

# No net land take policy in practice: Applications and potentials of planning instruments in municipalities. Results of an online survey in North Rhine-Westphalia

Sebastian Eichhorn, Brigitte Adam, Kerstin Schürholt, Hendrik Jansen, Theo Kötter, Thomas Terfrüchte, Silas Eichfuss, Natascha Rohde, Johannes Wilberz, Jan Matthias Stielike

Received: 21 March 2023 ■ Accepted: 16 August 2023 ■ Published online: 19 October 2023 ■ Corrected: 07 February 2024

## Abstract

In line with the European Commission's target, land take in Germany has to be reduced to net zero by 2050. This not only presupposes greater inner urban development and more efficient development outside existing settlements, but also puts a greater planning and political focus on renaturation. The aim of this paper is to investigate the implementation of no net land take policy using the example of the highly dense and urbanised federal state of North Rhine-Westphalia in Germany. Based on an online survey, the current and potential use of (planning) instruments to implement this policy in all 396 municipalities in North Rhine-Westphalia was investigated. The

findings suggest that the municipalities are not yet in a position to consistently implement no net land take. Particularly in the field of renaturation, this is often due to a lack of experience and uncertainties in the use of the existing (planning) instruments, but also to lacking awareness of the problem and a lack of political and social acceptance for higher housing densities. Since the necessary instruments are defined in current legislation and the concepts for implementation are generally known, it is important to support municipalities in using the available instruments and concepts even without direct pressure to act.

**Keywords:** No net land take policy ■ inner urban development ■ land-saving construction ■ renaturation ■ survey ■ North Rhine-Westphalia

---

✉ **Sebastian Eichhorn**, ILS – Institut für Landes- und Stadtentwicklungsforschung, Brüderweg 22-24, 44135 Dortmund, Germany  
sebastian.eichhorn@ils-forschung.de

**Dr. Brigitte Adam**, Bundesinstitut für Bau-, Stadt- und Raumforschung, Deichmanns Aue 31-37, 53179 Bonn, Germany  
brigitte.adam@bbr.bund.de

**Kerstin Schürholt**, Amt 61-2, Bundesstadt Bonn, 53103 Bonn, Germany  
kerstin.schuerholt@bonn.de

**Prof. Dr. Hendrik Jansen**, bip | bläser jansen partner GbR, Hermannstraße 162a, 44263 Dortmund, Germany  
jansen@bjp-planer.de

**Prof. Dr. Theo Kötter**, Professur Städtebau und Bodenordnung, Rheinische Friedrich-Wilhelms-Universität Bonn, Nußallee 1, 53115 Bonn, Germany  
koetter@uni-bonn.de

**Dr. Thomas Terfrüchte**, Fakultät Raumplanung, Technische Universität Dortmund, August-Schmidt-Straße, 44227 Dortmund, Germany  
thomas.terfruechte@tu-dortmund.de

---

**Silas Eichfuss**, Viadukt GmbH, Friedrich-Ebert-Straße 107, 42117 Wuppertal, Germany  
eichfuss@viadukt.de

**Natascha Rohde**, Amt für Stadtentwicklung und Statistik, Stadt Köln, Willy-Brandt-Platz 3, 50679 Köln, Germany  
natascha.rohde@stadt-koeln.de

**Johannes Wilberz**, Amt für Stadtentwicklung und Statistik, Stadt Köln, Willy-Brandt-Platz 3, 50679 Köln, Germany  
johannes.wilberz@stadt-koeln.de

**Dr. Jan Matthias Stielike**, Professur Städtebau und Bodenordnung, Rheinische Friedrich-Wilhelms-Universität Bonn, Nußallee 1, 53115 Bonn, Germany  
jan.stielike@igg.uni-bonn.de



© 2023, by the author(s); licensee oekom. This Open Access article is published under a Creative Commons Attribution 4.0 International Licence (CC BY).

## Flächenkreislaufwirtschaft in der Praxis: Anwendung und Potenziale von Planungsinstrumenten in Kommunen. Ergebnisse einer Online-Befragung in Nordrhein-Westfalen

### Zusammenfassung

In Übereinstimmung mit der Europäischen Kommission soll die Flächeninanspruchnahme bis 2050 in Deutschland auf Nettonull reduziert werden. Dies setzt nicht nur eine stärkere Innenentwicklung und eine flächensparende Außenentwicklung voraus, sondern rückt Rückbau- und Renaturierungsmaßnahmen ungleich stärker in den Fokus von Planung und Politik. Ziel dieses Beitrags ist es, den Umsetzungsstand der Flächenkreislaufwirtschaft in den Städten und Gemeinden des hochverdichteten Bundeslandes Nordrhein-Westfalen zu untersuchen. Aufbauend auf einer Online-Befragung werden hierzu der aktuelle und potenzielle Instrumenteneinsatz zur Umsetzung einer Flächenkreislaufwirtschaft in allen 396 nordrhein-westfälischen Städten und Gemeinden abgefragt. Die Ergebnisse zeigen, dass die Städte und Gemeinden gegenwärtig noch nicht in der Lage sind, eine Flächenkreislaufwirtschaft konsequent umzusetzen. Dies liegt, insbesondere im Bereich Rückbau, mitunter an den geringen Erfahrungswerten und Unsicherheiten im Umgang mit den bestehenden (Planungs-)Instrumenten, muss aber bezüglich aktueller Wohnbauvorhaben auch auf ein generell unzureichendes Problembewusstsein und die fehlende politische und gesellschaftliche Akzeptanz für höhere Bebauungsdichten zurückgeführt werden. Da die erforderlichen Instrumente im geltenden Recht definiert und Umsetzungskonzepte allgemein bekannt sind, ist es wichtig, die Kommunen dabei zu unterstützen, die verfügbaren Instrumente und Konzepte auch ohne direkten Handlungsdruck zu nutzen.

**Schlüsselwörter:** Flächenkreislaufwirtschaft ■ innerstädtische Entwicklung ■ flächensparendes Bauen ■ Renaturierung ■ Befragung ■ Nordrhein-Westfalen

## 1 Introduction

Land take is defined as the conversion of natural or semi-natural land for urban and other artificial land uses (Decoville/Schneider 2015; Science for Environment Policy 2016; Marquard/Bartke/Gifreu i Font et al. 2020). It includes sealed as well as non-sealed areas and covers buildings, urban infrastructure, parks, and sport and leisure facilities.<sup>1</sup> The main

<sup>1</sup> <https://www.eea.europa.eu/data-and-maps/indicators/land-take-3/assessment> (11.08.2023).

drivers of land take are population growth and economic development (Colsaet/Laurans/Levrel 2018). The former is primarily related to a need for more housing, public facilities and transportation; the latter relates to new industrial and commercial sites, the competition between municipalities to attract more investment, and the prioritisation of economic development over environmental sustainability. Due to its implications for biodiversity loss, habitat fragmentation and ecosystem degradation, as well as climate change and increasing follow-on costs for infrastructure (Behnisch/Krüger/Jaeger 2022), land take has garnered significant attention from policymakers and researchers worldwide (Schatz/Bovet/Lieder et al. 2021). More than ten years ago, in 2011, the strategy paper “Roadmap to a Resource Efficient Europe”, for example, set the target at EU level to continuously reduce land take and achieve no net land take by 2050 (EC 2011).

Spatial planning and its instruments have long been recognised as crucial in steering urban development towards more sustainable and efficient spatial outcomes. Summarised under terms such as growth management, smart growth or urban containment, land-use planning regulations, zoning policies, development incentives and financial mechanisms are applied in many countries (Ewing/Lyons/Siddiq et al. 2022; Siedentop/Schmidt/Dunlop 2022). Against the backdrop of primarily market-driven settlement development, land-saving and the target of “no net land take” must, therefore, be seen in the legal context of public interventions (Bovet/Reese/Köck 2018; Lacoere/Leinfelder 2022).

Accordingly, in our study, we want to examine which instruments are currently being used to steer urban development and to work towards reducing land take and the EU’s no net land take target. Since municipalities are usually responsible for settlement development and decide on the use of planning instruments within the framework of multi-level planning systems (Reimer/Getimis/Blotevogel 2014), we concentrate exclusively on the local level. Consequently, regional planning instruments are not the focus of our study. Following the EU Soil Strategy for 2030, we employ the “Land Take Hierarchy” principles (avoid – reuse – minimise – compensate) as our analytical framework (EC 2021: 9). These principles provide a systematic approach to structuring and evaluating the planning instruments used. Methodically, we examine the status of implementation using an online survey of local planning authorities within the framework of a case-study design (Blatter/Haverland 2014).

Following the “Land Take Hierarchy” principles, Section 2 describes the status of research in the fields of reuse, minimisation and compensation. In Section 3, we describe the methodology used in the empirical study, the national framing and the starting situation of our case study. Sec-

tion 4 lists the key findings, while Section 5 discusses these findings and the resulting requirements for further action. Section 6 presents the conclusions.

## 2 The way towards no net land take

The European Commission describes the way to achieve the target of no net land take through a fundamental change in land use. The target is part of both the EU's 7th Environmental Action Programme (EU 2013) and the EU Soil Strategy for 2030 (EC 2021). The European Union Soil Strategy provides a set of principles for a "Hierarchy of Land Take" that forms the basis for sustainable land-use practices. These principles include avoidance, reuse, minimisation and compensation. Avoidance means prioritising the prevention of land conversion, with a focus on preserving undeveloped and ecologically valuable areas. Reuse encourages the recycling of previously developed land, effectively reducing the need for further land take (BBR 2004; Cortinovis/Haase/Zanon et al. 2019). Depending on the context, terms such as infill development, (soft) densification, inner urban development and redevelopment are also commonly used (Listokin/Walker/Ewing et al. 2006; Dillmann/Beckmann 2018; Koch/Bilke/Helbig et al. 2018; Schiller/Blum/Hecht et al. 2021; Ehrhardt/Behnisch/Jehling et al. 2023). Minimisation is connected to greenfield development, which is considered a last resort and shall only be undertaken on land in a less favourable condition when there are no viable alternatives. Where land is taken up or sealed, compensatory and replacement measures should be implemented to minimise the loss of ecosystem services.

By prioritising reuse, the principles actively promote the efficient use of existing land resources. This minimises the need to encroach upon undeveloped lands, thereby curbing further habitat destruction and conserving biodiversity-rich areas. Empirical studies have shown that compact spaces have a positive impact on traffic volumes and mode choice, energy efficiency, infrastructure costs and economic productivity (for a summary discussion see Ahlfeldt/Pietrostefani/Schumann et al. 2018; Berghauser Pont/Haupt/Berg et al. 2021). However, reuse is not only about density specifications (e.g. housing units per hectare) and overall higher densities, but is also strongly linked to the development and qualification of urban green spaces (green recycling). In addition, climate-friendly mobility offers as well as cultural and social aspects have increasingly been taken into account in academic discussion and in practical implementation when planning inner urban measures (Selle 1999; Westphal 2008; Böhm/Böhme/Bunzel et al. 2016; Eichholz/Schoppengerd 2020).

Notwithstanding the advantages, there are numerous lo-

cal challenges and obstacles to the successful implementation of inner urban measures. On the one hand, landowners may not be interested in further building development or selling undeveloped land for various reasons (Reiß-Schmidt 2018: 998). In addition, the European Central Bank's low interest rate policy (at least until spring 2022) and dynamically rising land and housing prices have encouraged speculation, which have boosted land banking and inhibited the construction of (affordable) housing (Paccoud/Hesse/Becker et al. 2022; Goldman 2023). On the other hand, there are still municipalities that continue to designate new building land even though population development does not justify it (Söntges 2007). The reasons for this include inter-municipal competition for potential new residents as well as short- to medium-term economic benefits (Phelps/Wood 2011; Ultsch/Behnisch 2017). Furthermore, there are limits due to legal constraints (e.g. zoning, building regulations) and general requirements for healthy living and working conditions in inner-city areas, which stand in the way of ever further densification (BBSR 2020; Lacoere/Leinfelder 2022). Likewise, there is frequently a lack of acceptance of densification measures, which leads to protests and resistance among the urban population (Wicki/Kaufmann 2021).

To overcome these obstacles, numerous initiatives in the field of building culture (for instance from the *Bundestiftung Baukultur*) have developed guidelines for municipal practice, describing consensual solutions for successfully implementing inner urban measures (BSBK 2018). Given the availability of increasingly small-scale geodata backed by key metadata, for several years now the use of (semi-) automated monitoring systems has been increasingly discussed in academia and practice to support inner urban development (Schmeer/Terfrüchte/Münter 2021; Ehrhardt/Eichhorn/Behnisch et al. 2022).

To achieve no net land take, it will be necessary to offset land take by renaturalising built-up areas elsewhere. In contrast to reuse, this perspective is new in both academic research and planning practice. Nevertheless, renaturation has gained importance in recent years as a possible strategy for adapting to demographic and economic decline as well as in the context of the increasingly dynamic discussion on degrowth (Herfert 2007; Xue 2022). The current lack of experience can be traced back, on the one hand, to the fact that renaturation measures are not financially attractive and, on the other hand, to the massive impact on property rights (BBSR/BMUB 2016; Hartz/Schaal-Lehr/Langenbahn et al. 2021). Moreover, planning law has predominantly developed in the context of capitalism, which has led to a growth-oriented planning paradigm. Therefore, the use of instruments for renaturation is unfamiliar to planners and does not enjoy broad public support (Xue 2022). In addition, the implementation of compensation mechan-

isms (“one in, one out”) raises a number of questions that have not yet been answered (BBR 2007; Hartz/Schaal-Lehr/Langenbahn et al. 2021): At what scale (national, regional, local) should compensation mechanisms be applied? How are the artificialised and renatured hectares measured? How is the ecological and agronomic value of lands taken into account since one hectare is not equivalent to another?

### 3 Methodology and case study

Based on the brief overview of the state of research, we are interested in the planning instruments that are currently being used to manage urban development and to work towards reducing land take and the EU’s no net land take target, and which obstacles hinder their implementation. Due to their more widespread use in academia, we refer to the following terms – inner urban development, land-saving construction and renaturation – in the remainder of this paper. In the following subsections, we describe, firstly, our online survey, secondly, the national framing, and thirdly, the case study in which we conducted our online survey.

#### 3.1 Online survey

To investigate the implementation of planning instruments, we selected Germany and the densely populated federal state of North Rhine-Westphalia as our study area and case study. The reasons for this selection are, first, the long-established planning tradition in Germany and, secondly, the intensity of problems and need for action in a highly dense and urbanised federal state. Both factors led us to expect that we will be able to capture a differentiated picture regarding the planning instruments used. However, we would like to point out that our empirical results – with reference to differences in the European planning systems (Newman/Thornley 1996) – do not allow general conclusions about the planning practice in other European countries to be drawn.

We developed an online survey covering all three above-mentioned fields. The questionnaire was made up of mul-

tiiple-choice and open-ended questions on the current relevance and importance of no net land take policy in planning practice. The main focus was on the planning instruments used and their relevance for successfully implementing such a policy. We sent the online survey to the urban development, planning or land registry departments of all 396 municipalities in North Rhine Westphalia. The survey was online between December 2021 and March 2022. Based on desktop research, 343 (86.6 %) personalised and 53 (13.4 %) general (departmental) e-mail addresses were used. Due to the use of general (departmental) e-mail addresses, it was not possible to restrict participation to an exclusive e-mail address in all cases. It is therefore necessary to keep in mind possible biases in the results, as in these cases, it cannot be ruled out that more than one person participated (see Table 1).

A total of 96 questionnaires were completed fully and 162 partially. Assuming that one person per municipality participated in the survey, this corresponds to a response rate of 24 % for the fully completed questionnaires, or 41 % including those partially completed. To extract as much information as possible from the questionnaires, all questions were evaluated individually, irrespective of whether a questionnaire had been fully or partially completed. This means that the base total (N) may differ depending on the question. For this reason, the individual base total is included in the evaluation of each question. To classify the assessments of the surveyed municipalities by size, one survey question asked about the size category. 96 municipalities answered this question. Table 1 provides an overview of the survey sample by size category.

#### 3.2 National framing

Germany is a federal state with a multi-level planning system that has been in place since the 1960s. Within this planning system, municipalities hold the planning sovereignty and are – adhering to the requirements of state and regional

**Table 1** Municipalities by size category

Size category	Distribution (absolute/percentage)	Personalised e-mail addresses (absolute/percentage)	Answers (absolute/percentage)
under 10,000 inhabitants	55/13.9 %	51/92.7 %	15/27.2 %
10,000 to under 25,000 inhabitants	170/42.9 %	154/90.6 %	31/18.2 %
25,000 to under 50,000 inhabitants	95/24.0 %	86/90.5 %	19/18.9 %
50,000 to under 100,000 inhabitants	47/11.9 %	39/83.0 %	19/38.2 %
100,000 inhabitants and more	29/7.3 %	13/44.8 %	12/13.5 %
Total	396/100 %	343/86.6 %	96*/24.2 %

\* Municipalities with information on the size category

planning – responsible for their own local urban development (Münter/Reimer 2020). The Building Code (BauGB)<sup>2</sup> and the Land Utilisation Ordinance (BauNVO)<sup>3</sup> provide the legal basis. Both define the most important instruments available to municipalities for managing urban development (e.g. binding land-use plan).

The discussion about reducing land take can be traced back to the 1960s in Germany. Terms such as land take or urban sprawl were already mentioned in political agendas like the “Green Charter of Mainau” or the first environmental programme of the German government (Deutscher Bundestag 1971). However, a “trend reversal in land take” (BMI 1985: 8) was only called for at the beginning of the 1980s against the background of high urban growth rates and the crisis-ridden development of inner cities. The requirement to use land sparingly found its way into planning law with the amendment of the Building Code in 1987. Since 2012, § 1 (5) BauGB has stated that “urban development should be carried out primarily through measures of inner urban development”.<sup>4</sup> In § 1a BauGB, there is also an obligation to justify the need to convert (semi-)natural land into urban land, based on “investigations into the possibilities of inner urban development”.<sup>5</sup> In addition to the formulation of planning guidelines, since 2007 legislation (§ 13a BauGB) has provided the development plan for inner urban development and thus granted municipalities procedural simplifications in the implementation of inner urban development measures (see Krautzberger/Stüer 2013; Spannowsky 2013 for more details).

Against the backdrop of sharply rising prices on German land and housing markets (Ehrhardt/Eichhorn/Behnisch et al. 2022), especially in the dynamically growing metropolitan regions, further legislative changes have been made to the Building Code and Land Utilisation Ordinance in recent years. While these have also strengthened inner urban development, the primary aim was not to promote land saving but to accelerate the creation of (affordable) housing (e.g. *Urbanes Gebiet* of 2018; Building Land Mobilisation Act of 2021<sup>6</sup>). At the same time, tight housing markets

have again legitimised further urban expansion projects on greenfield sites (Altrock 2022), boosted by temporary legal simplifications in accordance with § 13b BauGB.

Despite the experience gained in a few small-scale projects, renaturation remains an unfamiliar task for urban and regional planners in Germany. Experience with renaturation has been gained mainly within the framework of the Urban Redevelopment East (*Stadtumbau Ost*) programme in East Germany, as well as to a certain extent within its West German counterpart, *Stadtumbau West* (UBA 2016; Hartz/Schaal-Lehr/Langenbahn et al. 2021). However, the focus has often been on de-densification (e.g. vacant buildings, especially the pre-fabricated, panel-system *Plattenbauten*) and not on the deconstruction of large-scale settlement areas. Where large-scale deconstruction was successful, specific preconditions usually pertained. These include a manageable number of owners who were often legal entities (e.g. public sector), a residential structure dominated by tenants, and the availability of public subsidies. Further experience exists, *inter alia*, in connection with resettlement programmes in opencast lignite mining areas and in areas affected by infrastructure projects, such as airports, and flood protection measures (Janssen/Rubel/Schulze et al. 2016; Greiving/Hurth/Gollmann et al. 2018). What all these projects have in common is that the deconstruction was limited to a specific area. Based on this concrete localisation, the necessity and proportionality of deconstruction was comparatively easy to justify. Moreover, there was often a developer who had the financial resources to compensate those affected. Practical experience in complete renaturation due to demographic and/or economic shrinkage is lacking.

In summary, we conclude that the political targets have been backed by numerous changes in planning law as well as the development of informal instruments for municipal planning (Jehling/Hecht/Herold 2018), all of which have the potential to contribute to the successful implementation of a no net land take policy. However, a look at the 2020 land take figure (54 hectares per day<sup>7</sup> and thus almost twice as high as the target of 30 hectares per day on a four-year moving average) shows that to date efforts remain insufficient and will have to be further intensified for the no net land take target to be achieved by 2050.

### 3.3 The case of North Rhine-Westphalia

North Rhine-Westphalia is made up of 396 municipalities,

<sup>2</sup> Baugesetzbuch in der Fassung der Bekanntmachung vom 3. November 2017 (BGBl. I S. 3634), das zuletzt durch Artikel 3 des Gesetzes vom 12. Juli 2023 (BGBl. 2023 I Nr. 184) geändert worden ist.

<sup>3</sup> Baunutzungsverordnung in der Fassung der Bekanntmachung vom 21. November 2017 (BGBl. I S. 3786), die zuletzt durch Artikel 2 des Gesetzes vom 3. Juli 2023 (BGBl. 2023 I Nr. 176) geändert worden ist.

<sup>4</sup> Translation by the authors.

<sup>5</sup> Translation by the authors.

<sup>6</sup> Gesetz zur Mobilisierung von Bauland (Baulandmobilisierungsgesetz) vom 14. Juni 2021 (BGBl. I S. 1802).

<sup>7</sup> <https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Flaechennutzung/Tabellen/anstieg-suv2.html> (14.08.2023).



**Figure 1** Residential development 2016-2019 in North Rhine-Westphalia in percent by size categories (N=391). Data Basis and Typology of Cities: Spatial Monitoring System of the BBSR, Further Calculations by B. Adam

many of which are large cities: 30 of Germany's 80 cities with more than 100,000 inhabitants are located in North Rhine-Westphalia. In terms of numbers, small cities (20,000 to 100,000 inhabitants) and large towns (10,000 to under 20,000 inhabitants) dominate, respectively accounting for 179 (45.2%) and 134 (33.8%) of all municipalities. By contrast, the proportion of smaller municipalities in Germany as a whole is much higher. While housing and population densities vary greatly between cities and towns, cities are, on average, extremely dense, as shown for example by the federal government's 2020 Urban Development Report (*Stadtentwicklungsbericht*) (BMI 2020). Questions about how to handle land in North Rhine-Westphalia must therefore be answered against the background of high housing densities. As a starting point for our empirical research, this section takes a closer look at land use development in North Rhine-Westphalian municipalities based on the following indicators:

- population density (inhabitants per housing and transport area in hectares), and
- the land used for housing and transport purposes as a share of a municipality's total area (see Figure 1).

In this respect, we need to take account of the 2016 reorganisation of land survey data which prevents any evaluation of longer time series. In addition, the results exclude five municipalities with conspicuous changes in their total land area or their housing and transport area. While further statistical inaccuracies in the comparison of individual municipalities cannot be completely ruled out, they are largely ironed out by the further aggregation (unweighted averages) into municipality types by size categories. For reasons of better readability, in the following, we refer to land use and land take for settlement and transport purposes as urban area

and land take. An increase in a municipality's urban area is understood as urban expansion. An increase in population density refers to an increase in the number of people living in an urban area over time (densification).

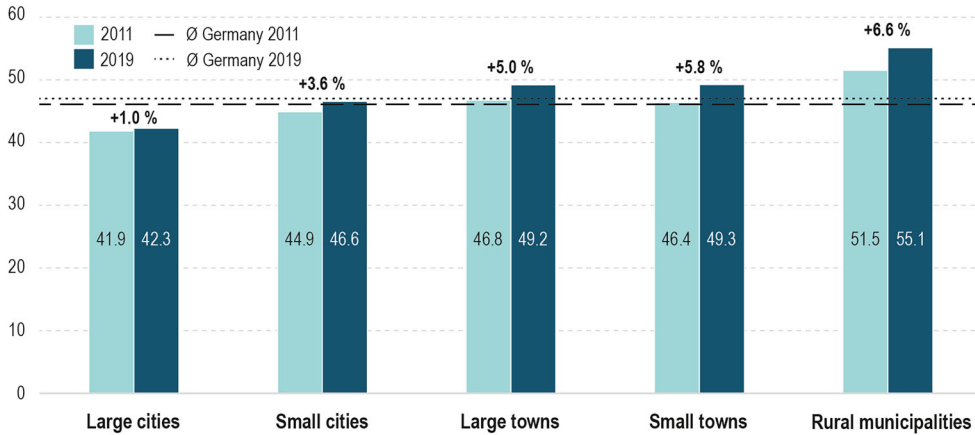
Aggregated by size categories, the results allow for a number of interpretations. The lower average population density – especially in smaller towns and rural districts – goes hand in hand with an increasing amount of urban area. Unless land take is primarily for transport, commercial or industrial purposes, it must be assumed that residential development has been more generous (i.e., less dense). This can be explained by a per capita increase in living space, but also by vacant buildings or more land-extensive new housing developments encroaching on green and recreational space. In fact, per capita living space has increased most in the smaller municipalities, i.e., where it was already particularly high (see Figure 2) and where urban sprawl and declining densities are dominant (see Figure 1).

It is noteworthy that there are many municipalities where, despite declining populations, land take is increasing just as much as in municipalities with growing populations. Conversely, irrespective of the size of municipality, there is a small subgroup of municipalities that are "constricted" from two sides, with increasing densification going hand in hand with above-average land take.

## 4 Findings

### 4.1 Inner urban development

The survey shows that the most frequent use of inner urban land was for housing purposes (with hardly any such land being used for commercial or industrial purposes). In terms of the type of measures taken, the municipalities men-



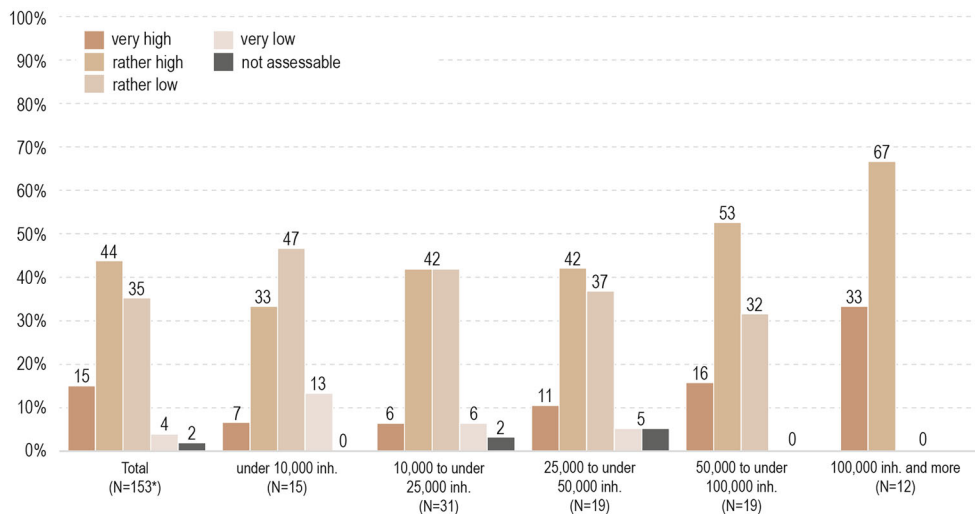
**Figure 2** Development of per capita living space in North Rhine-Westphalia and Germany 2011-2019. Data basis and Typology of Cities: Spatial Monitoring System of the BBSR and German Federal Statistical Office (Destatis)

tioned, for example, densification, conversion or redevelopment (i.e., the demolition of an existing building and the construction of a new one). The large cities attributed inner urban development an important role in combating tight housing markets (see Figure 3). According to the survey, this was not the case for the smaller municipalities. In view of the observed lower densification tendencies in towns, housing demand – irrespective of the expected population development – would appear to be often met by greenfield development.

In response to the question about obstacles in the way of developing inner urban land, the vast majority of respondents pointed to the difficulty of convincing owners with little or no interest in developing or selling their land in the near future. Moreover, several of the municipalities sur-

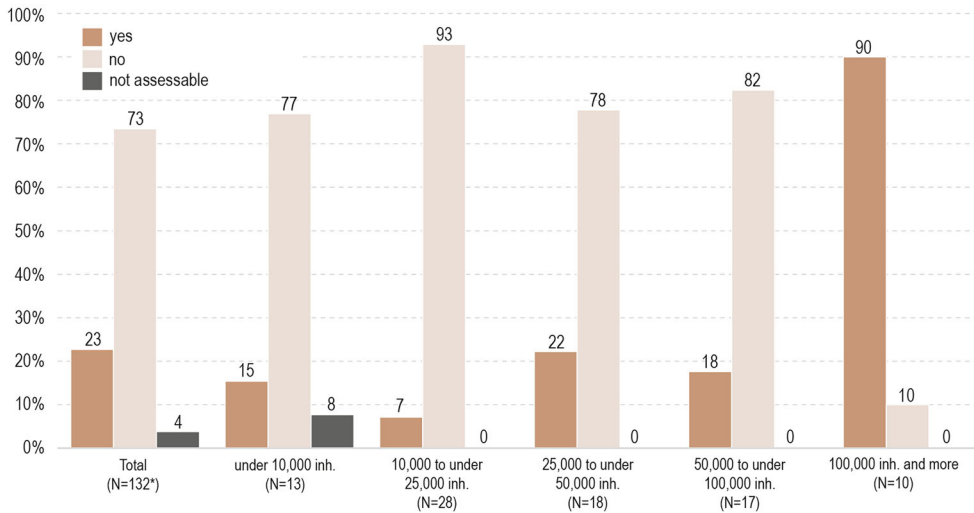
veyed cited the lack of acceptance by the population as an obstacle, even though there was no specific question on this in the survey.

The questions about the monitoring of inner urban development potential were answered in various ways (see Figure 4). With the exception of small municipalities with less than 10,000 inhabitants, the majority of those surveyed stated that they identify potential for inner urban development. However, whether this potential is evaluated varied. According to the results, there is hardly any systematic assessment of such potential except for in the big cities. In municipalities with 25,000 to 100,000 inhabitants, only around 20% responded affirmatively, with this figure dropping to 7% in those with less than 10,000 and to 15% in those with less than 25,000 inhabitants. Specific evaluation crite-



\* 57 of the surveyed municipalities did not state their size category

**Figure 3** Importance of inner urban development to counteract tight housing markets. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia



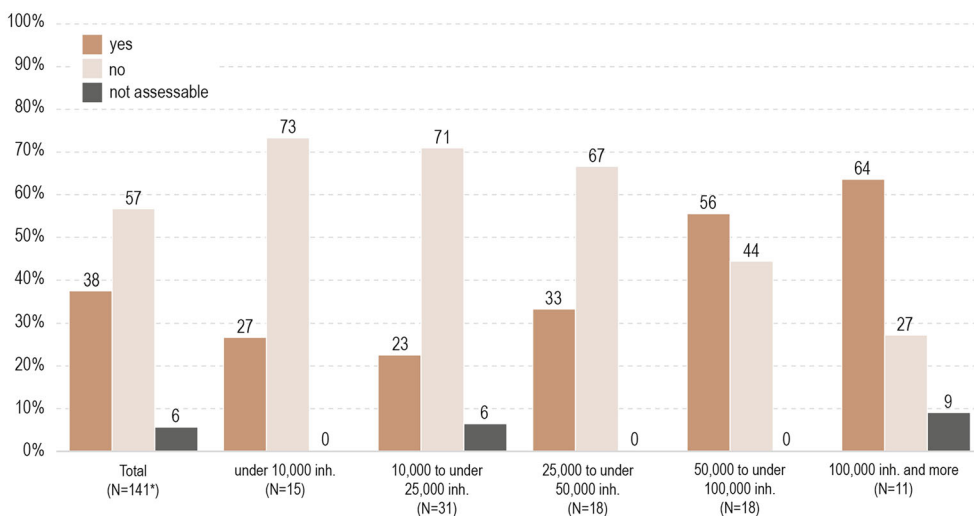
\* 57 of the surveyed municipalities did not state their size category

**Figure 4** Evaluation of inner urban development potential. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia

ria were rarely listed, but when listed they regularly included planning requirements and environmental concerns. Explicitly not listed were, for example, requirements for climate adaptation or healthy living conditions.

These findings reflect deficits in the integration of inner urban development policies into other urban development concepts. Open (green) space concepts that could supplement inner urban development policies are rarely found in the smaller municipalities, while they are by no means a matter of course in large cities either. The proportion of municipalities that answered “no” to the question on integrated concepts similarly predominated. Mobility concepts

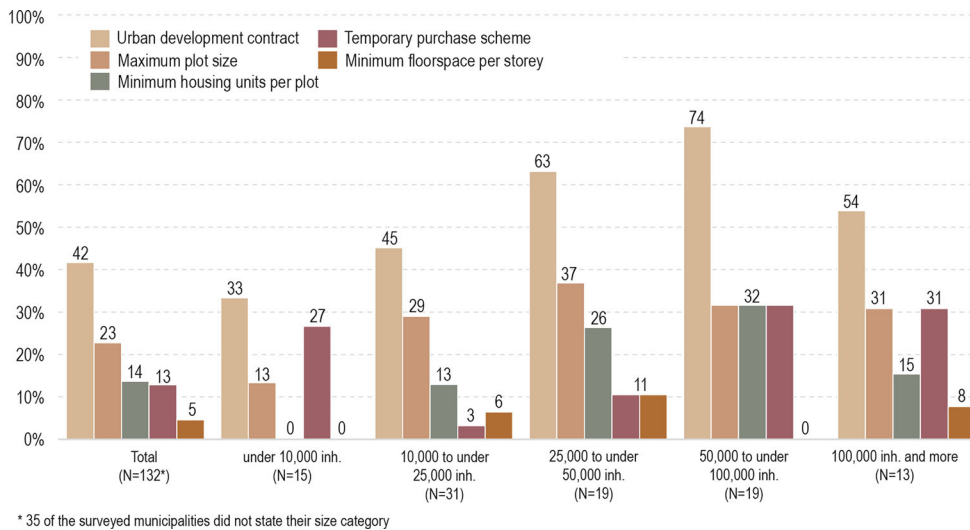
were listed more often, many linked to inner urban development topics. In municipalities with more than 50,000 inhabitants, positive responses predominated (see Figure 5). Densification concepts or the setting of upper or lower density limits were rarely mentioned: just nine of these 32 municipalities had set upper limits. Only one municipality (a small city) had resorted to the option of setting lower limits. Looking at the sample, upper limits were mainly set by small cities and towns.



\* 44 of the surveyed municipalities did not state their size category

**Figure 5** Importance of mobility concepts for inner urban development. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia





**Figure 6** Instruments promoting land-saving construction. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia

## 4.2 Land-saving construction

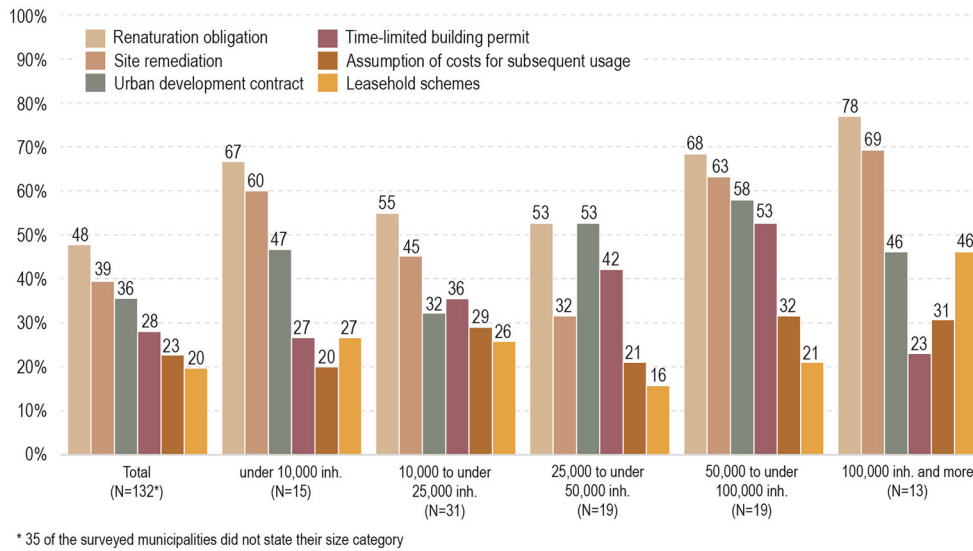
The survey shows that 56% of the larger housing projects (minimum 30 housing units) undertaken in the last five years featured housing densities of less than 30 housing units per hectare. The share of municipalities achieving higher housing densities was significantly lower. Housing projects in municipalities with up to 50,000 inhabitants exclusively featured densities of less than 60 housing units per hectare, with projects featuring less than 30 housing units per hectare dominating (a ratio of 31 to 11). Higher densities were only achieved in the larger municipalities, although here as well housing projects with lower densities (up to 60 housing units per hectare) predominated (a ratio of 16 to 5). The demand for houses (detached, semi-detached or terrace), a focus on existing developments, and the lack of political and social acceptance for dense housing construction were cited as key reasons for the low housing densities. Other reasons for higher or lower housing densities included municipal land availability, the cost effectiveness of new developments, housing demand and infrastructure capacities. However, these reasons were listed significantly less often than those mentioned above.

The survey findings indicate that land-saving construction was most frequently (48%) realised via urban development contracts (*städtebauliche Verträge*) and the specifications set forth therein (see Figure 6) – irrespective of the size of the municipality. Taking additional account of the size categories, the importance of such contracts increased with size – with the exception of cities with more than 100,000 inhabitants. Definitions in development plans on maximum housing plot dimensions were the second most frequently cited method, albeit over 20 percentage points behind that of

urban development contracts. An evaluation by municipality size categories revealed that their use tended to increase in line with a municipality's size. For municipalities with more than 50,000 inhabitants, however, their use remained at a similarly moderate level. At around 30%, the option of a municipality temporarily purchasing building land (*Zwischenerwerb*) was used mainly in very small municipalities and in larger cities. The municipalities surveyed also tended to make little use of specifications for minimum floorspace per storey or minimum numbers of housing units per building plot. For example, specifications for the former played an insignificant role (just 5% of responses) in the practical ways cited to achieve land-saving construction.

In addition to the use of formal instruments and the need for action in support of higher-density housing development, it is considered particularly important to create acceptance and support for higher-density neighbourhoods among both local policymakers and residents. The respondents see participatory planning and citizen involvement processes as a suitable way to achieve this.

When asked which instruments were particularly well suited to successfully implementing no net land take policy in the future, the instrument most frequently cited (just under 50%) was a renaturation obligation (see Figure 7). An evaluation by size revealed that the instrument was considered particularly important by both small and large municipalities. The second and third most frequently cited instruments were the remediation of contaminated sites and urban development contracts. Time-limited building permits, the assumption of costs for subsequent usage, and leasehold schemes were considered less relevant for a successful no net land take policy. Only 28 (20%) of the surveyed municipalities stated that these instruments (could) have a positive



**Figure 7** Instruments to achieve no net land take by municipality size category. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia

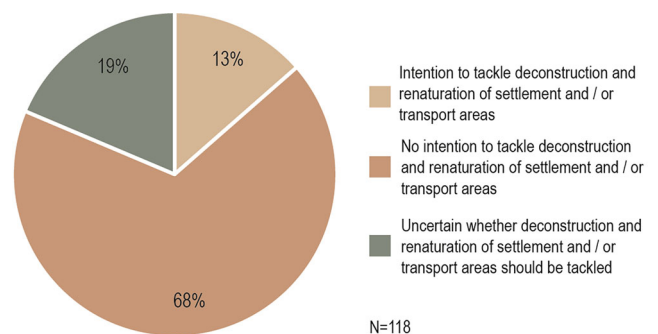
impact on such policy. It should, however, be emphasised that their importance increased with the size of the municipality surveyed.

### 4.3 Renaturation

The empirical findings on renaturation reveal that just under a quarter of respondents had practical experience with the topic. A total of 16% (20 of 127) stated that their municipality has renaturalised urban land in the past. However, a look at the specific renaturation measures revealed that in many cases this involved making land reusable for inner urban development. Renaturation measures covered vacant or derelict properties, former industrial sites, transport infrastructure, abandoned transport sites and former military bases. Of the respondents whose municipalities had not performed any renaturation measures in the past, more than two-thirds (68 of 96) justified this by citing a lack of need or an opposing high demand for land. Other causes included a lack of instruments or acceptance, while the threat of compensation claims and a lack of financial resources also played a role but were cited much less frequently.

Turning to future renaturation plans, only 13% stated that their municipality intended to carry out renaturation measures in the foreseeable future (by the end of the current municipal election period). 68% stated that their municipality had no plans to engage in renaturation in the future – regardless of whether the municipality in question was forecast to grow or shrink (see Figure 8).

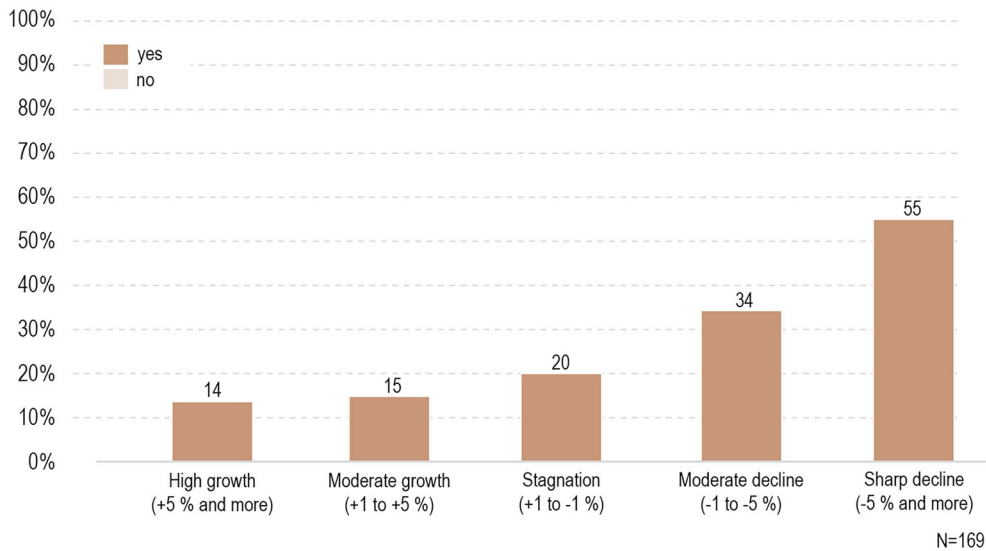
Although the survey shows that the national land take targets (the 30-ha target and the no net land take target) do



**Figure 8** Intention of implementing deconstruction and renaturation. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia

not guide municipal practice and that renaturation continues to play a secondary role, the majority of respondents considered municipalities to be responsible for the success of the associated measures (70%; 102 of 169). The state (in this case North Rhine-Westphalia) (44%), planning regions (40%) and federal government (38%) were seen as less relevant.

When asked which regions should contribute to renaturation, about 85% (144 of 169) of respondents believed that no contribution should be made in regions characterised by population growth (growth > 1%). It is noteworthy that according to the survey results, even regions with stagnating and declining populations (-5% to +1%) should not be obliged to implement renaturation measures (78% and 66% respectively). There was a slight majority (55%) in favour of renaturation only for those regions where signifi-



**Figure 9** Contribution to renaturation by forecast population development. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia

cant population decline ( $> -5\%$ ) is forecast (see Figure 9). Moreover, renaturation was not seen as an option for adapting the housing stock to a shrinking population. Even respondents from municipalities with populations forecast to decline sharply were nearly all of the opinion that there is no need for renaturation.

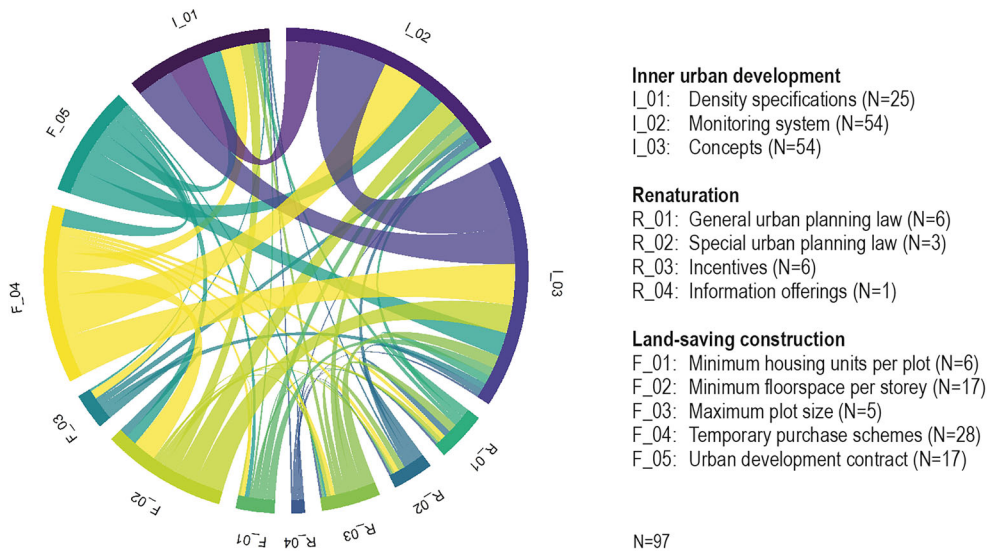
Half of the respondents indicated that existing instruments are insufficient to drive renaturation, while just 13% (15 out of 114) considered the existing instruments to be adequate. Ways of further developing and improving the instruments were also assessed by the respondents. Thus, financial incentives for municipalities were considered very effective (47 of 63) and financial incentives for the affected parties were similarly considered effective, with 32 of 63 respondents stating that the range of instruments offering financial support to them should be expanded. In addition to financial incentives, it was stated that tax breaks for the affected parties need to be expanded. Just under half of respondents (27 of 63) were in favour of incentives in the form of property tax cuts or tax incentives for relocating households and for demolition and reconstruction projects. Beyond the various financial incentives, many respondents (33 of 63) saw a need to further develop the legal instruments. As examples they cited the further development of regional planning, land funds, pre-emption rights, a malus system for permanently unused sealed brownfields, state development programme targets and a renaturation obligation. The demand for better information (e.g., individual counselling for municipalities and low-threshold information offers for policymakers and citizens) was also relatively high (19 of 63, or just under one-third).

The findings illustrate that willingness to implement renaturation is highly dependent on financial incentives for the municipalities and affected parties. A look at the responses of respondents from municipalities with renaturation experience confirmed this impression, with almost half of the respondents from these municipalities stating that renaturation was (partially) financed by state aid. The wide range of state aid programmes used (e.g. protection of urban heritage, the EU framework directive on water, support for remediating contaminated sites, urban development funding) was striking. Special urban planning law instruments accounted for a surprisingly low share (3 out of 20).

#### 4.4 Interaction between instruments in the fields of inner urban development, land-saving construction and renaturation

As outlined in Section 2, the only way for a no net land take policy to be successful is for municipalities to be equally active in the fields of inner urban development, land-saving construction and renaturation. While Sections 4.1 to 4.3 describe the implementation status of the individual fields independently of one another, Section 4.4 is devoted to consolidating the findings.

Based on the instruments used, we note that the degree of activity grows in line with a municipality's size. In absolute and relative terms, the largest municipalities employ the most instruments in each field. While the fields of inner urban development and land-saving construction show a similarly high level of instrument use, that of renaturation stands out due to the significantly lower use of available instruments. As described in Section 4.3, this field's



**Figure 10** Visualisation of the relationships between inner urban development, land-saving construction and renaturation according to the instruments used. Data basis: Own municipal survey 2021/2022 in North Rhine-Westphalia

lack of importance in current planning practice is evident. Although the larger municipalities are more broadly positioned in terms of instruments and concepts than their smaller counterparts, many of the instruments surveyed are not used here either.

Figure 10 visualises the relationships between the fields of inner urban development, land-saving construction and renaturation according to the instruments used. The width of the outer bars represents the relative importance of an instrument in comparison to all other instruments (e.g., density targets N=25 to monitoring systems N=54). The thickness of the lines symbolises the strength of the relationship between two instruments. As already mentioned above, there are significant differences in the frequency of application depending on the field and instrument. For example, while density specifications are used by 25 of the municipalities surveyed, only three stated that they use special urban planning law instruments for renaturation. Besides the width of the outer bars, this fact is reflected in the thickness of the lines. Due to their low frequency of application, renaturation instruments play a clearly secondary role in the context of the other instruments. In comparison, there are much stronger relationships between the instruments applied in the other two fields.

## 5 Discussion of the findings and requirements for action

The findings provide an overview of the status quo regarding inner urban development, land-saving construction and

renaturation in municipalities in North Rhine-Westphalia. They show that in all three fields implementation levels for achieving no net land take vary widely. In line with the findings of Ehrhardt, Eichhorn, Behnisch et al. (2022), larger municipalities in North Rhine Westphalia draw on a higher number of (planning) instruments in the three fields studied. The findings indicate that the need for action with regard to sustainable housing development is higher in such municipalities and that they have more manpower available, thereby necessitating and enabling an overall more differentiated use of instruments.

Looking at inner urban development, the evaluation shows that other urban fields of action have hardly been conceptually linked to the goal of inner urban development. However, greater integration of inner urban development into other urban concepts offers the opportunity to better utilise synergies between urban planning fields that substantively overlap and to raise awareness for the importance of increased inner urban development (Eichhorn/Rusche/Weith 2021).

Planning departments, especially in towns, not only have to deal with often conflicting goals from civil society and policymakers in the field of inner urban development, but also have to make do with a lack of human resources (Blum/Atci/Roscher et al. 2022: 155). The findings suggest that, under these conditions, municipalities often have to succumb to outside pressure, especially when current demand and policy objectives call for more houses to be built.<sup>8</sup> Without carefully negotiated, spatially differentiated con-

<sup>8</sup> [https://www.destatis.de/EN/Press/2022/05/PE22\\_212\\_31121.html](https://www.destatis.de/EN/Press/2022/05/PE22_212_31121.html) (14.08.2023).

ceptual foundations, planning departments thus often find themselves exposed to the arguments and goals of investors and residents.

In such a scenario, the interaction of various instruments is decisive for assertive and high-quality inner urban development. This includes continuous and systematic monitoring able to transparently capture the status of inner urban development. While more and more municipalities are now mapping developments (Blum/Atci/Roscher et al. 2022: 16), there is still a need to catch up in terms of systematic assessments of the status quo. Digitalisation continues to offer a great deal of potential, as yet inadequately tapped (Ehrhardt/Behnisch/Jehling et al. 2023).

The findings indicate that new housing developments in North Rhine-Westphalia tend to be planned and implemented with low densities. In line with Ammann, Brack, Claßen et al. (2021: 46–50), therefore, land-saving construction continues to play a secondary role, especially in smaller municipalities. However, for housing development to be land-saving, the goal must be to make new land take more efficient, including in more rural areas (Schmeer/Terfrüchte/Münter 2021). A core demand is therefore to achieve a commitment to higher housing densities overall, leading to the share of new housing developments that solely feature detached or semi-detached houses declining in planning practice. Since it can be assumed that owning a house will remain the core housing model for the wider public in the long term, attempts should be made to meet the desire for individual forms of housing within the framework of community-oriented housing concepts, which allow higher densities (Schubert/Büttner/Lindmaier et al. 2021: 29–30). Such housing concepts must be geared to town and city centres and railway station catchment areas. On the one hand, it is easier to realise higher densities in city and town cores – due to existing housing densities –, while on the other hand the spatial proximity of environmentally friendly modes of transport has a demonstrably positive influence on the choice of means of transport and the modal split (Eichhorn/Gerten/Diller 2021). According to the survey findings, acceptance is a *sine qua non* for all these measures, meaning that it is of particular importance for local policymakers and civil society to be made aware of the need for higher densities. One possible starting point here is the dissemination of best practice examples and illustrations of densified housing projects (Schubert/Büttner/Lindmaier et al. 2021: 29–30).

Unlike the 30-ha target, the net-zero target is not just about limiting the amount of land take, but also about balancing land take and renaturation (“one in, one out”). This means that – in addition to inner urban development and land-saving outer urban development – renaturation measures are moving into much sharper focus. In accor-

dance with Janssen, Rubel, Schulze et al. (2016) and Hartz, Schaal-Lehr, Langenbahn et al. (2021), the findings show that urban planning departments remain unfamiliar with the concept of renaturation, with only a few municipalities having any concrete experience of it. Renaturation areas should be selected in such a way that they match spatial planning and urban development objectives. Housing structures and transport infrastructures which have become dysfunctional over time can be adapted to current requirements and past urban planning shortcomings can be eliminated through renaturation. Since, however, renaturation incurs high costs without generating any direct financial gain, it is imperative that land take is linked to renaturation, i.e., land take must always be offset by land renaturation elsewhere. The costs for renaturation must be borne by those behind the planning and construction measures causing land take. The instruments required for implementing this approach need to be coordinated among all administrative levels – in the sense of multilevel governance – and could be applied analogously to the “one in, one out” regulation under nature conservation law (*Eingriffs-Ausgleichs-Regelung*). The fundamental need to expand the existing set of instruments is recognised by the majority of respondents. At the same time, developers need to make a contribution to renaturation, at least in correspondence with their share of land take.

## 6 Conclusion

The findings show that municipalities in North Rhine-Westphalia are not (yet) in a position to consistently implement a no net land take policy. The current conglomeration of conflicting interests, especially the balancing act between urgently required housing construction and open space protection, does not make this any easier. Though the instruments needed are defined in existing law (Building Code) and widely known concepts (integrated and specialised for urban development), their uptake by municipalities is as yet insufficient to implement a successful no net land take policy. Efforts to make municipalities with sufficient development potential more aware of land-saving construction, or to gain citizen acceptance for neighbourhood densification through enhanced participation schemes, have as yet been limited.

If the goal, under the current conditions of population growth in Germany (84.1 million inhabitants in 2022 with an upward trend), is indeed to move towards no net land take, municipalities will have to be better empowered, i.e., enabled to use existing tools even without direct pressure to act (as in some large cities or metropolitan districts).

The Building Code calls for precedence to be given to inner urban development. What is missing is a substantive

orientation from policymakers as to how the land potential is to be assessed from a multidimensional perspective. The survey revealed, for example, that municipalities now tend to identify a potential for inner urban development, but rarely evaluate it. Density thresholds or orientation values for shares of open spaces are currently of little use due to a lack of specifications in § 1a BauGB or the exemptions still listed in § 34 BauGB.

While higher densities – through densification or in the context of urban expansion – are unavoidable, they can only be achieved if additional (recreational) amenities, e.g. in the form of green spaces, sports areas and/or meeting areas for the general public, are also planned. The latter aspect relates to healthcare and adaptation to climate change, but also to the urban and architectural design requirements enshrined in § 1 (5) BauGB. In some places, alliances have already been formed within the population to do this, especially when generational shifts create demand for denser, more community-oriented forms of housing.

So far, experience with renaturation has been at best ad hoc. Against this background, no net land take policy constitutes a fundamental paradigm shift in urban and regional planning. In addition to legally binding requirements, an intensive dialogue between municipalities, specialist planning departments and other stakeholders is of key importance. Model projects or simulations can be particularly helpful in testing (new) (planning) instruments and procedures under scientific supervision. The development of a reliable system for monitoring the land take/renaturation balance is also gaining in importance.

Continuing population growth on the one hand and restrictions on land take on the other will inevitably lead to shortages and ultimately to price increases. It is therefore necessary to create appropriate instruments to ensure “socially just” land use, inevitably these must be sought outside current planning law.

**Competing Interests** The authors declare no competing interests.

**Acknowledgements** This paper is the result of the ARL Working Group “Perspektive Nettonull Flächenverbrauch”. We thank ARL – Akademie für Raumentwicklung in der Leibniz-Gemeinschaft for their (financial) support. Moreover, we would like to thank two anonymous reviewers for their helpful comments.

**Funding** This work received external funding for the translation and proofreading by the ARL – Akademie für Raumentwicklung in der Leibniz-Gemeinschaft.

## References

Ahlfeldt, G.; Pietrostefani, E.; Schumann, A.; Matsumoto, T. (2018): Demystifying compact urban growth: Evidence from 300 studies from across the world. Paris. =

- OECD Regional Development Working Papers 2018/03. <https://doi.org/10.1787/bbea8b78-en>
- Altrock, U. (2022): New (sub)urbanism? How German cities try to create “urban” neighborhoods in their outskirts as a contribution to solving their recent housing crises. In: *Urban Governance* 2, 1, 130–143. <https://doi.org/10.1016/j.ugj.2022.04.001>
- Ammann, I.; Brack, N.; Claßen, G.; Degener, E.; Duvernet, C.; Franke, J.; Lihs, V.; Neußer, W.; Nielsen, J.; Oettgen, N.; Rein, S.; Schmidt, C.F.; Schürt, A.; Waltersbacher, M.; Zander, C. (2021): *Wohnungs- und Immobilienmärkte in Deutschland 2020*. Bonn.
- BBR – Bundesamt für Bauwesen und Raumordnung (2004): *Fläche im Kreis. Kreislaufwirtschaft in der städtischen/stadtregionalen Flächennutzung*. Bonn. = ExWoSt-Informationen 25/1.
- BBR – Bundesamt für Bauwesen und Raumordnung (ed.) (2007): *Perspektive Flächenkreislaufwirtschaft. Kreislaufwirtschaft in der städtischen/stadtregionalen Flächennutzung. Fläche im Kreis. Ein ExWoSt-Forschungsfeld. Band 3: Neue Instrumente für neue Ziele*. Bonn.
- BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung (2020): *Aktivierung von Innenentwicklungspotenzialen in wachsenden Kommunen. Erhebung und Erprobung von Bausteinen eines aktiven Managements*. Bonn.
- BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung; BMUB – Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (2016): *Gemeinsame Evaluierung der Programme Stadtumbau Ost und Stadtumbau West*. Bonn.
- Behnisch, M.; Krüger, T.; Jaeger, J.A.G. (2022): Rapid rise in urban sprawl: Global hotspots and trends since 1990. In: *PLOS Sustainability and Transformation* 1, 11, e0000034. <https://doi.org/10.1371/journal.pstr.0000034>
- Berghauser Pont, M.; Haupt, P.; Berg, P.; Alstäde, V.; Heyman, A. (2021): Systematic review and comparison of densification effects and planning motivations. In: *Buildings and Cities* 2, 1, 378–401. <https://doi.org/10.5334/bc.125>
- Blatter, J.; Haverland, M. (2014): *Designing case studies. Explanatory approaches in small-N research*. Basingstoke.
- Blum, A.; Atci, M.M.; Roscher, J.; Henger, R.; Schuster, F. (2022): *Bauland- und Innenentwicklungspotenziale in deutschen Städten und Gemeinden*. Bonn. = BBSR-Online-Publikation 11/2022.
- BMI – Bundesministerium des Innern (1985): *Bodenschutzkonzeption der Bundesregierung*. Bonn. = Bundestags-Drucksache 10/2977 vom 7. März 1985.
- BMI – Bundesministerium des Innern, für Bau und Heimat (2020): *Stadtentwicklungsbericht der Bundesregierung 2020*. Berlin.

- Böhm, J.; Böhme, C.; Bunzel, A.; Kühnau, C.; Landua, D.; Reinke, M. (2016): Urbanes Grün in der doppelten Innenentwicklung. Bonn-Bad Godesberg. = BfN-Skripten 444.
- Bovet, J.; Reese, M.; Köck, W. (2018): Taming expansive land use dynamics – Sustainable land use regulation and urban sprawl in a comparative perspective. In: *Land Use Policy* 77, 837–845. <https://doi.org/10.1016/j.landusepol.2017.03.024>
- BBSK – Bundesstiftung Baukultur (ed.) (2018): Baukultur Bericht 2018/19. Erbe – Bestand – Zukunft. Berlin.
- Colsaet, A.; Laurans, Y.; Levrel, H. (2018): What drives land take and urban land expansion? A systematic review. In: *Land Use Policy* 79, 339–349. <https://doi.org/10.1016/j.landusepol.2018.08.017>
- Cortinovis, C.; Haase, D.; Zanon, B.; Geneletti, D. (2019): Is urban spatial development on the right track? Comparing strategies and trends in the European Union. In: *Landscape and Urban Planning* 181, 22–37. <https://doi.org/10.1016/j.landurbplan.2018.09.007>
- Decoville, A.; Schneider, M. (2015): Can the 2050 zero land take objective of the EU be reliably monitored? A comparative study. In: *Journal of Land Use Science* 11, 3, 331–349. <https://doi.org/10.1080/1747423X.2014.994567>
- Deutscher Bundestag (1971): Umweltprogramm der Bundesregierung. Bonn. = Bundestags-Drucksache VI/2710 vom 14. Oktober 1971.
- Dillmann, O.; Beckmann, V. (2018): Do Administrative Incentives for the Containment of Cities Work? An Analysis of the Accelerated Procedure for Binding Land-Use Plans for Inner Urban Development in Germany. In: *Sustainability* 10, 12, 4745. <https://doi.org/10.3390/su10124745>
- Ehrhardt, D.; Behnisch, M.; Jehling, M.; Michaeli, M. (2023): Mapping soft densification: a geospatial approach for identifying residential infill potentials. In: *Buildings and Cities* 4, 1, 193–211. <https://doi.org/10.5334/bc.295>
- Ehrhardt, D.; Eichhorn, S.; Behnisch, M.; Jehling, M.; Münter, A.; Schünemann, C.; Siedentop, S. (2022): Stadtreignen im Spannungsfeld zwischen Wohnungsfrage und Flächensparen. Trends, Strategien und Lösungsansätze in Kernstädten und ihrem Umland. In: *Raumforschung und Raumordnung | Spatial Research and Planning* 80, 5, 522–541. <https://doi.org/10.14512/rur.216>
- Eichholz, A.-K.; Schoppengerd, J. (2020): Nachverdichtung versus Dichteobergrenzen? Zur Anwendung der Überschreitungsmöglichkeiten nach § 17 (2) BauNVO. In: *RaumPlanung* 206, 2/3, 16–23.
- Eichhorn, S.; Gerten, C.; Diller, C. (2021): Bewertung und Klassifizierung von Bahnhaltspunkten in Nordrhein-Westfalen. Ein methodischer Ansatz zur Operationalisierung von „Transit-Oriented Development“. In: *Raumforschung und Raumordnung* 79, 1, 21–38. <https://doi.org/10.14512/rur.28>
- Eichhorn, S.; Rusche, K.; Weith, T. (2021): Integrative governance processes towards sustainable spatial development – solving conflicts between urban infill development and climate change adaptation. In: *Journal of Environmental Planning and Management* 64, 12, 2233–2256. <https://doi.org/10.1080/09640568.2020.1866509>
- EC – European Commission (2011): Roadmap to a Resource Efficient Europe. COM (2011) 571. Brussels.
- EC – European Commission (2021): EU Soil Strategy for 2030. Reaping the benefits of healthy soils for people, food, nature and climate. COM (2021) 699 final. Brussels.
- EU – European Union (2013): Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 ‘Living well, within the limits of our planet’. Brussels.
- Ewing, R.; Lyons, T.; Siddiq, F.; Sabouri, S.; Kiani, F.; Hamidi, S.; Choi, D.-A.; Ameli, H. (2022): Growth Management Effectiveness: A Literature Review. In: *Journal of Planning Literature* 37, 3, 433–451. <https://doi.org/10.1177/08854122221077457>
- Goldman, M. (2023): Speculative urbanism and the urban-financial conjuncture: Interrogating the afterlives of the financial crisis. In: *Environment and Planning A: Economy and Space* 55, 2, 367–387. <https://doi.org/10.1177/0308518X211016003>
- Greiving, S.; Hurth, F.; Gollmann, C.; Kirstein, M.; Fleischhauer, M.; Hartz, A.; Saad, S. (2018): Siedlungsrückzug als planerische Strategie zur Reduzierung von Hochwasserrisiken. In: *Raumforschung und Raumordnung | Spatial Research and Planning* 76, 3, 193–209. <https://doi.org/10.1007/s13147-018-0533-4>
- Hartz, A.; Schaal-Lehr, C.; Langenbahn, E.; Fleischhauer, M.; Greiving, S.; Nguyen, B.-H.; Janssen, G.; Bartel, S. (2021): Rücknahme von Siedlungsbereichen als Anpassungsstrategie. Praxishilfe zur Anpassung von Siedlungsstrukturen an den Klima- und demografischen Wandel. Dessau-Roßlau.
- Herfert, G. (2007): Regionale Polarisierung der demographischen Entwicklung in Ostdeutschland – Gleichwertigkeit der Lebensverhältnisse? In: *Raumforschung und Raumordnung* 65, 5, 435–455. <https://doi.org/10.1007/BF03183833>
- Janssen, G.; Rubel, C.; Schulze, F.; Keimeyer, F. (2016): Siedlungsrückzug. Recht und Planung im Kontext von

- Klima- und demografischem Wandel. Dessau-Roßlau. = Climate Change 21/2016.
- Jehling, M.; Hecht, R.; Herold, H. (2018): Assessing urban containment policies within a suburban context – An approach to enable a regional perspective. In: Land Use Policy 77, 846–858. <https://doi.org/10.1016/j.landusepol.2016.10.031>
- Koch, F.; Bilke, L.; Helbig, C.; Schlink, U. (2018): Compact or cool? The impact of brownfield redevelopment on inner-city micro climate. In: Sustainable Cities and Society 38, 31–41. <https://doi.org/10.1016/j.scs.2017.11.021>
- Krautzberger, M.; Stüer, B. (2013): BauGB-Novelle 2013. Gesetz zur Stärkung der Innenentwicklung in den Städten und Gemeinden und weiteren Fortentwicklung des Städtebaurechts. In: Deutsches Verwaltungsblatt 128, 13, 805–872.
- Lacoere, P.; Leinfelder, H. (2022): Land oversupply. How rigid land-use planning and legal certainty hinder new policy for Flanders. In: European Planning Studies, 1–23. <https://doi.org/10.1080/09654313.2022.2148456>
- Listokin, D.; Walker, C.C.; Ewing, R.; Cuddy, M.; Cander, A. (2006): Infill Development Standards and Policy Guide. New Brunswick.
- Marquard, E.; Bartke, S.; Gifreu i Font, J.; Humer, A.; Jonkman, A.; Jürgenson, E.; Marot, N.; Poelmans, L.; Repe, B.; Rybski, R.; Schröter-Schlaack, C.; Sobocká, J.; Tophøj Sørensen, M.; Vejchodská, E.; Yiannakou, A.; Bovet, J. (2020): Land Consumption and Land Take: Enhancing Conceptual Clarity for Evaluating Spatial Governance in the EU Context. In: Sustainability 12, 19, 8269. <https://doi.org/10.3390/su12198269>
- Münter, A.; Reimer, M. (2020): Planning Systems on the Move? Persistence and Change of the German Planning System. In: Planning Practice and Research, 1–19. <https://doi.org/10.1080/02697459.2020.1832362>
- Newman, P.; Thornley, A. (1996): Urban planning in Europe. International competition, national systems, and planning projects. London.
- Paccoud, A.; Hesse, M.; Becker, T.; Górczyńska, M. (2022): Land and the housing affordability crisis: landowner and developer strategies in Luxembourg's facilitative planning context. In: Housing Studies 37, 10, 1782–1799. <https://doi.org/10.1080/02673037.2021.1950647>
- Phelps, N.A.; Wood, A.M. (2011): The New Post-suburban Politics? In: Urban Studies 48, 12, 2591–2610. <https://doi.org/10.1177/0042098011411944>
- Reimer, M.; Getimis, P.; Blotvogel, H.H. (eds.) (2014): Spatial planning systems and practices in Europe. A comparative perspective on continuity and changes. London.
- Reiß-Schmidt, S. (2018): Innenentwicklung. In: ARL – Akademie für Raumforschung und Landesplanung (eds.): Handwörterbuch der Stadt- und Raumentwicklung. Hannover, 995–1000.
- Schatz, E.-M.; Bovet, J.; Lieder, S.; Schroeter-Schlaack, C.; Strunz, S.; Marquard, E. (2021): Land take in environmental assessments: Recent advances and persisting challenges in selected EU countries. In: Land Use Policy 111, 105730. <https://doi.org/10.1016/j.landusepol.2021.105730>
- Schiller, G.; Blum, A.; Hecht, R.; Oertel, H.; Ferber, U.; Meinel, G. (2021): Urban infill development potential in Germany: comparing survey and GIS data. In: Buildings and Cities 2, 1, 36–54. <https://doi.org/10.5334/bc.69>
- Schmeer, N.; Terfrüchte, T.; Münter, A. (2021): Interkommunales Flächenmanagement in der Praxis. In: Henn, S.; Zimmermann, T.; Braunschweig, B. (eds.): Stadtreregionales Flächenmanagement. Berlin, 1–28. [https://doi.org/10.1007/978-3-662-63295-6\\_12-2](https://doi.org/10.1007/978-3-662-63295-6_12-2)
- Schubert, S.; Büttner, A.; Lindmaier, J.; Schröder, A.; Dross, M.; Reißmann, D.; Janitzek, T.; Schmied, M. (2021): Umlandstadt umweltschonend. Nachhaltige Verflechtung von Wohnen, Arbeiten, Erholung und Mobilität. Dessau-Roßlau.
- Science for Environment Policy (2016): No net land take by 2050? Brussels. = Future Brief 16. <https://doi.org/10.2779/537195>
- Selle, K. (1999): Vom sparsamen Umgang zur nachhaltigen Entwicklung. Programme, Positionen und Projekte zur Freiraum- und Siedlungsentwicklung. Ein Lesebuch für Studierende und andere Interessierte. Dortmund. = AGB-Werkbericht 41.
- Siedentop, S.; Schmidt, S.; Dunlop, A. (2022): Managing Urban Growth – an Overview of the Literature. In: Raumforschung und Raumordnung | Spatial Research and Planning 80, 6, 659–677. <https://doi.org/10.14512/rur.1653>
- Söntges, P. (2007): Innenentwicklung vor Außenentwicklung – Wunsch oder Wirklichkeit? In: Institut für Städtebau, Wohnungswirtschaft und Bausparwesen (ed.): Regionale bzw. kommunale Entwicklungen im Bereich der Wohnungs- und Städtebaupolitik. 42. Königsteiner Gespräche – Referate und Statements. Berlin, 77–82. = Schriftenreihe des Instituts für Städtebau, Wohnungswesen und Bausparwesen 69.
- Spannowsky, W. (2013): Stärkung der Innenentwicklung und Reduzierung der Flächeninanspruchnahme. In: Umwelt- und Planungsrecht 33, 6, 201–207.
- UBA – Umweltbundesamt (2016): Siedlungsrückzug. Recht und Planung im Kontext von Klima- und demografischem Wandel. Dessau-Roßlau. = Climate Change 21/2016.
- Ultsch, A.; Behnisch, M. (2017): Effects of the payout system of income taxes to municipalities in Germany. In:



Applied Geography 81, 21–31. <https://doi.org/10.1016/j.apgeog.2017.02.001>

Westphal, C. (2008): Dichte und Schrumpfung. Kriterien zur Bestimmung angemessener Dichten in Wohnquartieren schrumpfender Städte aus Sicht der stadttechnischen Infrastruktur. Dresden. = IÖR-Schriften 49.

Wicki, M.; Kaufmann, D. (2021): How does Acceptance of Densification Differ among Neighborhood Types? Zürich. <https://doi.org/10.3929/ethz-b-000478720>

Xue, J. (2022): Urban planning and degrowth: a missing dialogue. In: Local Environment 27, 4, 404–422. <https://doi.org/10.1080/13549839.2020.1867840>