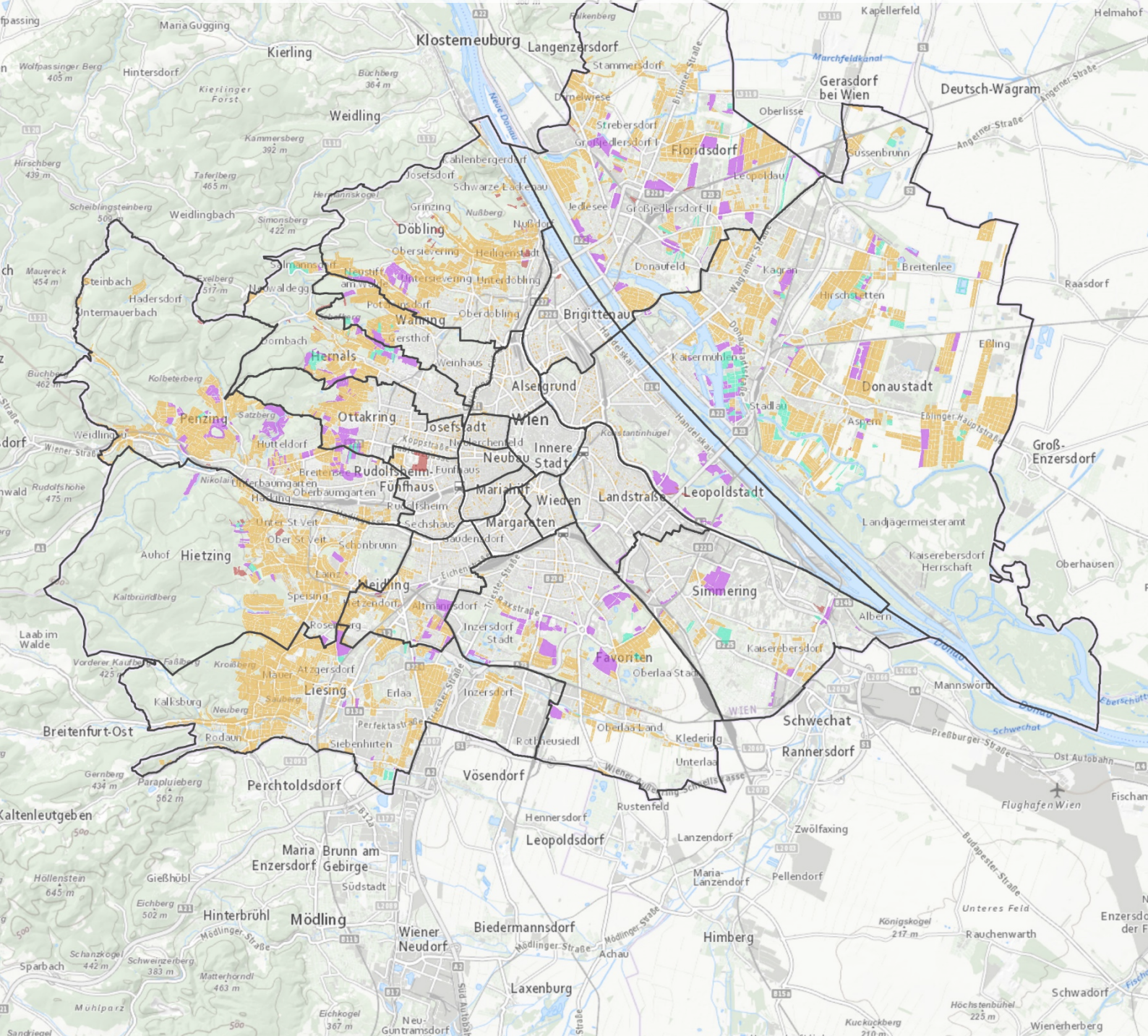
Florian Reinwald, Sophie Thiel, Birgit Gantner, Ursula Liebl

Executive Summary

Das „Große rote G“ wird grün

Study on Securing the Microclimatic Services of Green Settlements with Regard to the Challenges of Climate Change



Study commissioned by

Vienna City Administration – Municipal Department 50

Mag. Dr. Georg Fellner

Department for Housing Research and International Relations

Muthgasse 62

1190 Vienna

Contractor:

Institute of Landscape Planning (ILAP)

Department of Landscape, Spatial and Infrastructure

University of Natural Resources and Life Sciences Vienna

Peter-Jordan-Straße 65

1180 Vienna

Project team:

Dipl.-Ing. Dr. Florian Reinwald, E-Mail: florian.reinwald@boku.ac.at

Dipl.-Ing. Sophie Thiel

Dipl.-Ing. Birgit Gantner

Mag. Dipl.-Ing. Ursula Liebl

Figure Cover: Location of the observed land use zones allotment garden areas (Ekl), allotment garden areas for year-round living (Eklw), garden settlement zones (GS) and residential areas (W) construction class I (Own representation, sources: City of Vienna - data.wien.gv.at, City of Vienna - MA 21, City of Vienna - MA 18, basemap.at).

Full version of the study: Reinwald, F; Thiel, S; Gantner, B; Liebl U. (2021): Das „Große rote G“ wird grün, Grundlagenstudie zur Sicherung der mikroklimatischen Leistungen durchgrünter Siedlungen unter Berücksichtigung der Herausforderungen des Klimawandels, Bericht der Wohnbauforschung, Wien.

Available at: www.wohnbauforschung.at

Vienna, December 2021

Initial situation and objectives

Urban growth and an increasing sealing of city spaces result in land use and target conflicts and, as a consequence, in the **loss of green (and blue) infrastructure**. Changing temperatures and precipitation due to **climate change** as well as their direct and indirect impacts on urban spaces are key challenges in spatial development in Vienna.

Securing the micro- and urban climatic services and the biodiversity of greened settlements of allotment garden zones (Kleingartengebiete), allotment garden zones for year-round living (Kleingartengebiete für ganzjähriges Wohnen), garden settlement zones (Gartensiedlungsgebiete) as well as residential areas of building class I (Wohngebieten der Bauklasse I) while considering the challenges of climate change is the main objective of this research project "Das ‚Große rote G' wird grün". The focus of the research project lies on the non-built-up areas. **Possible measures and instruments to control the greening and thus the microclimatic and ecological performance of urban green infrastructure elements** will be identified. This research project "Das ‚Große rote G' wird grün" is a contribution to the implementation of the (political) **goal of adaptation to climate change** in the city of Vienna.

The "horticultural design" and "strictly necessary extent"

The term „Gärtnerische Ausgestaltung" [engl. "horticultural design"] (§ 5 para. 4 lit. p BO W) is assigned for reasons of urban design and urban ecology. Essentially, the aim is to **preserve and create green spaces** to improve or maintain microclimatic conditions. Additionally, the existing **green space character of the built-up areas is to be secured** and **the sealing of surfaces is to be averted** (cf. Kontrollamt der Stadt Wien 2006). What the "horticultural design" specifically includes is not further specified. The Viennese allotment garden law (WKlG 1996) provides for horticultural design as well (§ 16 Abs. 1 WKlG 1996). Accordingly, at least two thirds of an allotment garden must be of horticultural nature. However, as reality shows, an increasing sealing can be observed even in the low construction classes (W BK I and GS) as well as in the allotment garden zones (Ekl and Eklw).

The increase in sealing results from the **maximized utilization of the permitted building possibilities**, but also from the **increasing sealing of non-built-up areas or those to be designed horticulturally**, e.g. through access roads or retaining walls, but also through structures that do not require a permit, such as pools or carports. According to § 79 para. 6 BO W, paved paths, driveways, retaining walls, stairs, ramps, etc. are permitted within the areas to be horticulturally designed, as long as they are constructed to the " strictly necessary extent". As on construction land, sealing is also permitted on green land and its areas to be horticulturally designed to the "strictly necessary extent" (§ 16 para. 2 WKlG 1996). The **lack of a definition** of the term "strictly necessary extent" causes a similar problem at the level of execution as that of the "horticultural design".

Climate change adaptation and securing biodiversity through the preservation of green settlements

The increasing sealing modifies the character of settlements and by the decay of urban green infrastructure (UGI) its ecosystem services are also lost. Urban green infrastructure has ecological, economic, and social benefits through the **provision of ecosystem services**, in addition to climatic benefits (Artmann et al. 2019; Sturiale & Scuderi 2019; Yu et al. 2016). The negative effects that result from sealing are numerous e. g.:

- Loss of biological functions and threat to biodiversity.
- Loss of particulate matter retention
- Increased risk of floods
- Amplification of the heat island effect (Umweltbundesamt o.J.).

Climate Change Adaptation and Safeguarding Biodiversity as Central Strategies of the City of Vienna

A reduction of the impacts of climate change through adaptation measures as well as the enhancement of the ecosystem services of green settlements are anchored in numerous concepts at the international and national level as well as in the City of Vienna.

With the "**World Climate Treaty**" (Paris Agreement) ratified by Austria in 2016, Austria has committed to plan, implement and monitor adaptation measures to mitigate the impacts of climate change (Paris Agreement, Article 7, (9)). The "**EU Strategy for Adaptation to Climate Change**" (EC 2013) as well as the "**Austrian Strategy for Adaptation to Climate Change**" (BMNT 2017) also call for the integration of adaptation concerns into urban planning through nature- or ecosystem-based approaches, which are highlighted as both effective and cost-efficient.

A separate field of action in the "**Climate Protection Program of the City of Vienna**" (Stadt Wien 2009) emphasizes the importance of adaptation measures. Adaptation was also included in the last amendment of the "**Smart City Wien Framework Strategy**" (Magistrat der Stadt Wien 2019) as an **equally important second pillar of urban climate policy**. All strategy and development concepts such as the "**Urban Development Plan Vienna (STEP 2025)**" (MA 18 2014), the "**Thematic Concept Green and Open Space**" (MA 18 2015) or the "**Urban Heat Island Strategy City of Vienna**" (MA 22 2015) emphasize the climatic function of green spaces and their contribution to climate change adaptation.

With the amendment of the "Bauordnung für Wien" – the **construction regulations for Vienna** – in 2020 (LGBl. Nr. 61/2020), climate protection and climate change adaptation were introduced as objectives to be considered when modifying the determinations on zoning and development plans (§ 1 Abs. 2 lit. 4 BO Wien). The provision for and preservation of green and water areas as well as the provision for a climate-friendly rainwater management are explicitly anchored in the objectives (§ 1 para. 2 lit. 6).

Current situation and trends

About **14 % of the total area of the city of Vienna** (41,487 ha in total) is dedicated to Ekl, Eklw, GS and BK I zoning (6,053 ha in total). Around 2.5 % of the area is dedicated to green land (Ekl, Eklw), and around 12 % to construction land (GS, BK I). In Vienna, there are currently about 35,800 allotment garden plots with a total area of 1,432 ha. About 40 % of their total area is owned by the City of Vienna. Two sites - "Alte Donau" and "Heuberg" - were studied in depth. The analyses show that in all land use categories considered very high degrees of sealing (up to 99 % of the land area) occur in some cases (see in detail the long version of the study).

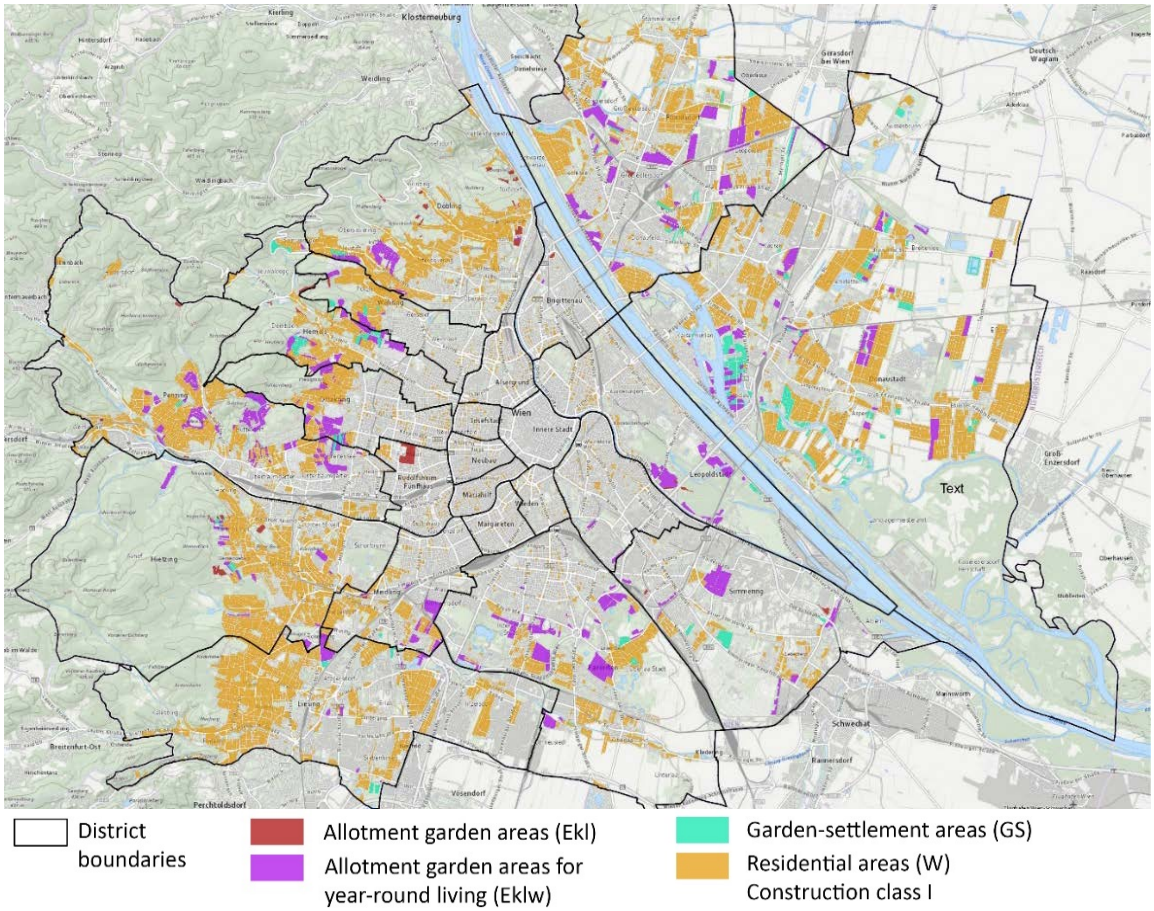


Image 1: Principal zoning Allotment garden areas (Ekl), Allotment garden areas for year-round living (Eklw), Garden-settlement areas (GS) and Residential areas (W) Construction class I (Source: Own representation, data sources: City of Vienna - data.wien.gv.at, City of Vienna - MA 21, City of Vienna - MA 18, basemap.at).

The **development** in the studied zoning categories differs in detail, although **similar tendencies** can be observed in both categories. In the areas of allotment gardens, the **amendment to the allotment garden law** of 1992 had a decisive effect. With the introduction of the zoning category "allotment gardens for year-round living" (Eklw) including the larger allotment garden dwelling house, the possibility of year-round occupation of the allotment garden was

introduced. The amendment also created the possibility of ownership. The increased attractiveness of the allotment gardens as a "small family home" in the city also **brought changes in the use of the allotment gardens** and thus also an increase in sealing.

Similar trends can be observed in the construction class I or garden settlement zones. In addition, there is an increasing tendency in these settlements for **commercial developers** to subdivide plots and erect several single-family houses or apartment buildings with several apartments on the former single-family house plots. All experts interviewed during the project believe that this development will continue unabated if no measures are taken to control it. The last amendment of the construction regulations for Vienna (BO für Wien) reacted to these developments for the first time by reducing the exploitability in low building classes.

Summary of the challenges

Controlling greening and sealing is primarily done by regulating the (con)structural usability of a plot and by ordering the "horticultural design" (§ 5 para. 4 lit. p BO W). In addition, there are other regulations that influence sealing.

Challenging interpretation or open to interpretation: Both terms – "horticultural design" as well as the "strictly necessary extent" – are poorly defined or cannot be defined at all. The required or admissible extent is difficult to determine and also depends on the individual case. In the course of numerous discussions and interviews with experts, a quantification was considered necessary in order to reduce the scope for interpretation and to facilitate verification.

Many regulations, which determine the constructability: A large number of additional individual regulations and provisions of the BO für Wien and the allotment garden law (as well as other secondary laws) determine the sealing and greening of the examined land use categories (see in detail the long version of the study).

Impact on existing buildings: The possibilities were assessed very differently by the experts interviewed. One solution is that, for example, in the case of a renovation or extension or a change of use exceeding a certain size, obligations with regard to greening or unsealing should become effective.

Varying structural and spatial conditions: The neighborhoods differ greatly in terms of their structural and spatial conditions. Some are located in well-equipped and developed areas, others are more peripherally located. In this context, it is important to weigh the conflict of goals between the necessary density, in order to reduce the designation of new building land and thus overall land consumption, and the necessary greening, in order to support adaptation to climate change. It should be spatially differentiated where one can or want to allow redensification and where explicitly not.

Legal regulation vs. implementation via development plan: The implementation or further improvement of the control mechanisms of greening or sealing via the development plans or the special regulations (Besonderen Bestimmungen) allows, on the one hand, a higher flexibility (also in order to react to local peculiarities). On the other hand, the lengthy period it would take to achieve an effect is viewed critically, since the plan documents are only revised

at longer intervals or in case of concrete changes in zoning. A direct legal anchoring has the advantage of a quick and city-wide implementation.

Recommendations and proposed measures

Especially the terms "horticultural design" and "strictly necessary extent" have to be specified or quantified in order to achieve the regulatory intent: the preservation of green settlements. At the same time, the many exceptions and detailed specifications must be "tightened up" in order to reduce the scope for interpretation and to achieve the overarching goal of adaptation to climate change. The upcoming amendment of the “BO für Wien” provides the framework here. Merely "qualifying" the term "horticultural design" is considered as insufficient. Explicit and concrete requirements for vegetation are also regarded as excessive encroachment on property and freedom of design, and their (long-term) implementation is difficult to monitor. A quantitative solution should therefore be preferred. This can also enable or facilitate the examination of the implementation.

Introduction of an (extended) degree of sealing or green and open space factor: Two key approaches to control and quantify the "horticultural design" are recommended: 1. direct control of greening and 2. control of sealing by means of corresponding quantitative specifications and measurements. The advantage of a degree of sealing is that it corresponds to the " traditional" means of the BO for Vienna, i.e. to create the preconditions for later greening by quantitatively specifying corresponding unsealed areas or covering heights in the case of underbuilt areas. Its disadvantage is that a direct control of greening is not possible with. Green and open space factors, on the other hand, directly control the extent of greening. Both instruments have the advantage that no specific measures are mandated, but that individual solutions for the reduction of sealing or the improvement of greening can be developed for each building site and only the overall result may not exceed the degree of sealing or, in the case of a green and open space factor, may not fall below a target value.

Horticultural design of all non-built-up areas: In residential zones of construction class I and in garden settlement zones, only front gardens and clearance areas must be “horticultural designed”, as long as no buildings or parts of buildings are erected as permitted there. Other unbuilt areas may also be designated for "horticultural design" in development plans (§ 5 para. 4 lit. p BO W). An extension of the " horticultural design " to all parts of the property that can be built on but remain unbuilt is recommended (at least in the case of open and coupled development).

Cross-building-class regulation: The focus of this research project was on the small building classes as well as the allotment garden zones. Similar tendencies towards increasing densification and sealing can also be observed in the other building classes (especially in the underbuilt areas). There is a separate working group within the InKA project that is also looking at the possibilities of control for other building classes. A cross-building class solution is

welcomed on the one hand, but also viewed critically on the other hand, since there are other conflicting goals in BK I than in other building classes (and other owner structures).

Review of the exceptions and adaptation of the legal framework: In addition to the "horticultural design" there are numerous other regulations of the “BO für Wien” as well as the allotment garden law, which influence the sealing or greening (see in detail the long version of the study). Above all, the cover heights of underground building components beneath areas to be greened should be standardized throughout Vienna via the “BO für Wien” the same applies to the construction heights of green roofs).

Strategic land use management: Greened settlements are a central land reserve in the city when it comes to adapting to climate change and securing biodiversity. Selling these areas reduces the possibilities for influence and control. Strategic land preservation is highly recommended.

Improvement of the submission processes and the monitoring options: For both the lowest building classes and the allotment garden zones, the submitting documents are not sufficient to record or assess the greening or the total sealing on a particular plot. Possible improvements in this case would be the introduction of a corresponding design concept also for the BK I, the garden settlement zones as well as the allotment gardens. Another central challenge is the inspection of the implementation of the measures or specifications. Here, too, a strengthening of the monitoring possibilities is indicated. Appropriate resources must be made available for monitoring.

Expansion of complementary measures: In addition to measures that directly affect sealing and greening, it is also recommended that complementary measures be implemented. More communication is needed from the city about how important unsealed areas are for the climate and biodiversity of the city as a whole. The topic of unsealing and greening should be discussed in a positive way. Awareness raising (e.g. along the lines of the "Natur im Garten" initiative) and complementary communication of the positive effects of the measures are necessary.

Literature and list of sources

Artmann, M.; Inostroza, L. & Fan, P. (2019): Urban sprawl, compact urban development and green cities. How much do we know, how much do we agree? Ecological Indicators, 96, 3–9. https://doi.org/10.1016/j.ecolind.2018.10.059"

Bauordnung für Wien (BO W) idF 11/1930. Gesetz vom 25. November 1929. Online: https://alex.onb.ac.at/cgi-content/alex?aid=lgw&datum=19300004&seite=00000009

Bauordnung für Wien (BO W) – Wiener Stadtentwicklungs-, Stadtplanungs- und Baugesetzbuch

Beilage 19/2020 (2020): Entwurf des Gesetzes, mit dem die Bauordnung für Wien, das Wiener Kleingartengesetz 1996 und das Wiener Garagengesetz 2008 geändert werden (Bauordnungsnovelle 2020). LGBl 61/2020. Aktenzahl LG-850017-2019

BMNT – Bundesministerium für Nachhaltigkeit und Tourismus (Hrsg.) (2017): Die österreichische Strategie zur Anpassung an den Klimawandel. Aktionsplan. Wien: BMNT. Online: https://www.bmk.gv.at/dam/jcr:c7120fee-1e70-49e0-bbab-252c75d0993a/NAS_Aktionsplan2017.pdf

Bundesgesetz vom 16. Dezember 1958 über die Regelung des Kleingartenwesens (KlGG 1959)

EC – European Commission (2013): Eine EU-Strategie zur Anpassung an den Klimawandel COM (2013). Online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0216

Gesetzesentwurf Bauordnungsnovelle 2021: Entwurf des Gesetzes, mit dem die Bauordnung für Wien geändert wird (Bauordnungsnovelle 2021). LGBl 70/2021 kundgemacht am 13.12.2021. Aktenzahl LG-844151-2021. Online unter: https://www.wien.gv.at/infodat/ergdt?detvid=157395

Kontrollamt der Stadt Wien (2006): MA 21 A, MA 21 B, Koordination der Dienststellen bzgl. der für den Bebauungsplan vorgeschlagenen besonderen Bestimmungen (KA VI-21 A/B-1/06; S. 26).

MA 18 – Stadtentwicklung und Stadtplanung (2014): STEP 2025 – Stadtentwicklungsplan.

MA 18 – Stadtentwicklung und Stadtplanung (2015): Fachkonzept Grün- und Freiraum

MA 22 – Wiener Umweltschutzabteilung (2015): Urban Heat Islands (UHI) - Strategieplan Wien

Magistrat der Stadt Wien (2019): Smart City Wien Rahmenstrategie 2019-2050, Die Wiener Strategie für eine nachhaltige Entwicklung

Stadt Wien (2009): Klimaschutzprogramm der Stadt Wien (KliP II). Fortschreibung 2010–2020. Online: https://www.wien.gv.at/umwelt/klimaschutz/pdf/klip2-lang.pdf

Sturiale, L. & Scuderi, A. (2019): The Role of Green Infrastructures in Urban Planning for Climate Change Adaptation. Climate, 7(10), 119. https://doi.org/10.3390/cli7100119"

Umweltbundesamt GmbH (o. J.): Flächeninanspruchnahme. Online: https://www.umweltbundesamt.at/umweltthemen/boden/flaecheninanspruchnahme

Wiener Kleingartengesetz 1996 (WKlG) – Gesetz über Kleingärten in Wien idF 61/2020

Yu, S.; Yu, B.; Song, W.; Wu, B.; Zhou, J.; Huang, Y.; Wu, J.; Zhao, F. & Mao, W. (2016): View-based greenery: A three-dimensional assessment of city buildings' green visibility using Floor Green View Index. Landscape and Urban Planning, 152, 13–26. https://doi.org/10.1016/j.landurbplan.2016.04.004"