BuGG-Market Report on Building Greening 2020

Green Roofs, Green Facades and Interior Greening in Germany

Excerpted translation of the original German version

BuGG
Bundesverband GebäudeGrün e. V.
Dach-, Fassaden- und Innenraumbegrünung

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BuGG – Market Report on Building Greening 2020
Green Roofs, Green Facades and Interior Greening

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1 Preface

For the first time in Germany, the Bundesverband GebäudeGrün e.V. (BuGG) published with the „BuGG-Marktreport GebäudeGrün 2020" an overview of the latest figures on roof, facade and interior greening. Especially on green roofs, the BuGG and its predecessor, the Fachvereinigung Bauwerksbegrünung e.V. (FBB), had collected internal data for many years, but not until now a comprehensive report on the matter was published. This publication marks the start of annual market reports on building greening. It aims to provide politicians, the industry, construction partners, the media and all other interested parties with the latest numbers on the building greening market.

As of now, the focus is on green roofs, for which the data collection methods are well established and hence data are easy to obtain. However, the situation differs for facade and interior greening – here the data collection methods are not mature enough yet to obtain reliable data. Most data are based on BuGG research and were collected to the best of our knowledge and belief, without any claim to completeness.

An important component of the „BuGG Market Report Building Greening 2020" is the BuGG City Survey 2019 on direct and indirect subsidies and other incentives for green roofs and facades, which we have supplemented with additional research. Visit www.gebaeudegruen.info/foerderung for the latest news on municipal funding and incentives for building greening.

The BuGG is open to comments, suggestions and further market information and is happy to receive your feedback.

Lastly, a special thank you goes to the BuGG members and the many German cities for their support by providing us with crucial information and data.

This English translation is an excerpt from the original German version, which is 72 pages long and can be found here:
https://www.gebaeudegruen.info/kontakt/prospektanforderung
The numbering of the figures and tables corresponds to the original.

Dr. Gunter Mann
Präsident
Bundesverband GebäudeGrün e.V. (BuGG)

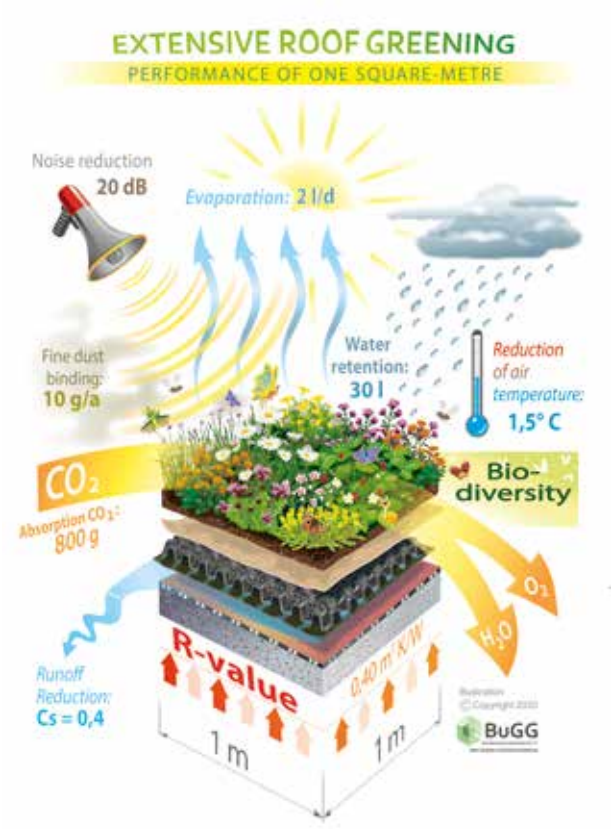

Fig. 3: Green roofs combine many positive effects.
Source: BuGG

2 The Market for Building Greening in Germany

2.1 Green Roofs

2.1.1 Newly Greened Areas in 2019

Methods for Determining Newly Greened Roof Areas: BuGG Green Roof Substrate Survey

A survey of the total market of annually newly greened roofs has been carried out since 2008 by the Fachvereinigung Bauwerksbegrünung e.V. (FBB), one of the two predecessor associations of the Bundesverband GebäudeGrün (BuGG). The BuGG has been continuing this analysis since 2018.
For this purpose, substrate manufacturers and suppliers were asked about the quantities of the following substrate types supplied in Germany:

- Extensive substrate, single-layer
- Extensive substrate, multi-layer
- Intensive substrate, single-layer
- Intensive substrate, multi-layer

With the help of the determined delivery quantities and fixed assumptions on the installation heights of extensive and intensive green roofs in single- and multi-layer construction, the overall new green roof area could be calculated approximately and differentiated into extensive, intensive, single- and multi-layer.

To test and confirm the measurement method and the conversion factor that was used, an additional survey was conducted among manufacturers and suppliers of protective layers in 2018. The obtained values confirmed the results of the substrate survey and thus verified the above-mentioned method.

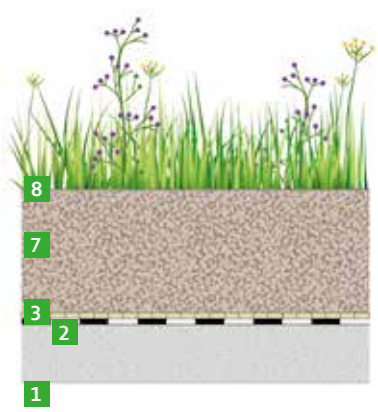

Fig. 13: Schematic representation of a single-layer green roof.
Source: BuGG

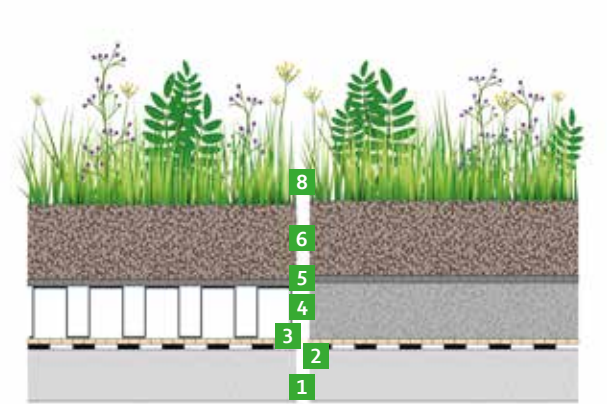

Fig. 14: Schematic representation of a multi-layer green roof.
Source: BuGG

1 Suitable roof substructure
Sufficient load-bearing capacity, suitable thermal insulation if necessary.

2 Roof waterproofing or root protection membrane
Root resistant according to FLL or DIN EN 13948 protection against water and roots.

3 Protective layer
Protective layer of fleeces, rubber granulate mats, etc., to protect the roof waterproofing from mechanical damage.

4 Drainage
Storage of rainwater and drainage of excess water to drainage facilities. The drainage can consist of plastics („solid drainage") or bulk materials such as lava („bulk drainage").

5 Filter fleece
Synthetic fleeces that separate the drainage from the vegetation base layer and prevent fine particles from being washed into the drainage.

6 Multi-layer substrate
Vegetation support layer; special, technically produced substrate according to the characteristic parameters of the FLL Green Roof Guideline for multi-layer construction.

7 Single-layer substrate
Vegetation support layer and drainage layer; special, technically produced substrate according to the characteristic values of the FLL Green Roof Guideline for single-layer construction.

8 Vegetation
Plant species adapted to the special habitat and proven over many years.

Results of the BuGG - Green Roof Substrate Survey

The most important results of the BuGG Green Roof Substrate Survey are summarised and presented below.

- In Germany, a total of 7,217,720 m² of green roof area was **added in 2019**
- The newly added total green roof area divided into **extensive and intensive green roofs** results in:
- Extensive green roofs: 6,024,421 m², which corresponds to a mark et share of 83.5%.
- Intensive green roofs: 1,193,299 m², which corresponds to a mark et share of 16.5%.

Tab. 1: Results of the BuGG Green Roof Substrate Survey 2019. Source: BuGG.

Green Roof Area 2019		
Extensive, total	m²	6,024,421
	% of total	83.47
single-layer	m²	1,656,796
	% of ext.	27.50
multi-layer	m²	4,367,626
	% of ext.	72.50
Intensive, total	m²	1,193,299
	% of total	16.53
single-layer	m²	100,355
	% of int.	8.41
multi-layer	m²	1,092,944
	% of int.	91.59
Total	m²	7,217,720

Fig. 16: In 2019, more than 7 million m² of green roof area was added in Germany. Source: BuGG

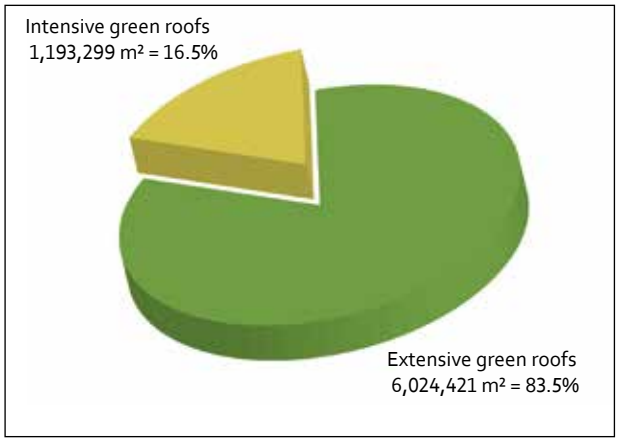

Fig. 15: Green roofs added in 2019. Proportions of extensive and intensive green roofs. Source: BuGG

Fig. 17: In 2019, 83.5% of the total newly green rooftop area was extensive (picture on the left) and 16.5% intensive greening (picture on the right). Source: BuGG

Going into more detail, a further distinction is made between single- and multi-layer construction for extensive and intensive greening which results in the following:

- **Extensive green roofs** in single-layer construction: 1,656,796 m², which corresponds to 27.5% of the extensive greening.
- Extensive green roofs in multi-layer construction: 4,367,626 m², which corresponds to 72.5% of the extensive greening.

- **Intensive green roofs** in single-layer construction: 100,355 m², which corresponds to 8.4% of the intensive green areas.
- Intensive green roofs in multi-layer construction: 1,092,944 m², which corresponds to 91.6% of the intensive greening.

The determined total green roof area includes all types of green roofs; the method currently does not allow for differentiating between flat and pitched roofs or underground garages or even building types.

It can be assumed that in addition to the companies participating in the annual surveys, there are other, mostly regionally active substrate manufacturers whose delivery quantities are not taken into account, nor are „conventionally" (gravel and earth filled) designed underground parking green spaces. Although this was compensated by a correction factor, it can be assumed that the total area of annually greened roofs is likely to be even higher than the numbers determined by the BuGG surveys.

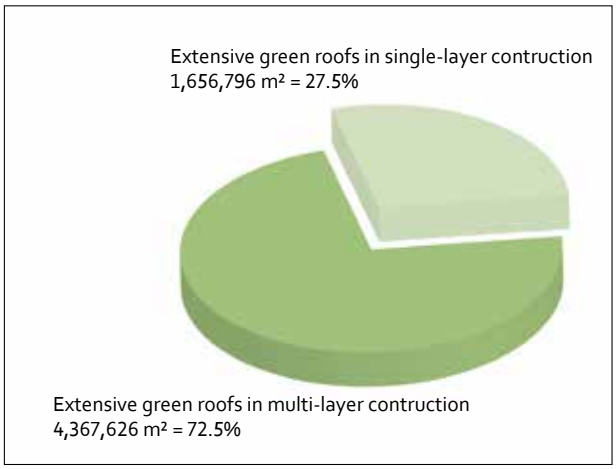

Fig. 18: Extensive green roofs 2019. Ratio of single- to multi-layer construction. Source: BuGG

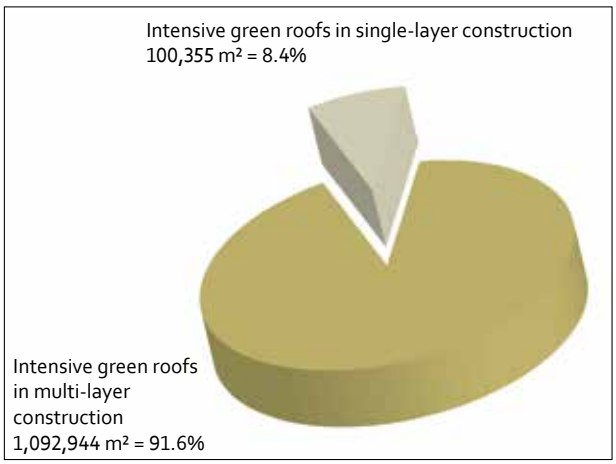

Fig. 19: Intensive green roofs 2019. Ratio of single- to multi-layer construction. Source: BuGG

7,200,000 m² of newly greened roof area in 2019 might sound impressive at first. However, this only accounts for around 9% of the assumed 80,000,000 m² of the total new flat roof area in Germany in 2019 alone*.

On the upside, this means that about 91% of flat roof area remained ungreened in 2019 - which represents an enourmous potential for further growth.

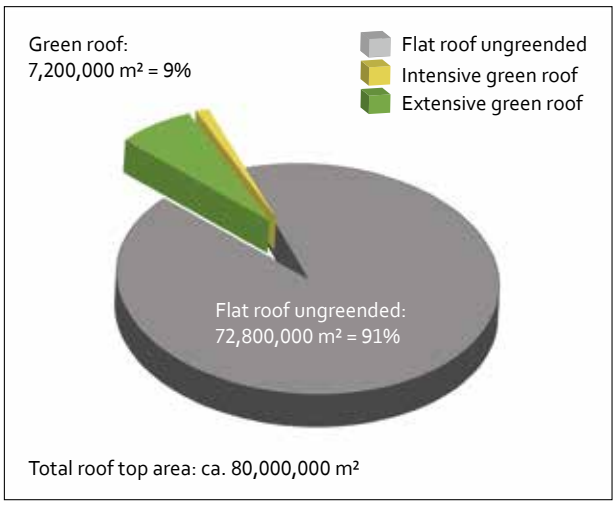

Fig. 20: Green roofs added in 2019 in relation to the total newly created flat roof area. Source: BuGG

*Note:
It was not possible to determine any verifiable numbers for the new flat roof areas created in 2019.
Therefore, the figure of 80 million m² is an estimate derived from discussions with roof waterproofing associations and literature (Hämmerle, 1995; HS, 1996; Dach+Grün, 1998; HS, 2000).

2.1.2 Developments of the Green Roof Market from 2008 to 2019

Since the method of the BuGG Green Roof Substrate Survey and the companies involved have remained the same over the years (since 2008), this allows for easy comparision over time, developments can be shown and trends can be derived.

The BuGG was able to determine the following market figures based on this:

- Development of the overall green roof areas
- Annual development/increase
- Development of the ratios of extensive and intensive greenery
- Development of the proportions of single- and multi-layer construction methods for extensive and intensive green roofs.

Tab. 2 on the following page shows all collected data from the BuGG green roof substrate surveys from 2008 to 2019.

In conclusion, the following can be stated:

- A total of 58,341,198 m² green roof area was created from 2008 to 2019.
- Of the total amount, 49,106,236 m² of roof area was extensively greened, which equals 84.2%.
- Of the total amount, 9,234,962 m² of roof area was intensively greened, which equals 15.8%.
- On average, the green roof market is growing by about 7% each year.
- The green roof market has grown by 100% from 2008 to 2019.
- The trend moves towards intensive green roofs (roof gardens) and therefore (predominantly) accessible and usable green roofs. While the amount of intensive green roofs in 2008 was just 11.4% (extensive: 88.6%), by 2019, the ratio had shifted in favor of intensive green roofs (16.5% to 83.5%).
- The average annual growth of intensive green roofs was higher than that of extensive green roofs. Over the last 12 years, extensive greening has annually grown by an average of 6.6%, while intensive greening has grown by an average of 10.8%.
- Even more pronounced is the trend towards extensive greening in multi-layer construction: while the ratio of single to multi-layer was 47:53 in 2008, it was 28:72 in 2019.
- For intensive greening, the single-layer construction method plays a subordinate role.

Tab. 2: Green roof areas annually added from 2008 to 2019. Source: BuGG

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	sum
Extensive, total	m²	3,197,430	3,163,786	2,754,869	3,720,750	3,445,036	3,812,746	4,159,762	4,244,366	4,228,843	4,708,932	5,645,296	6,024,421	49,106,236
	% of total	88.59%	85.33%	83.15%	86.65%	86.00%	85.96%	84.59%	84.72%	83.15%	80.91%	81.53%	83.47%	Ø 84.50
Annual growth	%		-1.05%	-12.92%	35.06%	-7.41%	10.67%	9.10%	2.03%	-0.37%	11.35%	19.88%	6.72%	Ø 6.64
single-layer	m²	1,506,180	1,501,786	1,177,574	1,560,330	1,384,546	1,374,570	1,681,842	1,595,872	1,447,030	1,777,189	1,628,206	1,656,796	18,291,919
	% of ext.	47.11%	47.47%	42.75%	41.94%	40.19%	36.05%	40.43%	37.60%	34.22%	37.74%	28.84%	27.50%	Ø 38.48
Annual growth	%		-0.29%	-21.59%	32.50%	-11.27%	-0.72%	22.35%	-5.11%	-9.33%	22.82%	-8.38%	1.76%	Ø 2.06
multi-layer	m²	1,691,250	1,662,000	1,577,294	2,160,420	2,060,490	2,438,176	2,477,920	2,648,495	2,781,814	2,931,743	4,017,090	4,367,626	30,814,316
	% of ext.	52.89%	52.53%	57.25%	58.06%	59.81%	63.95%	59.57%	62.40%	65.78%	62.26%	71.16%	72.50%	Ø 61.51
Annual growth	%		-1.73%	-5.10%	36.97%	-4.63%	18.33%	1.63%	6.88%	5.03%	5.39%	37.02%	8.73%	Ø 9.86
Intensive, total	m²	411,701	543,827	558,288	573,146	560,867	622,655	758,047	765,539	857,243	1,111,140	1,279,211	1,193,299	9,234,962
	% of total	11.41%	14.67%	16.85%	13.35%	14.00%	14.04%	15.41%	15.28%	16.85%	19.09%	18.47%	16.53%	Ø 15.49
Annual growth	%		32.09%	2.66%	2.66%	-2.14%	11.02%	21.74%	0.99%	11.98%	29.62%	15.13%	-6.72%	Ø 10.82
single-layer	m²	3,817	4,630	0	0	0	54,724	40,356	0	0	581,574	606,002	100,355	1,391,458
	% of int.	0.93%	0.85%	0.00%	0.00%	0.00%	8.79%	5.32%	0.00%	0.00%	52.34%	47.37%	8.41%	Ø 10.33
Annual growth	%		21.28%	-100.00%	0.00%	0.00%	0.00%	-26.25%	-100.00%	0.00%	0.00%	4.20%	-83.44%	Ø -25.83
multi-layer	m²	407,884	539,197	558,288	573,146	560,867	567,931	717,691	765,539	857,243	529,566	673,208	1,092,944	7,843,505
	% of int.	99.07%	99.15%	100.00%	100.00%	100.00%	91.21%	94.68%	100.00%	100.00%	47.66%	52.63%	91.59%	Ø 89.66
Annual growth	%		32.19%	3.54%	2.66%	-2.14%	1.26%	26.37%	6.67%	11.98%	-38.22%	27.12%	62.35%	Ø 12.16
Sum (ext+int.), total	m²	3,609,131	3,707,612	3,313,157	4,293,896	4,005,902	4,435,400	4,917,809	5,009,905	5,086,086	5,820,072	6,924,506	7,217,720	58,341,198
Annual growth	%		2.73%	-10.64%	29.60%	-6.71%	10.72%	10.88%	1.87%	1.52%	14.43%	18.98%	4.23%	Ø 7.05

Tab. 2: Green roof areas annually added from 2008 to 2019. Source: BuGG

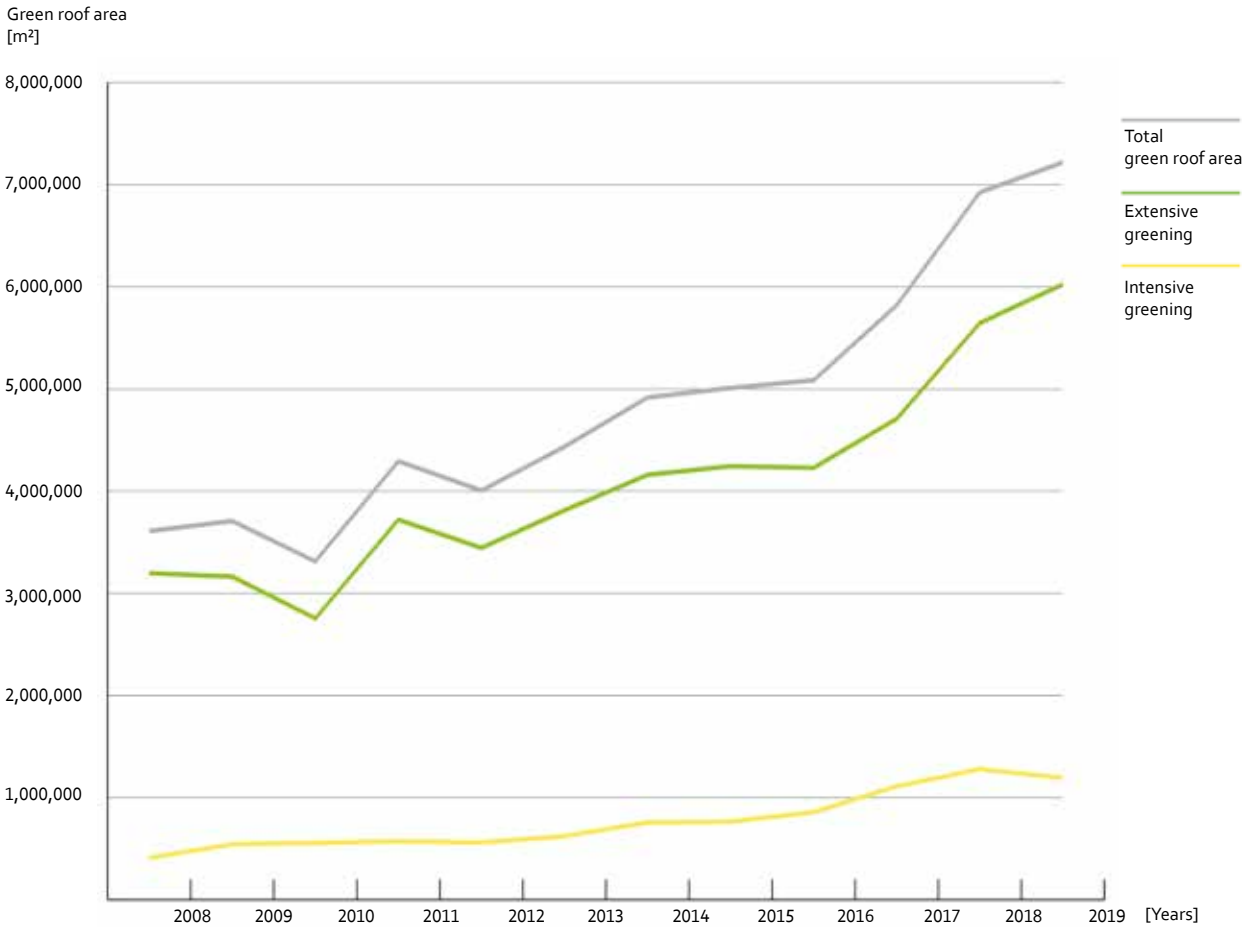

Fig. 21: Development of annual green roof areas from 2008 to 2019. Source: BuGG

Tab. 3: Green roof expansion rates from 2008 to 2019. Source: BuGG

Year	Total green roof market	Extensive greening	Intensive greening
2009	+2.7%	-1.1%	+32.1%
2010	-10.6%	-12.9%	+2.7%
2011	+29.6%	+35.1%	+2.7%
2012	-6.7%	-7.4%	-2.1%
2013	+10.7%	+10.7%	+11.0%
2014	+10.9%	+9.1%	+21.7%
2015	+1.9%	+2.0%	+1.00%
2016	+1.5%	-0.4%	+12.0%
2017	+14.4%	+11.4%	+29.6%
2018	+19.0%	+19.9%	+15.1%
2019	+4.2%	+6.7%	-6.7%
Ø	**+7.0%**	**+6.6%**	**+10.8%**

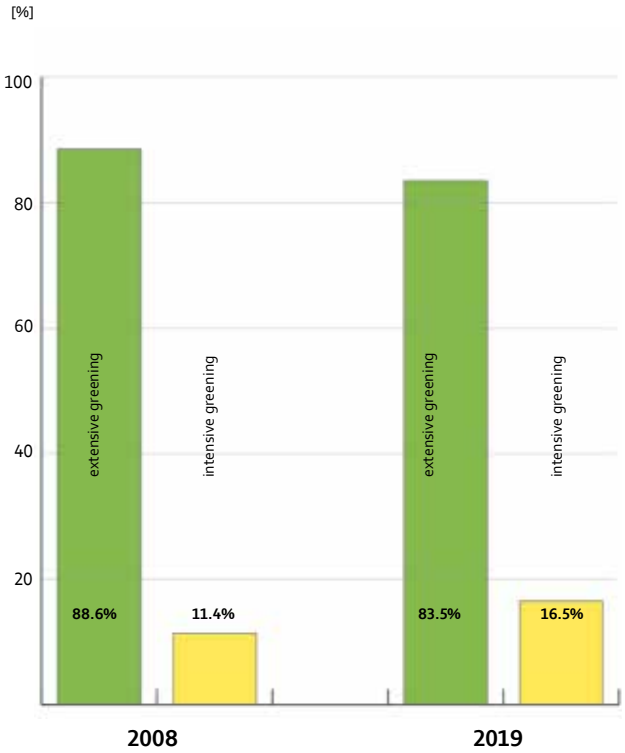

Fig. 22: Development of the ratio of extensive to intensive greening 2008 to 2019. Source: BuGG

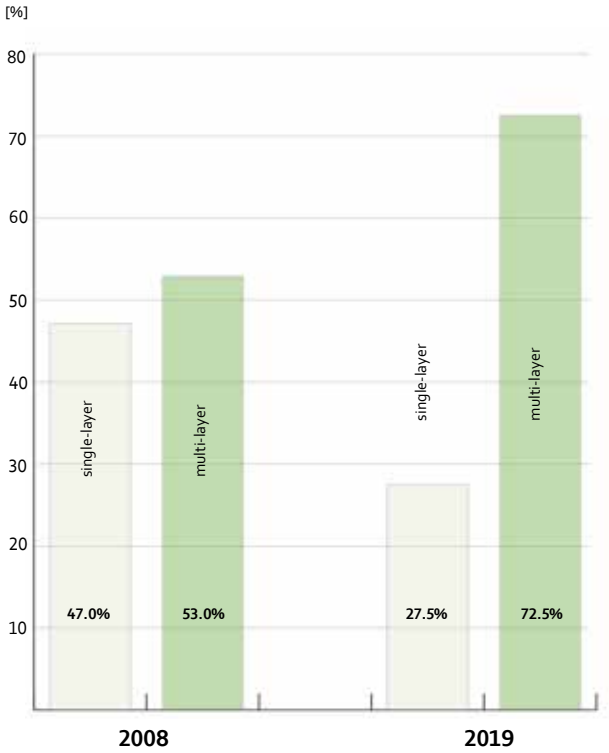

Fig. 23: Development of the construction method of single- and multi-layer extensive greening 2008 to 2019.
Source: BuGG

Fig. 24: The trend in the past few years moves towards of intensive greening; i.e. roof gardens. Source: BuGG

2.1.3 Green Roof Inventory, Green Roof National League and Green Roof Index

So far, only few German cities have taken and published inventories of their existing green roofs throughout the urban area. There are different approaches and methods to record existing green roofs.

One method was developed as part of a DBU funded project 2013 - 2016. Together with the German Aerospace Center (Deutschen Zentrum für Luft und Raumfahrt (DLR)), the German Roof Gardeners Association (Deutsche Dachgärtner Verband e.V. (DDV) - now Bundesverband GebäudeGrün e.V. (BuGG)) completed the research project „Inventory and Potential Analysis of Green Roofs" and developed a standardised method for determining their inventory and potential. The outcome of the project was the development of a software application that allows a fast and efficient analysis of urban roof surfaces. In the process, aerial or satellite images, i.e. remote sensing data, are linked with high spatial resolution and building data. Cities usually keep these data in their geo-data systems. The combined evaluation of the data sets allows green roof analyses for the entire urban area down to the level of individual buildings. The advantage of the method is the fast, automated and cost-effective determination of the green roof inventory and the potential of roof areas that still could be greened. A brief description is available in the BuGG brochure „Inventarisierung und Potenzialanalyse von Dachbegrünungen".

The BuGG has collected the inventory figures of green roofs of different cities and compared these data with different variants. For 15 cities, such information was available. These included:

- Berlin
- Braunschweig
- Dresden
- Düsseldorf
- Frankfurt a. M.
- Hannover
- Karlsruhe
- Mannheim
- Munich
- Nuremberg
- Nürtingen
- Osnabrück
- Ottobrunn
- Straubing
- Stuttgart

The BuGG has created three variants of the BuGG Green Roof National League:

- Version 1.1: Number of square metres of green roof area without underground car park greenery
- Version 1.2: Number of square metres of green roof area with underground car park green roofs
- Version 2: Green roof index (green roof square me tres per inhabitant)

Version 1.1: Number of square metres of green roof area without underground car park greenery

In version 1.1 (Tab. 4), cities are listed according to their absolute green roof area, excluding underground car park green roofs. Munich leads the table with 3,148,043 m² of green roofs, just ahead of Berlin (2,969,396 m²). As expected, the large cities have advantages in this version compared to small cities, such as Nürtingen (59,450 m²).
At the time of data collection, the 15 included cities had a combined green roof inventory of 13,034,165 m².

Fig. 25: BuGG Green Roof National League. Good perspectives with green roofs. Source: BuGG

Tab. 4: BuGG Green Roof National League Version 1.1: sorted by square metre of green roof area without underground car park greening. Source: BuGG

Ranking	City	Year of data collection	Green roof area without underground park green roofs [m²]	Data collection method	Source
1	Munich	2016	3,148,043	Evaluation of high-resolution aerial photographs and building cadastre data or digital building models	Ansel, W., Zeidler, J., & Esch, T. 2015
2	Berlin	2016	2,969,396	Evaluation of digital color infrared orthophotos and building cadastral data	Coenradie et al., 2016
3	Stuttgart	2017	2,593,670	Evaluation of high-resolution aerial photographs and building cadastre data or digital building models	Landeshauptstadt Stuttgart, Amt für Umweltschutz 2019
4	Frankfurt am Main	2015	1,436,371	Evaluation of high-resolution aerial photographs and building cadastre data or digital building models	Stadt Frankfurt am Main, Umweltamt 2019
5	Düsseldorf	2018	921,000	Evaluation of aerial photographs with the help of of a geographic information system and wastewater data	Umweltamt Düsseldorf 2018
6	Hannover	2016	633,076	Evaluation of aerial photographs and with the help of a topographic map and digitization by GIS Software	Landeshauptstadt Hannover, Fachbereich Umwelt und Stadtgrün 2020
7	Nuremberg	2016	450,000	Evaluation of aerial photographs, building cadastre data and digital building models	Stadt Nürnberg, Umweltamt 2020
8	Dresden	2018	236,960	Evaluation of high-resolution aerial photographs and building cadastre data or digital building models	Landeshauptstadt Dresden, Umweltamt 2019
9	Braunschweig	2008/2010	186,536	Evaluation of georeferenced infrared aerial photographs (2008) and a building occupancy map (2010), measurement error: up to 15%	Stadt Braunschweig, Fachbereich Umwelt 2020
10	Karlsruhe	2015	177,546	Evaluation of high-resolution aerial photographs and buildin cadastre data and digital building models	Ansel, W., Zeidler, J., & Esch, T. 2015
11	Osnabrück	2017	157,000	Evaluation with GIS and laser scanner data	Stadt Osnabrück, Fachbereich Umwelt und Klimaschutz 2020
12	Nürtingen	2015/2008	59,450	Evaluation of high-resolution aerial photographs (2015) and building cadastral data and digital building models (2008)	Ansel, W., Zeidler, J., & Esch, T. 2015
13	Straubing	2020	33,617	Evaluation of aerial photographs and precipitation water charges (green roofs on properties with rainwater infiltration were not taken into account)	Stadt Straubing, Stadtentwicklung und Stadtplanung 2020
14	Mannheim	2014	22,000	Evaluation of orthophotos	Umweltplanung Bullermann Schneble GmbH 2015
15	Ottobrunn	2016	9,500	Evaluation of high-resolution aerial photographs	Gemeinde Ottobrunn, Landkreis München, Umweltschutz 2020
		Sum:	**13,034,165**		

Note: Comparability is limited due to different recording methods and years.

Version 1.2: Number of square metres of green roof area with underground car park green roofs

In variant 1.2 (Tab. 5), the cities are listed according to their absolute green roof area; which also includes the greened underground car parks. Not all of the listed cities have published an inventory of underground car park green roofs as well, so this version of the BuGG Green Roof National League only includes six cities. Here, Munich leads the table again with 4,548,043 m² of green roofs and underground car parks, just ahead of Stuttgart (4,416,190 m²). At the time of data collection, the six cities had a total green roof area (including green underground car parks) of 17,744,367 m². The total of greened underground car parks alone adds up to 6,042,811 m².

Version 2: Green roof index (green roof square metres per inhabitant)

In version 2 (Tab. 6), the total green roof areas in each city is set in relation to the corresponding number of inhabitants. This results in the green roof square metre ratio per inhabitant („green roof index").

The average green roof index of the 15 cities is 1.2 m²/inhabitant. Stuttgart, the current leader, has a green roof index of 4.1 m²/inhabitant.

The appeal of this approach is that because it uses relative numbers, smaller cities can also compete in the „championship" as the ranking is independent of the size of the city. In this version, Nürtingen now ranks 4th with a green roof index of 1.5 m²/inhabitant.

It is important to mention that the values of the individual cities are only comparable to a limited extent, since both the methods and the dates of the inventory differ in some cases.

Updates and the inclusion of further cities are possible at any time. If additional cities were to conduct an inventory of their green roof areas, they would be included in the BuGG Green Roof National League.

With the BuGG Green Roof National League, there are, for the first time, well-founded key figures on the green roof index in a city comparison for politics and urban planners. Also, cities can now better compare their green roof activities to other cities. Ideally, cities should carry out an inventory of their green roof areas at regular intervals to monitor the effects of direct and indirect support measures introduced for green roofs, for example.

Green roof inventory in Germany

Germany has a long green roof tradition. Roofs have been professionally greened since the mid-1970s. Initially on a smaller scale than in recent years, this has nevertheless resulted in a significant number of green roof areas from 1974 to 2007 (i.e. before the BuGG Green Roof Survey). Since 2008, the newly added area has been recorded by the BuGG Green Roof Survey.

Based on the available figures from the BuGG Green Roof National League, the BuGG surveys and the extrapolation derived from those, the BuGG assumes that there is a total of 100,000,000 to 120,000,000 m² of green roof areas in Germany. This includes extensive, intensive and underground car park green roofs.

Fig. 26: Decades ago, entire housing estates were completely „green roofed" as shown here in Düsseldorf. Source: BuGG

Fig. 27: The green roof index in Germany currently averages about 1.2 m² green roof per inhabitant. Source: BuGG

Tab. 5: BuGG Green Roof National League version 1.2: sorted by the number of square metres of green roof area with underground parking. Source: BuGG

Ranking	City	Year of data collection	Green roofs with underground car park greening[m²]	Only underground car park greenings [m²]
1	Munich	2016	4,548,043	1,400,000
2	Stuttgart	2017	4,416,190	1,822,520
3	Berlin	2016	4,002,682	1,033,286
4	Düsseldorf	2018	1,979,000	1,058,000
5	Frankfurt am Main	2015	1,962,252	525,881
6	Hannover	2016	836,200	203,124
		Sum:	**17,744,367 m²**	**6,042,811 m²**

Note: Comparability is limited due to different recording methods and years.

Tab. 6: BuGG Green Roof National League version 2: sorted by green roof area per inhabitant („Green Roof Index")

Ranking	City	Year of data collection	Inhabitants	Green roofs without underground car parks [m²]	„Green Roof Index" [m² green roof/inhabitant]
1	Stuttgart	2017	632,742	2,593,670	4.1
2	Munich	2016	1,464,301	3,148,043	2.1
3	Frankfurt am Main	2015	732,688	1,436,371	2.0
4	Nuremberg	2015/2008	40,395	59,450	1.5
5	Düsseldorf	2018	642,304	921,000	1.4
6	Hannover	2016	532,864	633,076	1.2
7	Osnabrück	2017	164,374	157,000	1.0
8	Nürnberg	2016	511,628	450,000	0.9
9	Berlin	2016	3,574,830	2,969,396	0.8
10	Braunschweig	2008/2010	246,012	186,536	0.8
11	Straubing*	2019/2020	48,110	33,617	0.7
12	Karlsruhe	2015	300,051	177,546	0.6
13	Ottobrunn	2016	21,000	9,500	0.5
14	Dresden	2018	560,641	236,960	0.4
15	Mannheim	2014	296,690	22,000	0.1
				mean	**1.2**

Notes:
* Green roofs on properties with stormwater infiltration were not taken into account. Comparability is limited due to different recording methods and years. Green underground car parks are not included. Number of inhabitants at the time of the survey.

2.1.4 BuGG City Survey on Municipal Funding and Incentives

Green roofs and facades offer multiple benefits for the city climate and thus are gaining national importance in the context of climate-adapted and water-sensitive urban development.

At the municipal level, the implementation of green roofs and facade can be promoted through various instruments that differ in their scope of action, their obligation and their financial cost for the city. The following funding and incentive instruments are discussed in this chapter:

- Determinations in development plans
- Municipal bylaws
- Funding programmes with financial subsidies
- Ecopoints
- Fee reduction for the split wastewater fee

For this, the 2019 BuGG city survey serves as a basis and continues the surveys that were formerly conducted by the Fachvereinigung Bauwerksbegrünung e.V. (FBB now BuGG) and the Nature and Biodiversity Conservation Union Germany (Naturschutzbund Deutschland e.V. - NABU) on the promotion of building greening. For this market report, this survey data were supplemented by BuGG research, to provide a comprehensive overview of the funding and incentive instruments for green roofs and facades in Germany.

First, the results of the city surveys (2010 - 2019/2020) are presented and the most important developments are summarised.

Afterwards follows an overview table on the current funding schemes and incentives for building greening in all German cities with more than 50,000 inhabitants. Subsequently, the individual funding instruments for green roofs are discussed in more detail. The funding instruments for facade greening are covered in Chapter 4.2.3.

Results of the City Surveys on the Funding and Incentives of Green Roofs and Facades 2010 - 2019 (2020)

Tab. 8 shows the results of the city surveys on the funding of green roofs and facades from 2010 to 2019. While FBB and NABU included all German cities with more than 10,000 inhabitants in the survey until 2016/2017, BuGG limited the survey in 2019 to all German cities with more than 20,000 inhabitants. The various funding instruments (except for municipal bylaws) were surveyed with a questionnaire, both digitally and analogue, and the responses subsequently analysed. The table is completed by the results of the research carried out in 2019/2020 on municipal funding in all German cities with more than 50,000 inhabitants.

Tab. 8: Results of the city surveys on funding for green roofs and facades from 2010 to 2019. Source: (BuGG, 2020)

	FBB-NABU Survey 2010	FBB-NABU Survey 2012	FBB-NABU Survey 2014	FBB-NABU Survey 2016/2017	BuGG Survey 2019	BuGG Survey 2019 + Research 2019/2020
Number of cities contacted	1,499 (>10,000 EW)	1,499 (>10,000 EW)	1,499 (>10,000 EW)	1,499 (>10,000 EW)	700 (>20,000 EW)	191 (>50,000 EW)
Response rate	579 (39%)	564 (38%)	510 (34%)	400 (27%)	199 (28%)	
Roof greening						
Direct grants (grant programme)	36 (6%)	32 (6%)	31 (6%)	32 (8%)	37 (19%)	49 (26%)
Fee reduction with split wastewater fee	221 (38%)	276 (49%)	270 (53%)	217 (54%)	98 (49%)	137 (72%)
Determination in Development plans	198 (34%)	208 (37%)	202 (39%)	213 (53%)	133 (67%)	140 (73%)
Ecopoints	50 (9%)	59 (11%)	55 (11%)	50 (13%)	42 (21%)	45 (24%)
Facade greening						
Direct grants (grant programme)	32 (6%)	30 (5%)	25 (5%)	28 (7%)	34 (17%)	45 (24%)
Determination in development plans	188 (32%)	187 (33%)	172 (34%)	135 (34%)	89 (45%)	78 (41%)

Comparison and Findings

Concerning the funding programmes, when comparing the survey results, it should be pointed out that ...

- the share of cities offering direct subsidies for green roofs has increased from 6% in 2010 to 19% in 2019
- a similar increase can be seen for direct subsidies for green facades from 6% in 2010 to 17% in 2019
- at the same time, 26% of the approached cities with more than 50,000 inhabitants have direct subsidies for roof greening and 24% have directs grants for facade greening

In terms of development plans, it can be seen that ...

- In 2010, 34% of the investigated cities had made green roofs mandatory in development plans, 32% did the same for facade greening. By 2019, these numbers were up to 67% and 45%
- the proportion of cities with over 50,000 inhabitants with provisions in B-plans is 73% (roof greening) and 41% (facade greening)
- the determination of roof greening is carried out more frequently compared to facade greening

A further increase can be seen in the awarding of **ecopoints** for green roofs (2010: 9%, 2019: 21%, for cities with over 50,000 inhabitants 2019/2020: 24%).

Concerning the reduction in fees for the **split wastewater fee**, it can be seen that ...

- the percentage of cities promoting green roofs through a fee reduction minimally fluctuated between 2012 and 2019 and remained stable at 49%
- in cities with more than 50,000 inhabitants, the percentage is now very high at 72%, according to BuGG research

Specification of Green Roofs in Development Plans

According to the BauGB (German Building Code), the development plan is a binding urban land-use plan. It is adopted by statute and creates building law for new construction projects or structural alterations in a specific area (planned inner area) of a municipality. To achieve certain objectives in urban land-use planning, legally binding stipulations, e.g. on green roofs, can be made for urban development reasons. The type and manner of the stipulation as well as the written justification are important here. The legal basis for establishing green roofs is § 9 par. 1 Nr. 20 on the one hand and Nr. 25a and b BauGB on the other.

The advantage of the B-Plan is that the implementation of green roofs by the building owner is mandatory. The disadvantage of this funding instrument is its limited scope within the municipality, as the B-Plan is spatially limited due to its small area of application. According to the BuGG city survey (2019) and the subsequent research in 2020, approx. 73% of all German cities with more than 50,000 inhabitants already have specified green roofs in their development plans. The following Tab. 10 shows examples of green roof provisions (not underground car park green roofs) in current urban development plans of different cities.

It should be highlighted that ...

- the stipulations apply primarily to flat roofs and flat pitched roofs
- the average substrate layer required is at least 10 cm (in some cases even 12 cm)
- in some cities, priority is given to the use of species-rich planting with autochthonous seeds

An additional issue is the combination of green roofs with photovoltaic and solar thermal systems, which in many current development plans are not mutually exclusive, but instead complement each other.

Local Bylaws on Green Roofs

In almost all federal states, municipalities can enact local building regulations under their state building regulation, which define design requirements for building structures (design statutes). Their scope can refer to the entire (i.e. also the unplanned) inner area of a municipality or to parts of the inner area and apply to both new construction projects and renovations of existing buildings. Green roofs can be incorporated in a design statute under the item „Begrünung baulicher Anlagen" (cf. § 86 par. 1 Nr. 7 MBO) and are usually part of a municipal greening statute. The advantages of design statues over land-use plans are their wider scope. However, a design statute is only the smallest common denominator and can sometimes impose lower requirements on green roofs than the stipulation in a land-use plan. This funding instrument has only been used sporadically by German cities with more than 50,000 inhabitants.

Tab. 11 shows seven cities with municipal bylaws on green roofs and their design specifications. The design specifications for the greening of underground car parks are not listed. It can be seen that …

- the design specifications apply primarily to flat roofs and low-pitched roofs.
- all bylaws specify a minimum size of the roof area for mandatory greening (min. 10 m² to 200 m²).
- only three cities specify the minimum layer of substrate or the total rootable layer (at least 10 cm).

While in Bremen, Munich and Meerbusch the greening obligation can be waived in favour of energy generation systems on the roof surfaces, Speyer is the only city to point out that photovoltaics and green roofs are not mutually exclusive but can be combined.

Funding Programs with Financial Subsidies for Green Roofs

Municipalities can promote through funding programmes activities (e.g. green roofs) to achieve certain goals in a self-defined sphere of action within the municipal area with their own budgetary funds or in combination with federal and state funds. These financial incentives intend to motivate eligible applicants (e.g. private property owners, companies, and so on) to install green roofs voluntarily on new or existing buildings.

Funding programmes can be used to offer targeted funding where there is a high need for action or where other funding instruments are not effective. Municipalities provide this service voluntarily, which is very dependent on their respective budgetary situation. In contrast to B-plans or municipal bylaws, a funding programme is only a non-binding offer for the implementation of green roofs. However, the municipality can attach certain conditions and quality criteria to the funding itself.

As a result of the BuGG city survey (2019) and the subsequent research in 2020, 26% of all German cities with more than 50,000 inhabitants provide financial subsidies for green roofs. Smaller cities with fewer than 50,000 inhabitants, such as Ingelheim am Rhein and Kehl am Rhein, have also set up funding programmes. Details on the individual funding programmes are shown in Tab. 12. The funding volumes, as well as the requirements for funding, differ from city to city:

- Some funding programmes apply to the entire city area, others only in selected parts of the city.
- The range of maximum funding varies from 10 to 100 €/m² and 500 to 100,000 €/project.
- In percentage terms, the funding limit varies between 20 and even 100% of the fundable costs in individual case decisions. For the majority of cities, however, the maximum funding is 50%.

Ecopoints for Green Roofs as Part of the Impact Compensation Regulation

Within the context of the impact compensation regulation according to the Federal Nature Conservation Act, biotope value procedures are used throughout Germany. This is done to determine the negative impacts on nature and landscape within a certain area of influence and to determine appropriate compensation measures in the case of unavoidable impairments. The basis for this determination is formed by value points (also called ecopoints), which are assigned to the various biotope types. Comparing the balance in ecopoints before and after an environmental intervention allows for mapping the extent of the necessary compensation measures due to the loss of value.

Depending on the balancing model of the federal state, green roofs can be awarded a specific number of ecopoints, so that it has a positive effect on the eco-balance of interventions and hence reduces the need for compensation measures. As a result of the BuGG city survey in 2019 and following enquiries in 2020, it can be stated for all German cities with more than 50,000 inhabitants that approx. 24% of the cities award ecopoints for green roofs. Future research is required as several of the contacted cities did not provide information. In addition, some cities also offer ecopoints for facade greening, which was not covered by previous surveys. This needs to be included in future BuGG city surveys.

Tab. 13 lists examples of cities that take green roofs into account as a reducing method based on state-specific regulations within the balancing process. Depending on the balancing model and green roof structure, the number of ecopoints for green roofs varies from 0.5 to 19 ecopoints/m².

Reduced Fees for Green Roofs in the Split Wastewater Fee

The municipalities individually regulate wastewater disposal for their municipal area by statute and provide the necessary infrastructure. To cover the costs of construction, operation and maintenance of the public wastewater disposal facilities, the municipalities charge a wastewater fee to the building owners. Within the split wastewater fee, the disposal of wastewater is calculated according to the freshwater scale.
For the determination of the precipitation water fee, the paved and runoff effective area with sewer connection of the particular property is used. Within the statutes, a fee reduction for rainwater disposal can be dispensed for actions that contribute to local rainwater retention. This also includes green roofs. Hence, green roofs are indirectly promoted by the split wastewater fee.

In January 2019, the BuGG researched the wastewater (fee) statutes of German with more than 50,000 inhabitants. This demonstrated that:

- At the time of the research, only two cities (1%) did not have a split wastewater charge. Accordingly, the precipitation water charge could be determined for 189 cities.
- The precipitation water fee for 2019 was on average at 0.81 €/m² (189 cities).
- Despite the split wastewater fee, a total of 52 cities (27%) did not plan to reduce the fee for green roofs.
- In contrast, a fee reduction was recorded in 137 cities (72%).
- Depending on the city, the amount of the precipitation water fee per year and the maximum fee reduction for a green roof varies from 0% to 100%.
- The average fee reduction for a green roof was 59% or 0.48 €/m².

Details on the 137 cities with a fee reduction for green roofs are listed in Tab. 14. The following conditions for a reduction can be summarised:

- Closed vegetation layer
- Permanent vegetation
- Construction height/substrate layer thickness
- Runoff coefficient or permanent water retention
- Multi-layer construction
- Maximum roof pitch
- State of the art construction

2.2 Facade Greening

2.2.1. Newly Greened Areas in 2019

It is harder to determine the extent of the greened facade areas in 2019 than it is for the greened roof areas. The method of monitoring substrate quantities and converting them into greening area, which is used for green roofs, is not feasible for green facades due to the design of the system. While the data for wall-bound facade greening can be determined quite easily, since the system solutions are only sold and installed for greening and in square metres, the situation is different for ground-bound facade greening. System suppliers of climbing aids (e.g. ropes and nets) are often unable to clearly identify whether the products sold are used for greening purposes or which spaces are actually greened. Depending on the spacing between adjacent linear climbing aids, the greening areas vary in size. One running metre of linear climbing aid does not necessarily equal one square metre of facade greening.

An exact determination of newly planted areas of ground-based facade greening with self-climbing plants (direct greening without climbing aids) is not possible for various reasons. Among other things, the distribution channels of plants used in greening facades are diverse. Additionally, both professionals and laymen are implementing ground-based facade greening. Lastly, it is difficult to determine the area that might be greened in the coming years. With this in mind, the data on the greened facade areas in 2019 should be evaluated.

The Bundesverband GebäudeGrün e.V. (German Association of Building Greening) asked its members who offer product and system solutions for facade greening about greened areas in 2019. The total area of both ground- and wall-bound facade greening were surveyed, although in the case of ground-bound facade greening, only the areas with climbing aids were considered.

- According to this, approximately 20,000 - 55,000 m² **wall-bound and ground-bound facade greening (with climbing aids)** was installed in Germany in 2019

- **Wall-bound green facades** cover an area of about 5,000 m²

- The surveyed BuGG members assume a ratio of wall-based facade greening to ground-based facade greening with climbing aids of 1:3 to 1:10. This results in a total facade area planted with climbing aids of 15,000 - 50,000 m².

As mentioned above, it was not possible to determine any data on the area of ground-based direct climbers (without climbing aids). The BuGG assumes a size of 20,000 - 80,000 m².

To compare the figures for green roofs and facades greening is logical since both measures are mentioned equally often in the context of climate change adaptation measures. However, this comparison falls short as facade greening differs considerably from greening rooftops regarding construction and vegetation requirements. The most appropriate comparison could be made using the production costs per square metre - green facades are in the same monetary range as roof gardens (intensive green roofs). This means that about 20,000 m² of facade greening would be compared to about 1,200,000 m² of intensive roof greening. In other words, while there is a demand for professional facade greening and green facades are already being implemented, the implementation rates are well below the numbers of greens roofs and well below their potential.

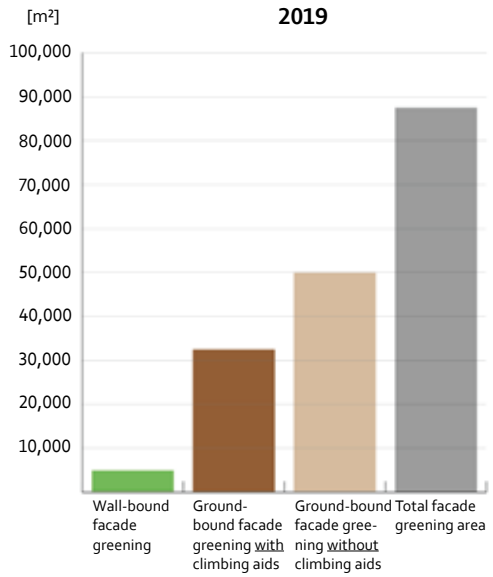

Fig. 29: Determined and estimated order of size of the newly greened facade areas in 2019. Source: BuGG

Fig. 30: A running metre of linear climbing aid can take up different surface areas depending on the spacing, ... Source: BuGG

Fig. 31: ... which makes it difficult to take stock of sales of climbing aids. Source: BuGG

Fig. 32: Soil-bound facade greening with nets or grids can be recorded quite well ... Source: BuGG

Fig. 33: ... as well as wall-bound facade greening. It is easily possible to determine the areas in square metres here. Source: BuGG

Fig. 34: The amount of newly greened areas per year with direct greeners (self-climbers) cannot be determined due to numerous distribution channels and origination options. Source: BuGG

Fig. 35: The areas of green noise barriers have not yet been determined. Source: BuGG

2.2.2 BuGG City Survey on Municipal Funding and Incentives

As already mentioned in Chapter 4.1.5, the funding instruments for facade greening are examined in more detail below. These include: Provisions in development plans, municipal bylaws and funding programmes with financial subsidies. For this, the data collected in the BuGG City Survey 2019 and the BuGG Research 2020 also serve as a basis. See also Chapter 4.1.5.

Specification of Facade Greening in Development Plans (B-plans)

In addition to roof greening, it is also possible to include facade greening in B-plans. It is important to specify the type and method of stipulation as well as the written justification. Section 9 (1) no. 20 and no. 25a and b of the German Building Code (BauGB) as well as state-specific building regulations can also serve as the legal basis for this.
As a result of the BuGG city survey in 2019 and following enquiries in 2020, it can be stated for all German cities with more than 50,000 inhabitants that approx. 41% have already stipulated facade greening in B-plans.
Tab. 15 shows examples of facade greening provisions in urban development plans of different cities. In general, soil-bound facade greening is defined by the building codes.

It turns out that the following parameters are essential for greening:

- Alignment of the facade
- Size of the facade
- Windows/openings

Guideline values for the specification can be ...

- the number of plants per wall length,
- the percentage of the facade area to be greened, or
- a specific minimum area to be planted with greenery

Municipal Bylaws for Facade Greening

As with green roofs, facade greening can also be embedded in a design statute under the item „greening of building structures" (cf. § 86 par. 1 no. 7 MBO). This funding instrument is rarely used by German cities with more than 50,000 inhabitants. Tab. 16 shows two cities with municipal bylaws on facade greening and their design specifications.

Funding Programmes with Financial Subsidies for Facade Greening

The greening of facades can also be subsidized by funding programmes.
As a result of the BuGG city survey in 2019 and following enquiries in 2020, it can be stated for all German cities with more than 50,000 inhabitants that 45 of 191 cities, i.e. 24%, already provide financial subsidies for facade greening. In addition, smaller cities with less than 50,000 inhabitants, such as Ingelheim am Rhein and Kehl am Rhein, have also set up funding programmes. Details on the individual funding programmes are presented in Tab. 17.

The funding levels for facade greening and the funding requirements or conditions also vary significantly from city to city:

- In percentage terms, the funding limit differs between 20 and 90% of the eligible costs. For the majority of cities, the maximum funding is 50%.

2.3. Interior Greening

2.3.1. Newly Greened Areas in 2019

BuGG Survey on Interior Greening

Due to the wide range of options for interior greening - planters, planting beds, vertical greening - it is not possible to provide information extent and overall area of new greening added in 2019.
To nevertheless make statements on the indoor greening market, the Bundesverband GebäudeGrün e.V. (BuGG), in cooperation with the Fachverband Raumbegrünung und Hydrokultur (FvRH) im Zentralverband Gartenbau e.V. (ZGV), surveyed the indoor greening specialists in the association on a number of indicators in 2019.

Results of the BuGG Survey on Interior Greening

The response rate was around 23%, with a total of 65 companies. The following statements are part of an overall picture and only allow limited conclusions to be drawn about the market as a whole.
The market for indoor greening is quite small compared to the market for roof and facade greening. The companies that provide this service are highly specialised. Some of them are nationwide active and realize more than 100 objects per year.
The general motives for indoor greening include design and prestige aspects of well-being, health, improvement of indoor air quality and indoor climate, as well as acoustic comfort.

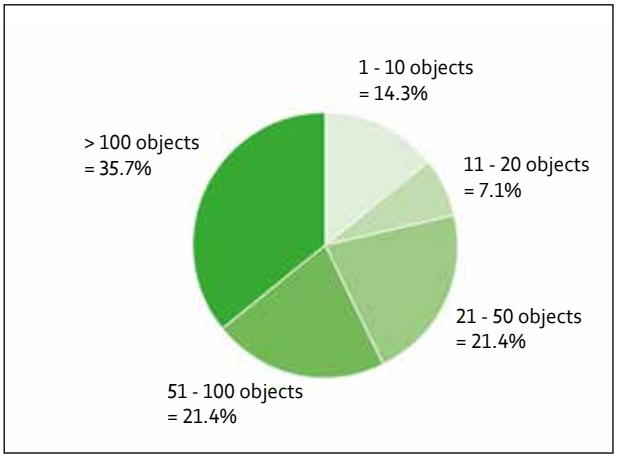

Fig. 40: Results of the survey of FvRH members in 2019 regarding the number of indoor greening objects. Source: BuGG

Plant Beds

Compared to buildings with planters and wall greening, the number of buildings with planting beds was significantly lower.

Fig. 41: There are still relatively few buildings with planting beds.

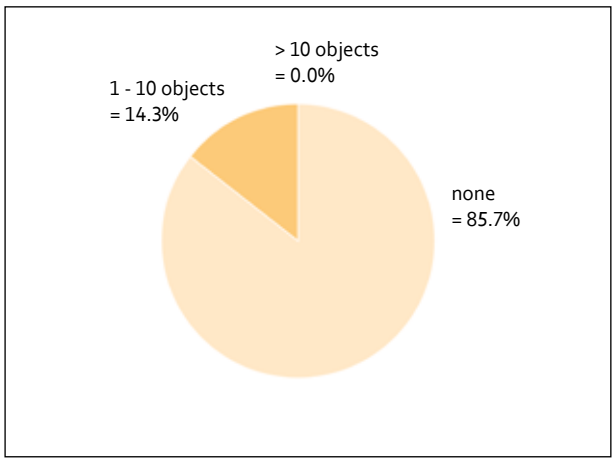

Fig. 42: Results of the survey of FvRH members in 2019 regarding the number of objects in „planting beds". Source: BuGG

Planters

The most common greening concepts are solutions with planters. Almost two-thirds of the responding companies had projects with a total of more than 50 planters. Planters can be used flexibly almost everywhere. They are used in living -, office- and work spaces, terraces, balconies, foyers and lobbies, e.g. in hospitals, retirement and nursing homes, schools, restaurants and public buildings (libraries, swimming pools...).

Fig. 43: Planters are very often used for interior greening

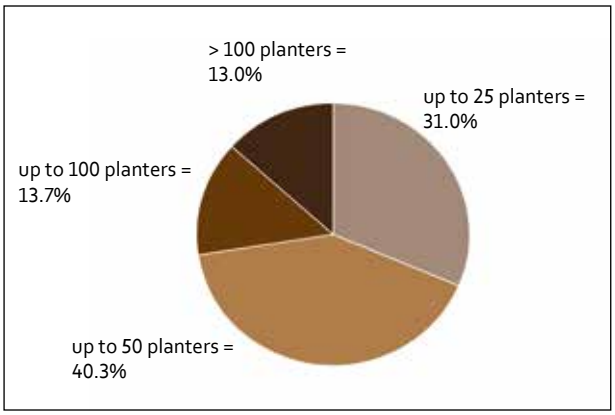

Fig. 44: Results of the survey of FvRH members 2019 regarding object sizes for planters. Source: BuGG

Wall Plantings - Living Walls

In projects with wall greening, the most common types are green walls or room dividers with surface areas of less than 10 m². Areas of application for green walls include representative areas, entrance areas, restaurants and canteens, staircases

The Bundesverband GebäudeGrün e.V. (BuGG) asked its members who offer product and system solutions for facade greening about greened areas and indoor greening implementations in 2019. The products of the surveyed BuGG-members are suitable for both outdoor and indoor use.

In total, 2,000 m² of interior walls were greened in 2019. If wall-based facade greening and wall greening inside and outside are considered together, around 70% is accounted for by outside greening and around 30% by interior greening.

Just as with facade greening, a method for determining the annual increase of indoor greening area (or a comparable variable) must be developed.

Fig. 45: A vegetated wall. Increasingly eye-catching in foyers, reception halls, etc. Source: BuGG

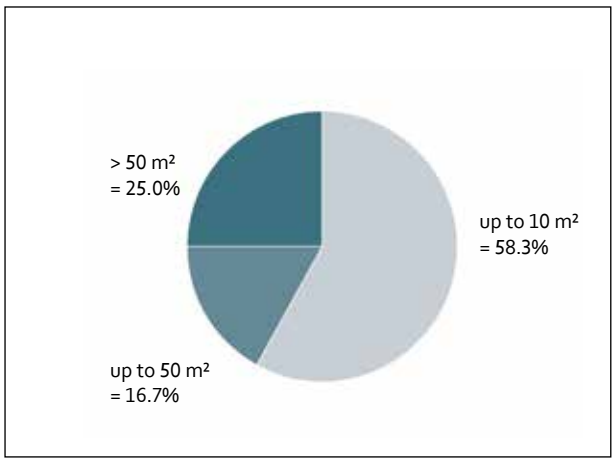

Fig. 46: Results of the survey in 2019 of FvRH members regarding object size for „wall greening". Source: BuGG

2.4 Research and Education Building Greening

Building greening is a cross-sectional issue that affects many professional fields. This is particularly evident in the membership composition of the Bundesverband GebäudeGrün e.V. which unites urban planners, civil engineers, architects and landscape architects who benefit from the association just as much as garden and landscape builders, irrigation technicians, roofers and various product and system manufacturers. Correspondingly, the German research and development sector concerning building greening is equally diverse and wide-ranging.

Fig. 52 lists universities and research institutions that, as far as the BuGG is aware, have already researched or are currently researching on roof, facade or interior greening. Many of the registered institutions are already members of the BuGG, including: LWG Veitshöchheim, ZAE Bayern, IASP Berlin, LVGA Großbeeren, IUNR Wädenswil, HTW Dresden, HfWU Nürtingen-Geislingen, HS Geisenheim University, HS Neubrandenburg, TH Nürnberg, TH Bingen, TU and Beuth HS Berlin, TU München and HS Weihenstephan-Triesdorf. Contact details can be found via the following link:
www.gebaeudegruen.info/gruen/forschung

Climate change and its consequences, insect die-off and the loss of biodiversity, as well as urban air pollution are global challenges for which solutions are currently being intensively sought for. The demand for scientific knowledge on the benefits and synergy effects of building greening has risen significantly. Although the greening of buildings has been practised for decades, there are still many research gaps (see also chapter 5) that need to be addressed in the coming years. Tab. 18 lists some current research projects on building greening. See also: www.gebaeudegruen.info/gruen/forschung

Fig. 52: Universities and research institutions that address the issue of building greening. Source: BuGG

3 Summary and Perspectives

3.1 Building Greening Has Arrived

Reliable figures are available, especially for green roofs. The data collection methods for facade and interior greening are not fully developed yet - nevertheless it is noticeable that building greening is no longer a niche product. Many people are aware of the green market and its many possibilities, which also translates into a large number of diverse building greening projects. The building greening market is growing.
In the course of climate adaptation measures, green roofs and facade greening play a major role, especially in the fields of heat stress reduction and flood prevention.

To sum up, it can be said:

- The basics (laws, guidelines, technology, etc.), decades of experience, many practice examples and specialised companies are available and provide an excellent basis
- 26 and 24% of the cities with more than 50,000 inhabitants promote and incentivize roof and/or facade greening and provide financial subsidies
- 72% of the cities with more than 50,000 inhabitants indirectly promote green roofs and reduce the precipitation water fee when green roofs are installed
- In Germany, around 7,200,000 m² of roof area was newly greened in 2019
- The total amount of greened roof areas in Germany, over the years is approximately in the range of 120,000,000 m². In terms of extensive greening, this means (see Fig. 3)
  ... a water storage capacity of about 3,600,000 m³.
  ... an evaporation capacity of about 240,000 m³ per (summer) day.
  ... an annual precipitation water retention of about 52,560,000 m³.
  ... a CO_2 storage of about 96,000 t.
- The BuGG Green Roof National League is led by Munich in terms of square metres (excluding underground car parks) with 3,148,043 m² of green roof area.
- According to the Green Roof Index, Stuttgart leads the BuGG Green Roof National League with 4.1 m² of green roof per inhabitant.
- The average green roof index (square metres of green roof per inhabitant) is 1.2.

3.2 Building Greening as a Growing and Promising Future Market. Need for Action.

The roof, facade and interior greening market is a growing and very promising future market.

- Doubling of annual green roof areas since 2008 and annual growth averaging over 7%.
- Only about 9% of newly constructed flat roofs are currently greened.
- Professionally installed facade greening is all still rarely seen and does not yet characterise our cityscapes. Thus, we are still far removed from building greening being a matter of course measure
- The building greening sector, including its related professions, already provides thousands of jobs - and the trend is increasing in line with the growth!
- Roof and facade greening as an important adaptation measure to climate change: rainwater management (flood protection) and heat prevention (evaporative cooling), plus species protection/biodiversity.
- Improvement of the urban climate by binding dust and CO_2 and thus an important contribution to preventing driving bans.
- Additional areas for recreational activities: the in-house roof garden as a crisis-proof leisure, recreation and cultivation area. So far, only about 17% of green roofs are intensively greened and used by people. However, mid-term more and more people and senior citizen will live in our cities, with a valid demand for easy, quick and barrier-free access to green infrastructure.

In the field of green roofs, **trends** can be observed, even though they are not substantiated by figures yet:

- The number of urban farming objects is increasing, along with biodiversity green roofs. In recent years, both forms of greening were seen as something „special" and maybe as an effective „marketing gag", but today they can be found in more and more official requirements and planning.
- Seeing green roofs as an important component of decentralised rainwater management is not new, but took on a new dimension with the „retention green roof" and the enormous additional possibilities.
- When planned and executed professionally, photovoltaics and green roofs can be combined in solar green roofs and function well and sustainably together. This could be demonstrated in numerous projects. However, this knowledge has not reached those involved in planning and constructing yet. Even if the political strongly focuses on advancing solar roofs, green roofs should not be neglected, but instead should be promoted as well as green and solar roofs are not mutually exclusive.

Germany has a decade-long tradition in research and development, as well as education regarding building greening. Hence, Germany is a global front runner concerning rooftop and facade-greening. However, there is still a considerable need for further research, which includes:

- Field tests on existing buildings and their surroundings. Recording of environmental and energy-relevant parameters before and after installation of the roof and facade greening and a comparison with existing simulation programmes and those that are currently under development.
- Comprehensive determination and compilation of the energetic effects of roof and facade greening.
- Development of a method for the inventory and potential analysis of greened facades.
- Preparation of life cycle assessments of green roof and facade systems.
- Monitoring the fauna of greened facades and their spreading tendencies.
- Investigation of the ecosystem services of individual plant species for building greening.
- Examination of vegetation development, plant selection and irrigation strategies for green roofs and facade greening under the aspect of climate change.
- Determination of the evaporation performance of various forms of green roofs and facades.
- Investigations into the fire behaviour of facade greening.

The BuGG sees further **need for action** especially in the following points:

- Conservation and revitalisation of existing greenery.
- Funding for the maintenance of building greening.
- Integration, promotion and funding of interior greening.
- Funding for smaller cities with state and federal subsidies.
- Education and advanced training of professionals in roof, facade and interior greening, considering that these are three different areas of application with different requirements.
- Provide/produce reliable annual market figures on facade and interior greening.
- Current cost-benefit considerations for roof, facade and interior greening.
- Cost comparison photovoltaic roof, green roof, solar green roof.

The Bundesverband GebäudeGrün bundles forces and connects market participants, cities, builders, planners, suppliers and implementers:

- Internet platform www.gebaeudegruen.info to bring together various information on building greening
- BuGG-Städtedialog Gebäudegrün 2021 – 2023 in Munich, Stuttgart, Frankfurt a. M., Düsseldorf, Hanover and Leipzig. A project funded by the Deutsche Bundesstiftung Umwelt (DBU).
- World Congress of Building Green on 10 - 12.05.2022 in Berlin.
- Various formats of information events on roof, facade and interior greening: „Gründach-Forum", „Fassadengrün-Forum", „Gründach-Welten. Natur, Sport und Spiel", „Gründachsymposium", „Fassadenbegrünungssymposium" und „Innenraumbegrünungssymposium".

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Bundesverband GebäudeGrün e.V.
About Us

The Bundesverband GebäudeGrün e.V. was founded in May 2018, and can look back on a long history of associational activities.
It was founded on 17 May 2018 through the fusion of the established and renowned associations Fachvereinigung Bauwerksbegrünung e V. (FBB) and Deutscher Dachgärtner Verband e.V. (DDV). By creating one large association, the duplication of work and investments is avoided, energies are bundled, successful components and competences are combined and thereby the impact is increased. Both associations join forces in the BuGG, contributing strengths, contacts and decades of experience - which brings enormous advantages for all involved and for the development of the markets for roof, facade and interior greening.

The Bundesverband GebäudeGrün e. V. (BuGG) is both a professional association and an advocacy group for companies, cities, universities, organisations and all those interested in building greening. The BuGG is one of the few associations that deals primarily and comprehensively with building greening, i.e. with roof, facade, interior and other building greening. The Bundesverband GebäudeGrün e.V. always pursues the overall goal of bringing building greening closer to the widest possible public. In the BuGG, the community of interest offers opportunities that are not available to individual companies to create positive framework conditions for the greening of buildings and other structures in a company-neutral way. The Bundesverband GebäudeGrün e.V. focuses its activities on the following three areas:

Our profile

Trades
Urban development, urban planning, urban ecology, architecture, landscape architecture, gardening and landscaping, roofers

Activities
Building greening (green roofs, green walls and interior greening) and associated trades (e.g. hydroisolation, thermal isolation, rainwater management, leak detection, fall protection), primarily in Germany.

Objectives
- Public relations and image improvement for building greening
- Central information platform on building greening: expert information, events, branch and market news, research, networking
- Networking and exchange of experiences

Founded: 17.05.2018
Employees: 10
Member: 373
Office: Berlin
Administration: Saarbrücken

Inform and Educate
- Brochures, technical information, symposia, ...
- www.gebaeudegruen.info

Support and Research
- Supporting research projects

Contacts and Networking
- „Network managers" for cities and universities, Connecting industry, contractors, planners and cities
- Members: e.g. producers (roofing, facade, interior), planners, contractors, cities, universities

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