the same time restore public finances. The most important moves were

- in 2004 and 2006, respectively, reduction and abolishment of direct subsidies for construction or purchase of dwellings inhabited by their owners
- in 2007, the attempt to reduce the commuter allowance; this action was very brave but not successful, for it was overturned by a judgement, of the Federal Constitutional Court (BVerfG 2008).¹²

A second attempt to reduce the commuter allowance has not yet been undertaken. In 2008, a new subsidy for construction or purchase of dwellings inhabited by their owners was established in the guise of supplementary pension schemes (Wohn-Riester). These experiences illustrate the difficulty of changing the system against strong interest groups.

On the other hand, in several federal states, regional development support is now focused on or even limited to the development of brownfields and other derelict urban sites, whilst subsidies for the development of greenfields have been cut or even abolished.

Furthermore, in 2004 a research programme known by the acronym REFINA was launched by the Federal Ministry of Education and Research. Other ministries were also involved in this programme, namely the Federal ministries of Environment, of Transport, Urban Development and Spatial Planning, of Agriculture, of Finance, and several ministries of the federal states. REFINA was dedicated to developing a rich choice of instruments and actions aimed at slowing down LTST and furthering development inside settlements and to putting them into practice by model projects in regions, towns and villages. The results were spread widely and intensified the public discussion of this issue.

4.5.1 New Measures and Instruments to Slow Down Future Land Take

A lot of research has been conducted and practical experience gained during the last years. The following gives a short overview of the current state of play in these areas.

¹²It is interesting to note that the Court didn't criticise the fact that this allowance had been cut. Instead, the Court picked at the fact that the cut was not logically consistent in all aspects. According to the judgement a total abolishment founded solely on environmental reasons might have been tolerated, whilst the actual reduction for fiscal reasons in combination with exceptions for social reasons in favour of long-distance commuters was not.

4.5.1.1 Communication, Education and Information Tools

In order to head for the 30 ha goal, public views on a lot of topics have to be changed thoroughly to obtain support for the rigorous and today quite unpopular instruments and measures which have to be applied. One of the most crucial topics in this context is demographic change and its impacts on real estate markets. But also resource and energy consumption by buildings and infrastructures might become important issues in the near future.

Communication with the Public and with Decision-Makers

First of all, we have to recognise that every communication strategy has limits in what it can achieve. For instance, you can't convince the owners of greenfields in economically booming regions who are willing to sell. For, even if the price for arable land is actually rising and will continue to rise in future, it is not likely that it will ever reach the price level of building plots. And you can't convince young families to move into the inner parts of towns and villages if the environmental quality there is deficient. So, often, communication has to be combined with instruments and measures designed to bring about the desired changes. On the other side, measures without communication might be futile, too, for unfavourable opinions on living near city centres, partly based on bad experiences and partly on prejudices, are difficult to overcome without communication.

In REFINA and other model projects, a large variety of good arguments and communication instruments were developed and tried out together with actions in order to really improve the quality of old houses in the inner parts of villages and towns. An excellent example of this kind of policy presents the case of the United Villages of Wallmerod initiative in the federal state Rhineland-Palatinate, which some years ago started a successful communication and investment programme "Life inside the Village – Life in the Middle of the Middle".¹³

Additionally, publicly accessible information tools were developed for use for town marketing, e.g. on the properties and characteristics of different parts of towns and the infrastructures and public services they offer along with information on the housing market. This should provide better information for newcomers and might even attract more middleclass households into the inner parts of towns.

Improvement of Professional Training

But even if public opinion turns in favour of the redevelopment of old sites and buildings, you need professional planners, architects, project developers and craftsmen, who have the knowledge and the skills to deal with the task. It is also

¹³ www.lebenimdorf.de

indispensable to change professional training in these fields. This may also open up new opportunities for construction companies having specialised until now in the development of greenfield sites.

Monitoring and Assessment of Future Land Use

Several research activities have been devoted to the development and implementation of tools for identifying and assessing the potentials which could be developed within existing settlement areas for managing the wealth of information on contaminated and non contaminated sites and for making this information readily accessible to relevant stakeholders or the public. First tools have already been developed by the environment ministries of the federal states of Bavaria¹⁴ and Baden-Wuerttemberg,¹⁵ who invested great efforts to raise local governments' awareness of the opportunities presented by developing the inner parts of their villages or towns. In some villages and small towns, up to 30 % of all sites were found to be unoccupied.¹⁶

In the framework of REFINA these kinds of tool have been further elaborated and combined with tools e.g. for forecasting population development and infrastructure capacities and maintenance needs, and in some cases these tools were also combined with quite sophisticated scenario tools for predicting the future development of settlements or whole communities.¹⁷ Also, models and calculation tools were developed which enable local governments to assess future costs and benefits of public investments (including revenue from taxes and fees but also the costs for maintaining public infrastructures) for many years in advance. These calculations when done properly might temper a bit the hopes for the extra income that can be gained by attracting new tax payers.¹⁸

4.5.1.2 Support and Enforcement Instruments

The legal system in Germany allows, in principle, restrictions to be imposed in planning at federal-state and regional level which could achieve any quantitative goal. But in reality, the driving forces mentioned in Sect. 4.3.1 have an enormous influence on planning decisions. Therefore it is crucial to weaken or redirect some of the driving forces by a consistent set of instruments.

¹⁴ www.lfu.bayern.de/umweltwissen/doc/uw_96_flaechensparen.pdf

¹⁵ www.melap-bw.de/infos/; www.leader-hohenlohe-tauber.de/dorfkomm/pdf/leitfaden.pdf; www.pfif.info/

¹⁶ REFINA project: HAI - Handlungshilfen für eine aktive Innenentwicklung; www.refina-info.de/projekte/anzeige.phtml?id=3124

¹⁷ www.lean2.de

¹⁸ www.folgekostenrechner.was-kostet-mein-baugebiet.de

But even if restrictive planning instruments will not be implemented in the near future, instruments addressing some of the driving forces – though not sufficient by themselves to reach the 30 ha goal – will at least guide development some steps further into the right direction. In Germany, a rich choice of such instruments has been discussed during the last decade.¹⁹ In the following, only those instruments are presented which might have some relevant quantitative effect, whose legal basis has already been investigated and which are supported at least to some degree by relevant parts of the scientific or even political community.

Adjusting the Economical Framework

Restrictive planning instruments have to struggle with market forces strongly pulling in the opposite direction. Therefore it is crucial to adjust the economic framework so as to weaken driving forces which pull developments out of towns onto greenfields and draw development into existing settlements. Of course, it is impossible to change the global economic framework by national policies, but some economic drivers can be influenced to some degree on national, regional and local level, particularly through subsidies, taxes or public investment decisions on infrastructures and buildings.

First, all existing subsidies and tax incentives for housing and economic, rural and regional development should be directed towards the renewal or improvement of existing sites. Likewise, all subsidies flowing into the building sector should be concentrated on the modernisation of existing buildings, with the emphasis on energy efficiency and adaptation to climate change or demographic change. With a view to sustainability, it would be worthwhile launching a general discussion on the distribution of public funds between the construction sector and other important public tasks, e.g. education or child care.

Second, the German system of property taxes and property transfer taxes could be very much improved by changing it so as to encourage the efficient use of areas inside settlements.

Third, existing public transport infrastructures should be repaired, modernised or optimised instead of constructing additional ones. All subsidies encouraging additional traffic should be cut and the system of HGV tolls should be extended to include additional types of roads and types of vehicles.

Last but not least, the system of financing municipalities should be thoroughly changed. In order to minimise destructive competition between different local governments leading to excessive greenfield development in the hope of attracting additional taxpayers, the collection of taxes should be shifted to the regional level, and the tax revenue should be allocated according to the needs resulting from the functions, burdens and tasks assigned to the individual municipalities in the regional context.

¹⁹UBA (2003, p. 108ff), TAB (2007), REFINA Projects, e.g. DoRiF (DoRiF 2009).

Further Improvement of the Planning System

Besides quantitative restrictions on the development of new settlements, additional qualitative planning requirements should be adopted.

In order to make sure that all spatial planning will be focused on development inside settlements instead of on greenfields, sustainability checks (e.g. demographic projections to assess the necessity of developments, investigation of development potentials inside settlements, long-term cost-benefit analyses and – of course – environmental impact assessments) should be obligatory for every planning process. This should be true especially for plans and projects supported by subsidies.

Especially for less prosperous regions, it will be of utmost importance to reverse ancient plans for the enlargement of settlements which have not yet been put into practice and to annul building permissions for unbuilt or derelict sites where there is no hope of future development. The removal of superfluous buildings and building permissions might even stabilise to some extent the value of the remaining real estate.

New Instruments Increasing the Price of Land Take

Some authors (UBA 2003; Krumm 2004) have proposed new instruments, i.e. taxes or fees, designed to increase the costs for transforming greenfields into new construction sites.

The effects of tax increases depend on the amount of the tax in relation to other costs for buying and developing land. The tax rate for land take or soil sealing proposed by UBA – on condition that at the same time the property transfer taxes will be abolished and the total tax revenues remain unchanged – should amount to 18.6 € per square meter of land transformed from greenfields to construction sites. Economic model calculations show that this level of taxation will reduce land take for settlements and accompanying transport infrastructure by roughly 20 % (Frohn et al. 2003). Although this would not be sufficient to attain the 30 ha goal or to stop land take completely, it would be a step in the right direction.

At present, we cannot properly predict the level of a tax necessary to reach the 30 ha goal. For such a radical change in the tax level the effects cannot be tackled by models working in the range of prices and taxes that have been observed over the last decades. Besides, we strongly believe that a sound mix of economic and planning instruments will work better than radically increasing the price of land only. After all, an adequate level of taxation in combination with planning instruments to reach the 30 ha goal could only be found in the real economic system by trial and error.

Though some scientists have sympathy with these taxation tools, not many supporters are currently to be found at the political level.

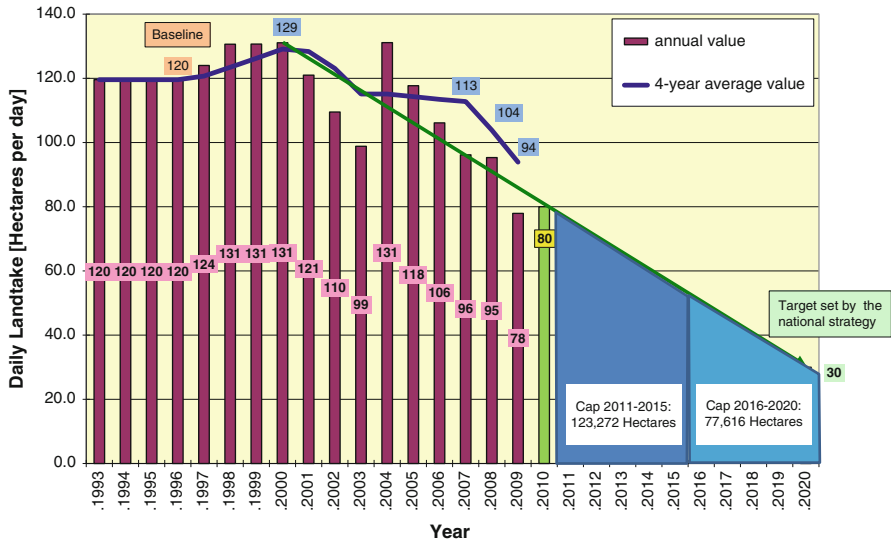


Fig. 4.8 Proposed caps on future land take for settlements and transport infrastructure until 2020

4.5.1.3 An Innovative Instrument to Guarantee the 30 ha Goal

Last but not least, it is time to mention the proposals to introduce trading in land take allowances – in analogy to greenhouse gas emission trading. The scientific discussion on this instrument started as early as the 1990s. The UBA and the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) tried to explore the legal and practical conditions under which such trading could take place and how it could be harmonised with the normal planning system (ISI 2009; BBSR 2006).

From the ecological point of view, there is no doubt that, apart from strict spatial planning by the federal states and regional governments, this is the only appropriate instrument to effectively achieve the 30 ha goal. More controversial is the discussion on the economic and social impacts of a strict limitation of land take all over Germany and on the distributional effects of any kind of allocation of the remaining allowances to regions and municipalities.

Figure 4.8 shows that the 30 ha goal of the national strategy of sustainable in combination with the intermediate goals for LTST proposed by UBA²⁰ imply a total cap of 201,000 ha for the decade from 2011 to 2020. Following a linear path LTST would be capped to 123,272 ha and 77,616 ha, respectively, during the 5 year periods 2011–2015 and 2016–2020.

²⁰see Sect. 4.1.

Model calculations show that a cap of 201,000 ha until 2020 should be sufficient to cover all needs²¹ for housing, commercial development and transport even under conditions of a new wave of immigration, if these land use changes were allocated exactly where they are needed (UBA 2003, p. 121).

Therefore, there is no real argument against a cap on land take from the social and economic points of view. In contrast to a strict and invariable allocation of allowances to local and regional governments, trading has the advantage that it might easily adapt to unforeseen events, e.g. local or regional deviations in demographic or economic development. If allowances are traded under market conditions between different municipalities, land take will happen at sites where it yields the greatest economic or noneconomic²² benefits and the money will flow to places where it might do the most good.

In the framework of REFINA (see DoRiF 2009) and other research programmes (see e.g. ISI 2010), some simulations involving one or two dozens of municipalities were carried out to study the behaviour of professional planners in trading allowances, in calculating costs and benefits of different types of development, in (fictive) activities to develop greenfield and brownfield sites and in buying and selling allowances as well as the reactions of the “market” like the trading volume and the development of “prices” for allowances.

As a result, it could be demonstrated that cost-benefit analysis led – from the economic point of view – to better decisions by professional planners on whether “to develop or not to develop” greenfields. On the other hand, compared to other kinds of players (i.e. students of non-planning disciplines), professional planners tended to take the social impact of their decisions more strongly into account even under market conditions. This resulted in planning decisions which – from a purely economic point of view – were found to be some distance away from the economic optimum, but which were justified by social arguments.

As to the discussion with the most relevant stakeholders, local governments in general refuse to get tied into a system which might restrict their planning power by impeding their future decision making. This is true not only of municipalities in growing regions which might be obliged to buy additional allowances but also for municipalities in shrinking regions.

Nevertheless, federal politics opened a door to trading in land take allowances. In 2009, the former federal government constituted itself by signing a coalition agreement. Under the subheading “*Climate protection, energy and environment*”, this agreement contains – among other agreed actions to encourage development within existing settlements – the following provision: “*Voluntary interregional*

²¹This would be sufficient for 5.0 ha of additional commercial zones plus 1.75 ha of additional recreation zones plus 5.0 ha of additional housing areas to be developed in each and every of the existing 12,000 municipalities (towns and villages) in Germany. These additional housing areas developed on 60,000 ha of greenfield sites could accommodate one million additional single family houses (including traffic infrastructures).

²²Non economic benefits might “pay off” on polling day.

trade of land use allowances between municipalities shall be tested in the framework of a model project”.

Based on bilateral discussions between the Federal Ministry for Environment and the Federal Ministry for Transport, Building and Urban Development and in consultation with the authorities of the federal states and the syndicates of regions and municipalities, two well-matched, complementary model projects are in preparation.

One, guided by the UBA, will try to establish a model project on trading in land use allowances as announced by Federal Government. A scientific report with recommendations on the setting of this model project with 50–100 municipalities has recently been published (see FORUM 2012). UBA has by now started the practical part of the model project²³ which involves a first set of 15 brave municipalities.

The other model project, guided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), will try to devise non-monetary arrangements between municipalities for sharing the advantages and disadvantages of new developments and redevelopments.

In regard to sustainable land use, the years ahead might be quite interesting from the scientific point of view and hopefully, from the practical point of view as well.

4.6 Conclusions

Land take for settlements and transport infrastructure and at the cost of greenfields and fertile soils is an important issue, not only for the environment, climate protection and the efficient use of resources but also from the economic and social point of view, given the enormous global and regional challenges presented by global economic growth and increasing competition, globally growing and regionally shrinking populations and the unequal distributions of food and other resources between different regions.

The problem was recognised by Federal Government a decade ago, an action target was formulated on federal level, i.e. the goal to reduce daily land take to 30 ha by the year 2020, which *ceteris paribus* means an increase in the resource efficiency of land use by a *factor of 4*.

Furthermore, the UBA has proposed an intermediate goal for the year 2010 of 80 ha a day. Assuming a linear reduction until the year 2020, this implies a cap on total additional land take of 201,000 ha over the next 10 years.

A lot of measures to slow down land take a bit have already been launched at federal level as well as at Federal State, regional and municipal levels. Especially some subsidies have been cut or directed from development of greenfields to redevelopment of brownfields, and a lot of research, model projects and contests have been started on the development and utilisation of effective and efficient instruments to enforce sustainable land use and in order to demonstrate best practice.

²³ www.flaechenhandel.de.

As there are strong driving forces boosting land take, effective action should consist of a coordinated package of measures to adjust the economic framework and to implement at the same time strict spatial planning policies, based on the analysis of actual needs on one hand and on the development of existing potentials inside already built up areas, on the other.

But it has been quite clear from the start that effective measures are quite unpopular among stakeholders as well as the general public. The first and most important task is therefore to raise awareness of the impacts of urban sprawl and of the advantages of reducing land take not only for ecological systems, but also for economic efficiency, social systems and for urban and rural development. In order to highlight the importance of the issue and to explain the urgency of actions, messages on these topics have to be transported and highlighted by the very leaders of national, federal, regional and local governments, respectively.

Whilst stringent spatial planning could be implemented in Germany within the existing legal system, innovative instruments, in particular trading in land use allowances (analogous to trading in greenhouse gas emission allowances) and other ways of redistributing the costs and benefits of urban and rural development between municipalities, are still under discussion within the scientific community. The Federal Government has initiated two coordinated model projects to try out instruments which might lead to sustainable land use in a way which is both ecologically effective and economically efficient.

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