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Between ecology and legal regulation: The status of green roofs as an equivalent of biologically active area in Polish law*

A b s t r a c t: This article examines the status of green roofs as an equivalent of biologically active area in Polish law, with particular attention to stormwater retention and the durability of vegetation. The study combines dogmatic legal analysis of planning and technical building regulations and administrative court jurisprudence with a review of scientific literature and the authors' field research on extensive green roofs. The analysis identifies an inconsistency between the statutory definition of biologically active area and the technical building definition of biologically active terrain: the former does not expressly require stormwater retention for terraces and flat roofs, whereas the latter does. The uniform rule crediting 50% of their area does not reflect differences in hydrological performance and ecological potential. The empirical findings

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indicate the importance of vegetation for substrate microbial activity, but did not demonstrate a statistically significant effect of plant density on retention during the initial years of the experiment. The article argues for coordinating the two legal definitions and linking the qualification of green roofs to verifiable technical and functional parameters, including retention capacity and conditions for durable vegetation. Such an approach would strengthen the relationship between formal compliance and the environmental objectives of regulation.

Keywords: green roofs, biologically active area, biologically active terrain, stormwater retention, biodiversity, spatial planning law

1. Introduction

In the face of advancing urbanisation and climate change, a key challenge for spatial planning, construction law, and environmental protection is enhancing urban resilience to extreme weather events, such as heat islands and torrential rain. One of the main approaches to addressing environmental threats is the development of green infrastructure, including green roofs,[1] which perform numerous functions, such as: carbon sequestration, improving the energy efficiency of buildings, supporting the development and maintenance of biodiversity, or stormwater retention. However, the scope and scale of the socio-environmental benefits provided by green roofs, compared with those provided by other ecosystem types in developed areas, are not well understood.[2]

Polish law draws a distinction between "biologically active terrain" (*teren biologicznie czynny*), defined in § 3 point 22 of the Regulation on the technical conditions to be met by buildings and their location (hereinafter: the Technical Conditions Regulation),[3] and "biologically active area" (*powierzchnia biologicznie czynna*; hereinafter: BAA), defined in Article 2 point 28 of the Act on Spatial Planning and Development (hereinafter: the Planning Act).[4] Both regimes allow 50% of the area of qualifying terraces and flat roofs to be credited towards the relevant area balance, subject to the minimum area of 10 m² and conditions

[1] J. A. Pawłowicz, *Dach zielony jako przyjazne rozwiązanie dla środowiska i ludzi na terenach zurbanizowanych*, "Budownictwo o Zoptymalizowanym Potencjale Energetycznym" 2019, vol. 8, no. 2, p. 96, https://doi.org/10.17512/bozpe.2019.2.11.

[2] J. M. Aloisio, J. D. Lewis, *Editorial: Socio-ecological Dynamics of Green Roof Ecosystems*, "Frontiers in Ecology and Evolution" 2023, vol. 11, article 1254928, https://doi.org/10.3389/fevo.2023.1254928.

[3] Regulation of the Minister of Infrastructure of 12 April 2002 on the technical conditions to be met by buildings and their location (Journal of Laws of 2022, item 1225, as amended).

[4] Act of 27 March 2003 on Spatial Planning and Development (Journal of Laws of 2026, item 538, as amended).

for natural plant vegetation. Their requirements are not identical: the Technical Conditions Regulation expressly requires stormwater retention for terraces and flat roofs, whereas the Planning Act does not repeat that requirement for these surfaces. The standardised area criteria do not specify a measurable level of hydrological or ecological performance. The case law discussed in section 5 below is relevant to verifying conditions for vegetation, but must be read in the context of the provisions applicable when each case was decided.

The problem of qualifying green roofs as an equivalent of the biologically active area has not only technical-urban significance but also environmental-legal importance. It concerns how a legal norm translates environmental protection goals – in particular, stormwater retention, counteracting surface sealing, and preserving ecosystem functions – into measurable obligations for the investor. The standardised area criteria do not specify a measurable level of hydrological or ecological performance. The case law discussed in section 5 below is relevant to verifying conditions for vegetation, but must be read in the context of the provisions applicable when each case was decided.

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This article aims to evaluate green roofs as a legally credited component of BAA, focusing on their hydrological and ecological performance and the role of administrative court jurisprudence in verifying the functions required by law. The study employs the dogmatic-legal method, including analysis of the Planning Act, the Technical Conditions Regulation, the Water Law,[5] and the Environmental Protection Law,[6] supplemented by analysis of administrative court jurisprudence, scientific literature, and the authors' field research on extensive green roofs.

2. Legal and financial conditions for the implementation of green roofs in Poland

Under Article 2 point 28 of the Planning Act, BAA comprises land providing natural plant vegetation and retention of precipitation and snowmelt water;

[5] Act of 20 July 2017 – Water Law (Journal of Laws of 2025, item 960, as amended).

[6] Act of 27 April 2001 – Environmental Protection Law (Journal of Laws of 2025, item 647, as amended).

land covered with watercourses or water reservoirs, excluding recreational and industrial swimming pools; and 50% of the area of terraces, flat roofs and other surfaces providing natural plant vegetation, with an area of at least 10 m². In contrast, § 3 point 22 of the Technical Conditions Regulation defines biologically active terrain by reference to a surface arranged to provide natural plant vegetation and stormwater retention, including 50% of terraces and flat roofs with such a surface, other qualifying vegetated surfaces of at least 10 m², and surface water on the terrain. For terraces and flat roofs, the difference in the express retention requirement is central to the analysis.

For the basic category of BAA, the Planning Act specifies both natural plant vegetation and retention of precipitation and snowmelt water. For terraces, flat roofs and other surfaces, it expressly refers to natural plant vegetation without repeating the retention requirement. Consequently, 50% of a qualifying green roof's area may be credited towards BAA under the planning definition without an express retention requirement in that definition. This does not displace retention requirements arising independently under the Technical Conditions Regulation or other applicable provisions.

This difference creates a terminological and functional inconsistency between planning law and technical building regulations. For green roofs, the retention function is expressed more directly in the Technical Conditions Regulation than in the planning definition, even though planning instruments determine the minimum share of BAA. The definition proposed in Sejm Paper no. 3097 already distinguished the basic category, which included retention, from terraces, flat roofs and other surfaces described by reference to natural vegetation.[7] The difference in wording alone does not establish whether the omission was deliberate. It nevertheless warrants examination of how the two definitions operate together.

To maintain terminological precision, this article distinguishes between biologically active area (BAA) within the meaning of Article 2 point 28 of the Planning Act and biologically active terrain within the meaning of § 3 point 22 of the Technical Conditions Regulation. These concepts are functionally similar but not identical. In particular, the technical-building definition of terraces and flat roofs links their qualification to a surface that ensures natural vegetation and stormwater retention, whereas the statutory definition of BAA for this category of surfaces does not repeat the retention requirement. Whenever the following discussion refers to a functional equivalent of BAA, it concerns the evaluation of a green roof through the lens of both functions: vegetative and retentive.

The planning framework for the minimum share of BAA includes the municipality's general plan and the local spatial development plan. Their respective standards

[7] Government draft act amending the Act on Spatial Planning and Development and certain other acts, Sejm Paper no. 3097, 9th term of the Sejm, https://orka.sejm.gov.pl/Druki9ka.nsf/0/E04A41DBCDB2D35EC125897C002F4A3B/$File/3097.pdf [accessed 9 September 2026].

and the rules applicable to a particular development must be distinguished.[8] The area balance may also be relevant to public-law charges under the Water Law. Article 34 point 4 addresses the reduction of natural land retention through works or structures permanently attached to land on properties exceeding 3,500 m², where more than 70% of the property is excluded from BAA, in areas not covered by open or closed sewerage systems. The corresponding fee is regulated in Article 269(1)(1), Article 270(7) and Article 272(8) of the Water Law, subject to the statutory exemptions.[9] Its assessment concerns reduced natural retention and any qualifying retention measures. The absence of a separate definition of BAA in the Water Law raises an interpretative issue; the 50% planning credit should not be assumed automatically to establish retention compensation or a reduction in the fee.

3. Functional effectiveness of green roofs and the legal problem of equivalence

The legal problem of equivalence concerns whether crediting a green roof towards the required share of biologically active area adequately reflects the environmental functions it provides. Under the planning definition, terraces and flat roofs must support natural plant vegetation, whereas the technical building definition also expressly requires stormwater retention. The rule allowing 50% of a qualifying green roof's area to be credited towards biologically active area does not reflect differences in hydrological and ecological performance. The scientific findings discussed below explain why meeting an area threshold alone cannot establish functional equivalence with native soil. They inform the assessment of existing requirements and proposals for their refinement, without treating proposed technical standards as obligations already imposed by law.

Water retention in native soil depends on its physical properties and organic matter content,[10] as well as vegetation and land use.[11] Green roof performance

[8] Articles 13e and 15(2)(6) of the Planning Act.

[9] Article 34 point 4, Article 269(1)(1) and (2)–(4), Article 270(7) and Article 272(8) of the Water Law.

[10] B. D. Hudson, *Soil Organic Matter and Available Water Capacity*, "Journal of Soil and Water Conservation" 1994, vol. 49, no. 2, p. 191, https://doi.org/10.1080/00224561.1994.12456850; K. Saxton, W. Rawls, *Soil Water Characteristic Estimates by Texture and Organic Matter for Hydrologic Solutions*, "Soil Science Society of America Journal" 2006, vol. 70, p. 1570, https://doi.org/10.2136/sssaj2005.0117.

[11] W. Halecki et al., *Quantifying the Soil Water Storage Capacity of Flysh Catchments Surrounded by Mixed Forests in Outer Carpathians*, "Environmental Processes" 2023, vol. 10,

likewise varies with the design of the system, particularly substrate thickness and water storage capacity.[12] Vegetation and evaporation help restore that capacity between rainfall events.[13] Consequently, neither native soil nor green roofs constitute a uniform reference category. Comparisons drawn from studies conducted under different conditions are illustrative and do not establish a universal crediting factor. For legal assessment, this means that the credited surface area cannot by itself demonstrate the environmental performance of a particular roof.

Vegetation can reduce runoff, but its contribution depends on plant cover, substrate depth and operating conditions.[14] Retention, understood here as the amount of rainfall retained by the roof rather than discharged as runoff during the period assessed, must also be distinguished from detention, which delays runoff.[15] Plants with different functional traits, such as rooting depth and growth form, can complement one another in water use.[16] These findings identify the properties relevant to evaluating a roof's hydrological function. They also explain why verification should address the proposed structural layers and planting arrangements, rather than rely solely on a declaration that the roof is green.

The vegetative function shared by both legal definitions has a biological dimension. A roof substrate is a habitat whose microorganisms contribute to nutrient availability and plant health.[17] This does not make every measure

article 28, p. 15, https://doi.org/10.1007/s40710-023-00641-y; J. Kučera et al., *The Effect of Land Management on the Retention Capacity of Agricultural Land in the Conditions of Climate Change – Case Study*, "Journal of Ecological Engineering" 2021, vol. 22, no. 1, p. 259, https://doi.org/10.12911/22998993/130230.

[12] X. Zheng et al., *Green Roofs for Stormwater Runoff Retention: A Global Quantitative Synthesis of the Performance*, "Resources, Conservation and Recycling" 2021, vol. 170, article 105577, https://doi.org/10.1016/j.resconrec.2021.105577.

[13] S. Cascone et al., *The Evapotranspiration Process in Green Roofs: A Review*, "Building and Environment" 2019, vol. 147, p. 340, https://doi.org/10.1016/j.buildenv.2018.10.024; C. Berretta, S. Poë, V. Stovin, *Moisture Content Behaviour in Extensive Green Roofs During Dry Periods: The influence of vegetation and substrate characteristics*, "Journal of Hydrology" 2014, vol. 511, p. 374, https://doi.org/10.1016/j.jhydrol.2014.01.036.

[14] D. Schrieke et al., *Evaluating the Effectiveness of Spontaneous Vegetation for Stormwater Mitigation on Green Roofs*, "Science of the Total Environment" 2023, vol. 898, article 165643, https://doi.org/10.1016/j.scitotenv.2023.165643; S. Kemp, P. Hadley, T. Blanuša, *The Influence of Plant Type on Green Roof Rainfall Retention*, "Urban Ecosystems" 2019, vol. 22, p. 355, https://doi.org/10.1007/s11252-018-0822-2.

[15] V. Stovin et al., *The Influence of Substrate and Vegetation Configuration on Green Roof Hydrological Performance*, "Ecological Engineering" 2015, vol. 85, p. 159, https://doi.org/10.1016/j.ecoleng.2015.09.076.

[16] J. Lundholm et al., *Plant Species and Functional Group Combinations Affect Green Roof Ecosystem Functions*, "PLoS ONE" 2010, vol. 5, no. 3, article e9677, https://doi.org/10.1371/journal.pone.0009677.

[17] A. Mishra, L. Singh, D. Singh, *Unboxing the Black Box – One Step Forward to Understand the Soil Microbiome: A Systematic Review*, "Microbial Ecology" 2023, vol. 85, no. 2,

of microbial diversity a separate legal requirement. It does, however, explain why conditions for natural vegetation should be assessed with regard to the durability of the habitat, rather than merely the possibility of placing plants on a surface. The distinction matters because a roof may meet an area criterion while providing poor conditions for the continued development of vegetation.

The authors investigated these relationships on five experimental extensive green roofs, each measuring 2 × 2 m and containing a 15 cm substrate layer. One roof remained unplanted as a control, while the others were planted with species originating from post-mining waste heaps. This choice relates to the use of habitat characteristics and plant origins in green roof design discussed in the literature.[18] Table 1 presents the planting variants, vegetation cover and functional dispersion, an indicator of variation in plant traits. The experiment provides evidence relevant to the functional assessment of green roofs, while its small scale limits the conclusions that can be drawn for regulatory purposes.

Table 1. Summary of research results conducted on extensive green roofs (own study)

Roof variant	R 0	R 1	R 2	R 3	R 4
Plant composition	0	1	2	3	4
Plant cover: 1st year / max [%]	0	25 / 80	40 / 90	50 / 80	60 / 90*
Functional dispersion (FDis)	–	0	1.545	1.029	1.377

Note: * values represent percentages of surface cover in the first year and maximum achieved cover, respectively. Functional dispersion (FDis) is the overall range of traits; higher values indicate greater functional diversity.

During the initial years after planting, no statistically significant effect of plant density on retention was observed; maximum retention was approximately 44 mm of water. This value is within the range reported for extensive roofs with similar substrate thickness.[19] Increasing vegetation cover was nevertheless associated with faster substrate drying, helping to restore capacity before subsequent rainfall. The findings therefore do not demonstrate that more diverse plantings necessarily increase retention. Their legal significance lies in showing why vegetation cover and hydrological performance should be

p. 669, https://doi.org/10.1007/s00248-022-01962-5; X. Wang, Y. Chi, S. Song, *Important Soil Microbiota's Effects on Plants and Soils: A Comprehensive 30-Year Systematic Literature Review*, "Frontiers in Microbiology" 2024, vol. 15, article 1347745, https://doi.org/10.3389/fmicb.2024.1347745.

[18] J. T. Lundholm, *Green Roofs and Facades: A Habitat Template Approach*, "Urban Habitats" 2006, vol. 4, no. 1, p. 87; C. Butler, E. Butler, C. M. Orians, *Native Plant Enthusiasm Reaches New Heights: Perceptions, Evidence, and the Future of Green Roofs*, "Urban Forestry & Urban Greening" 2012, vol. 11, p. 4, https://doi.org/10.1016/j.ufug.2011.11.002.

[19] X. Zheng et al., *Green Roofs for Stormwater Runoff Retention*...

examined as related but distinct features, and why planting information alone cannot substantiate a declared retention capacity.

The planted roofs also showed greater microbial richness than the unplanted control, and plantings with diverse functional traits were associated with higher microbial activity. These observations support the importance of interactions between plants and substrate organisms for ecosystem development, as discussed in the literature.[20] They should not be read as establishing a simple proportional relationship between the number of plant species and ecological performance. For the compensatory function considered in this article, the relevant point is that durable vegetation depends on a functioning habitat. A surface calculation provides no direct information about the quality or persistence of that habitat.

Taken together, the findings support a distinction between formal crediting and functional equivalence. A uniform 50% crediting factor does not express differences in substrate properties, retention capacity or habitat development. Under the technical building regime, these properties help assess whether the required vegetation and retention functions can actually be provided; under the planning definition, the absence of an express retention requirement for terraces and flat roofs remains a separate regulatory issue. The research thus supports coordinating the definitions and developing verifiable technical criteria. It does not establish a scientifically validated replacement ratio. The following sections examine how such parameters relate to legal qualification and administrative verification.

4. Significance of technical parameters of green roofs for their qualification as biologically active areas

The definitions in the Planning Act and the Technical Conditions Regulation do not differentiate the crediting factor according to substrate thickness, vegetation composition or the hydrological performance of individual green roofs. The Lublin case study illustrates how an emphasis on compliance with an area crediting factor can favour technically minimal solutions without sufficient

[20] E. Oberndorfer et al., *Green Roofs as Urban Ecosystems: Ecological Structures, Functions, and Services*, "BioScience" 2007, vol. 57, no. 10, p. 823, https://doi.org/10.1641/B571005; R. Fulthorpe et al., *The Green Roof Microbiome: Improving Plant Survival for Ecosystem Service Delivery*, "Frontiers in Ecology and Evolution" 2018, vol. 6, article 5, https://doi.org/10.3389/fevo.2018.00005.

regard to their ecological purpose.[21] Research on biodiversity also shows why the habitat value of a green roof requires attention to its design and vegetation.[22] The risk is that a formally compliant solution may be presented as providing greater environmental compensation than its actual performance warrants. This supports refining the criteria for crediting green roofs, rather than assuming that every roof installed to meet the area requirement restores the same ecosystem functions.

Comparative examples illustrate different ways of linking green roofs to environmental objectives. The literature on European incentives describes stormwater fee reductions as one mechanism used in German municipalities to encourage green roofs.[23] In Basel, the approach described by Brenneisen combines roof greening with habitat-oriented design requirements, including variation in substrate depth and the creation of conditions for particular organisms.[24] These examples illustrate possible regulatory approaches; they do not establish that the same rules or incentive levels apply throughout Germany or Switzerland.

The international literature on green roof performance and certification likewise highlights the relevance of technical parameters.[25] For the Polish framework, the comparative value of these examples lies in showing how a surface requirement could be supplemented with verifiable environmental criteria. The scope and content of such criteria would need to reflect the functions being assessed and the conditions of the particular development.

Local spatial planning can translate environmental objectives into development parameters, including the required share of BAA.[26] Municipal climate change adaptation plans also have a role in this process. Under Article 18b(3) of the Environmental Protection Law, a municipal adaptation plan is not an act

[21] M. Michalik-Śnieżek et al., *Green Roofs: Nature-Based Solution or Forced Substitute for Biologically Active Areas? A Case Study of Lublin City, Poland*, "Sustainability" 2024, vol. 16, no. 8, article 3131, https://doi.org/10.3390/su16083131.

[22] S. Knapp, S. Schmauck, A. Zehnsdorf, *Biodiversity Impact of Green Roofs and Constructed Wetlands as Progressive Eco-Technologies in Urban Areas*, "Sustainability" 2019, vol. 11, no. 20, article 5846, https://doi.org/10.3390/su11205846.

[23] E. Burszta-Adamiak, W. Fiałkiewicz, *A Review of Green Roof Incentives as Motivators for the Expansion of Green Infrastructure in European Cities*, "Scientific Review Engineering and Environmental Sciences" 2019, vol. 28, no. 4, p. 648, https://doi.org/10.22630/pniks.2019.28.4.58.

[24] S. Brenneisen, *Space for Urban Wildlife: Designing Green Roofs as Habitats in Switzerland*, "Urban Habitats" 2006, vol. 4, no. 1, p. 31.

[25] A. Naranjo et al., *State-of-the-Art Green Roofs: Technical Performance and Certifications for Sustainable Construction*, "Coatings" 2020, vol. 10, no. 1, article 69, https://doi.org/10.3390/coatings10010069.

[26] P. Antoszewski et al., *Legal Tools for Blue-Green Infrastructure Planning—Based on the Example of Poznań (Poland)*, "Sustainability" 2024, vol. 16, no. 1, article 141, https://doi.org/10.3390/su16010141.

of local law, while Article 71(2a) requires its relevant conclusions and recommendations to be taken into account in preparing and updating specified strategic and planning documents.[27] A municipal adaptation plan therefore informs planning; it does not independently replace the binding requirements applicable to an investor.

The scientific literature discussed in section 3 indicates that substrate properties and vegetation can affect retention and runoff delay. Plant functional diversity may influence water use through complementary traits,[28] but this does not mean that every increase in the number of species produces higher retention. In particular, the authors' small-scale experiment did not demonstrate a statistically significant effect of plant density on retention during its initial years. Technical assessment should therefore distinguish the proposed vegetation from the demonstrated hydrological performance of the system.

The resulting proposal is to specify technical and functional criteria for green roofs, including substrate properties, retention performance and conditions for durable vegetation, when refining their role in the BAA balance. This follows the concern that formal area compliance may be insufficient to recover the environmental functions attributed to such roofs.[29] The proposed criteria are *de lege ferenda* and should not be presented as additional requirements already contained in the definitions.

5. Verification of retention potential as an element of controlling investment project compliance with the law

Under § 3 point 22 of the Technical Conditions Regulation, 50% of the area of qualifying terraces and flat roofs may be credited towards biologically active terrain where the surface provides natural vegetation and stormwater retention and meets the minimum area requirement of 10 m². This is a rule for calculating the legally required area, not a finding of complete ecological equivalence with native soil. Where compliance depends on that credit, the relevant conditions must be substantiated by the proposed design and supporting documentation.

The judgments of the Voivodeship Administrative Courts in Gdańsk of 19 December 2012 and in Warsaw of 31 August 2017 address the capacity

[27] Article 18b(3) and Article 71(2a) of the Environmental Protection Law.

[28] J. Lundholm et al., *Plant Species and Functional Group Combinations...*

[29] M. Michalik-Śnieżek et al., *Green Roofs: Nature-Based Solution or Forced Substitute...*

of engineered surfaces to support natural vegetation. Their relevance lies in the need to examine how a grass-grid surface and its underlying layers are arranged, rather than treating a product description as sufficient evidence of biological activity.[30] These judgments predate the express retention wording introduced in 2018[31] and should not be cited as if they had interpreted that later requirement. In applying the current technical building definition to a green roof, the authors consider that the same concern for substantiation supports examining the proposed layers and the functions required under the Technical Conditions Regulation. This is an inference for present-day assessment, distinct from the specific holdings of the earlier judgments.

The judgment of the Voivodeship Administrative Court in Gdańsk of 5 November 2025 concerns the assessment of a development as a single construction undertaking.[32] Its relevance here is the need to consider the functional connections between parts of a project. At the same time, the Court rejected a requirement to submit a detailed landscaping design that had no basis in the applicable provisions, illustrating that verification must remain within the limits of legally prescribed requirements. It does not, by itself, establish a measurable retention standard for green roofs or justify treating all environmental functions as express conditions of the planning definition of BAA.

Verification of the required functions may call for specialist hydrological or ecological knowledge. Where the submitted design does not substantiate a necessary property, the assessment should identify the missing evidence within the applicable procedural framework. This difficulty supports clearer technical criteria and access to specialist expertise, but does not justify assuming either that every administrative body lacks the relevant competence or that the absence of numerical standards permits automatic acceptance of an investor's declaration.

[30] Judgment of the Voivodeship Administrative Court in Gdańsk of 19 December 2012, File No. II SA/Gd 528/12, LEX No. 1234931; Judgment of the Voivodeship Administrative Court in Warsaw of 31 August 2017, File No. VII SA/Wa 2390/16, LEX No. 2373536; discussion: *Techniczne warunki sytuowania obiektów w kontekście terenów biologicznie czynnych*, "Izolacje", https://www.izolacje.com.pl/artykul/prawo-ekonomia-rynek/284571,techniczne-warunki-sytuowania-obiektow-w-kontekscie-terenow-biologicznie-czynnych [accessed 9 September 2026].

[31] § 1 point 2 letter d and § 3 of the Regulation of the Minister of Infrastructure and Construction of 14 November 2017 amending the Regulation on the technical conditions to be met by buildings and their location (Journal of Laws of 2017, item 2285).

[32] Judgment of the Voivodeship Administrative Court in Gdańsk of 5 November 2025, File No. II SA/Gd 461/25, LEX No. 3978175.

6. Conclusions

The analysis indicates that green roofs can contribute to urban climate adaptation, but their legal qualification does not in itself establish functional equivalence with biologically active terrain on native soil. The uniform rule crediting 50% of the area of terraces and flat roofs does not reflect differences in hydrological performance or habitat quality. Substrate properties, structural solutions and vegetation development influence these functions in different ways. The research discussed in this article illustrates this variability; it neither establishes universal equivalence with native soil nor provides a validated alternative conversion ratio. Regulation based on general criteria therefore risks encouraging technically minimal solutions that meet numerical requirements without delivering the expected environmental benefits.

This problem is compounded by the difference between the two legal definitions. The Act on Spatial Planning and Development does not include the retention requirement for terraces, flat roofs and other surfaces credited towards biologically active area, whereas the technical building definition expressly links the qualification of terraces and flat roofs to vegetation and stormwater retention. The definitions should therefore be coordinated by requiring the relevant surfaces credited towards biologically active area to provide both natural plant vegetation and retention of precipitation and snowmelt water. This amendment would strengthen the connection between the planning instrument and its environmental objectives.

Administrative court jurisprudence discussed in the article underlines the need to examine whether the proposed solution can actually perform the functions required under the applicable legal regime. Verification should address the structural layers and conditions for vegetation, together with retention where required, rather than rely solely on an investor's declaration. Such assessment must remain distinct from imposing additional obligations proposed *de lege ferenda*. Its effectiveness also depends on access to specialist knowledge, particularly where hydrological or ecological properties cannot be reliably assessed through a routine examination of the construction documentation.

A further direction of reform is to replace the uniform 50% crediting factor with a graduated scale linked to retention performance and ecological potential. Such a scale would require a clearly defined reference and a consistent assessment method, rather than coefficients inferred directly from studies conducted under different conditions. Technical standards should specify minimum parameters, including substrate thickness and drainage performance, with regard to vegetation type. Retention could be assessed against an explicitly defined reference, such as comparable biologically active terrain on native soil during the growing

season. These standards would make the environmental basis of crediting different roof systems more transparent.

The 10 m² threshold should also be made more flexible for cascade systems and smaller surfaces considered as parts of an integrated solution. This flexibility should be linked to verification of their combined performance, so that a reduction in the area threshold does not undermine the intended environmental function. A mandatory hydrological opinion is proposed for developments in which green roofs account for a significant share of the required biologically active area. Mandatory technical certification, supported by clearly specified assessment standards, would further assist verification and reduce uncertainty for both investors and administrative bodies.

Together, coordination of the definitions, differentiated crediting criteria and verifiable technical standards would provide a more coherent framework for green roofs as elements of urban blue-green infrastructure. The proposed solution is to link the formal recognition of green roofs as biologically active areas to their demonstrated stormwater retention performance and ability to sustain long-term vegetation, while acknowledging the limitations of the currently available empirical evidence. Under this approach, the compensatory value of green roofs would be evaluated based on their verified functional performance rather than assumed solely from their surface area.

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Edyta Sierka, Magdalena Biela, Artur Biela

Między ekologią a regulacją prawną – status zielonych dachów jako ekwiwalentu powierzchni biologicznie czynnej w prawie polskim

Streszczenie

Celem artykułu jest ocena statusu dachów zielonych jako ekwiwalentu powierzchni biologicznie czynnej w prawie polskim, ze szczególnym uwzględnieniem retencji wód opadowych i trwałości roślinności. W opracowaniu połączono analizę dogmatyczno-prawną przepisów planistycznych i techniczno-budowlanych oraz orzecznictwa sądów administracyjnych z przeglądem literatury naukowej i wynikami własnych badań terenowych ekstensywnych dachów zielonych. Wskazano niespójność między ustawową definicją powierzchni biologicznie czynnej a definicją terenu

biologicznie czynnego zawartą w przepisach techniczno-budowlanych: ta pierwsza nie uwzględnia wymogu retencji w odniesieniu do tarasów i stropodachów, podczas gdy ta druga wyraźnie go uwzględnia. Jednolita zasada zaliczania 50% powierzchni tarasów i stropodachów jako powierzchni biologicznie czynnej nie odzwierciedla zróżnicowania efektywności hydrologicznej i potencjału ekologicznego. Wyniki badań empirycznych wskazują na znaczenie roślinności dla aktywności mikrobiologicznej substratu, jednak w początkowych latach doświadczenia nie wykazano istotnego statystycznie wpływu zagęszczenia roślin na retencję. W artykule postuluje się skoordynowanie obu definicji prawnych oraz powiązanie kwalifikacji dachów zielonych z weryfikowalnymi parametrami technicznymi i funkcjonalnymi, obejmującymi zdolność retencyjną i warunki trwałej wegetacji. Takie podejście służyłoby wzmocnieniu związku między zgodnością formalną a środowiskowymi celami regulacji.

Słowa kluczowe: dachy zielone, powierzchnia biologicznie czynna, teren biologicznie czynny, retencja wód opadowych, różnorodność biologiczna, prawo planowania przestrzennego

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Между экологией и правовым регулированием: статус зеленых кровель как эквивалента биологически активной поверхности в польском законодательстве

Аннотация

Цель данной статьи – оценить статус зеленых кровель как эквивалента биологически активной поверхности в польском законодательстве, уделив особое внимание вопросам удержания дождевых вод и долговечности растительности. Работа сочетает в себе доктринально-правовой анализ норм территориального планирования и строительно-технических регламентов, а также практики административных судов, с обзором научной литературы и результатами собственных полевых исследований экстенсивных зеленых кровель. Выявлено несоответствие между правовой дефиницией «биологически активной поверхности» и определением «биологически активной территории», содержащимся в строительно-технических регламентах: первая не учитывает требования к водоудержанию на террасах и плоских кровлях, тогда как второе прямо включает их в сферу регулирования. Унифицированное правило, согласно которому 50% площади террас и плоских кровель считается биологически активной поверхностью, не отражает различий в гидрологической эффективности и экологическом потенциале таких объектов. Результаты эмпирического исследования подтверждают важность растительности для микробиологической активности субстрата; однако в первые годы эксперимента не было выявлено статистически значимого влияния плотности посадки растений на водоудерживающую способность. В статье обосновывается необходимость согласования обоих правовых определений, а также связи классификации зеленых кровель с поддающимися проверке техническими и функциональными параметрами, включая водоудерживающую способность и условия длительной вегетации. Такой подход позволил бы укрепить связь между формальным соответствием и экологическими целями регламентов.

Ключевые слова: зеленые кровли, биологически активная поверхность, биологически активная территория, удержание осадков; биологическое разнообразие, нормы пространственного планирования

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Tra ecologia e normativa: lo status dei tetti verdi come equivalente di una superficie biologicamente attiva nel diritto polacco

Sommario

Lo scopo del presente articolo è valutare lo status dei tetti verdi come equivalente di una superficie biologicamente attiva nel diritto polacco, con particolare attenzione alla ritenzione delle acque piovane e alla durata della vegetazione. Lo studio combina l'analisi dogmatico-giuridica delle norme urbanistiche e tecnico-edilizie, nonché della giurisprudenza dei tribunali amministrativi, con una rassegna della letteratura scientifica e i risultati delle proprie ricerche sul campo relative ai tetti verdi estensivi. È stata evidenziata un'incoerenza tra la definizione legale di superficie biologicamente attiva e quella di terreno biologicamente attivo contenuta nelle norme tecnico-edilizie: la prima non tiene conto del requisito di ritenzione per quanto riguarda terrazze e tetti piani, mentre la seconda lo considera espressamente. La regola uniforme che prevede di considerare il 50% della superficie delle terrazze e dei tetti piani come superficie biologicamente attiva non riflette la diversificazione dell'efficacia idrologica e del potenziale ecologico. I risultati delle ricerche empiriche indicano l'importanza della vegetazione per l'attività microbiologica del substrato; tuttavia, nei primi anni dell'esperimento non è stato dimostrato un effetto statisticamente significativo della densità della vegetazione sulla ritenzione. L'articolo propone di coordinare entrambe le definizioni giuridiche e di collegare la qualificazione dei tetti verdi a parametri tecnici e funzionali verificabili, che includano la capacità di ritenzione e le condizioni per una vegetazione permanente. Tale approccio contribuirebbe a rafforzare il legame tra la conformità formale e gli obiettivi ambientali della normativa.

Parole chiave: tetti verdi, superficie biologicamente attiva, area biologicamente attiva, ritenzione delle acque piovane; biodiversità, diritto urbanistico