

ANALYTICAL PAPER

Biophilic Cities

Nature as infrastructure, not decoration

Principles, measurable effects, world cases, and planning green space with verifiable indicators

Analytical platform **gosplan2.ru**

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1. Introduction: the city as a designed environment

More than half of humanity lives in cities, and that share keeps growing. The city is the only environment humans designed entirely themselves — which is precisely why it turned out to be an environment humans are not biologically adapted to: overheating, noise, polluted air, no living nature in sight.

The classical answer to these problems is an engineering one: more air conditioning, more storm sewers, more filters. It works, but it is expensive, energy-hungry, maintenance-heavy, and it treats symptoms. Biophilic urbanism proposes something different: **redesign the city so that natural systems work as engineering infrastructure** — cooling, filtering, retaining water and restoring people. Not "adding greenery" to a finished design, but making greenery part of the load-bearing structure.

This paper examines what stands behind the approach: the definition and origin of the idea, its measurable standards, six core principles, documented effects, working cases, and — importantly for this platform — how green infrastructure fits the logic of open planning. A separate section provides a directory of verified primary sources: networks, municipal programmes and methodologies for studying the subject without intermediaries.

2. What a biophilic city is

A biophilic city is one where **access to living nature is treated as a basic utility**, on a par with water, electricity and transport. Trees, water bodies, soils and biodiversity are not "amenities" funded with whatever is left over, but infrastructure with a measurable function: they lower temperatures, absorb stormwater, clean the air and directly affect residents' health.

The term goes back to the **biophilia hypothesis** of the biologist Edward Wilson (Biophilia, 1984): humans have an innate affinity for living things and natural forms, shaped by the whole evolutionary history of the species. An entire school of urban planning grew out of that hypothesis, systematized by Timothy Beatley (University of Virginia). Since 2013 there has been an international **Biophilic Cities** network of partner cities from Singapore and Wellington to Birmingham and Oslo.

The key difference between the biophilic approach and ordinary landscaping lies in the status nature holds in the project. Ordinary landscaping asks: "how much greenery can we afford once everything else has been designed?" The biophilic approach asks: "what function must this natural system perform, and what does it need in order to perform it?" The second question automatically produces an operating budget, indicators and responsible parties — things the first question almost never yields.

3. The 3–30–300 rule and other measurable standards

The main weakness of "green city" rhetoric is that it cannot be measured. The **3–30–300** standard, formulated and argued for by Cecil Konijnendijk, removes that weakness:

Indicator	Requirement	What it secures
3 trees	At least three trees visible from every window	The psychological effect: attention restoration and stress reduction at the level of everyday experience
30% canopy	Tree canopy covering at least 30% of every neighbourhood	Microclimate: shade, evaporative cooling, reduction of the heat-island effect
300 metres	No more than 300 m to the nearest park or green space	Accessibility: physical activity, social contact, actual use of green space

The value of the standard lies not only in the numbers but in **how it is verified**. Canopy cover is measured from satellite imagery, park accessibility from open geodata, the number of trees visible from a window from the building model. None of these indicators requires trusting a contractor's or a municipality's report: any independent researcher can recompute them. This is what fundamentally separates 3–30–300 from indicators like "N trees planted", which cannot be verified and are therefore easy to manipulate.

Complementary standards used in international practice: the share of permeable surfaces in a block, the green plot ratio, the volume of retained stormwater, and habitat connectivity indices. All are built on the same principle — a physically measurable result instead of a spent budget.

4. Six principles of a biophilic city

4.1. Nature within walking distance

Greenery is distributed across the whole city rather than concentrated in a few showcase parks. The key indicator is not the total green area in the city but the distance from a front door to it. A city with one enormous park and bare residential districts may look greener in the formal statistics than a city with an even network of small squares — but it is not biophilic.

4.2. Green roofs and facades

The building becomes part of the ecosystem rather than an isolated box. A planted roof retains stormwater, reduces heat gain and extends the life of the waterproofing by shielding it from ultraviolet light and temperature swings. Vertical greenery acts as a filter and as additional thermal insulation. An important caveat: both technologies require continuous maintenance and must be designed together with their operating budget.

4.3. Daylighting rivers and blue infrastructure

Rivers and streams, buried in culverts en masse during the 20th century, are returned to the surface. Rain gardens, permeable surfaces and retention ponds replace part of the storm sewer and absorb peak loads during heavy rainfall. Natural infrastructure competes directly with concrete here — and often wins on life-cycle cost, since it does not need replacing after thirty years.

4.4. Biodiversity and ecological corridors

Individual green patches are linked into a continuous network that birds, insects and small animals can move along. An isolated square is ecologically almost useless: a population cut off from the others degrades. What works is **connectivity** — which is why, in biophilic planning, a narrow green strip along a road can be worth more than a large but isolated park.

4.5. Daylight, forms and materials

Daylight, a view of nature from the window, natural ventilation, wood and stone in the finishes. This is the scale of the individual building and interior, where biophilia affects well-being directly. It is also the level worked out in the greatest methodological detail — above all in the report "14 Patterns of Biophilic Design".

4.6. Urban agriculture

Community gardens, school plots, edible landscapes. Beyond food (whose volumes are usually modest) they provide what an ordinary lawn cannot: **resident participation and hands-on care for the territory**. Land that someone personally tends degrades incomparably more slowly than land serviced by a contractor under a contract.

5. What it delivers: measurable effects

Biophilia is not an aesthetic stance but a set of measurable effects. That is exactly why it fits the logic of planning: every principle has an indicator that can be verified.

Domain	Effect	How it is verified
Health and mind	Lower stress levels, better recovery from illness, lower prevalence of anxiety disorders. For a city budget, a direct saving on healthcare	Medical statistics by district, matched against a map of green accessibility
Temperature	Air temperature in a neighbourhood lowered by several degrees through shade and evaporation. With heatwaves becoming more frequent, a matter of survival for vulnerable groups	Sensor network, satellite thermal imaging
Water	Retention of part of the precipitation, reducing peak sewer load and flooding risk	Sewer telemetry, runoff modelling
Air and biodiversity	Capture of part of the particulate matter and noise; the return of birds and pollinators to the city	Air monitoring stations, species surveys
Local economy	Rising property values, retention of residents and businesses, lower building cooling costs	Transaction data, electricity bills

The last row deserves a separate comment: that very same economic effect generates the model's main social risk — green gentrification, which we return to in section 8.

6. World cases

None of the projects listed was "greening for beauty" — each solved a specific engineering or social problem.

- **Singapore: "City in Nature".** A state landscape replacement policy: a developer must return to the building an amount of greenery equivalent to the land it occupies. The key point is that the standard is embedded in planning regulation rather than left to a developer's goodwill.
- **Seoul: the Cheonggyecheon river.** Where an elevated highway was dismantled in the city centre, a culverted river was brought back to the surface — nearly 6 km of public space. The riverside is noticeably cooler than the neighbouring streets, and birds and fish have returned. The project showed that removing transport infrastructure in favour of natural infrastructure is politically possible.
- **Milan: Bosco Verticale.** Two residential towers with hundreds of trees and thousands of plants on the balconies. The project demonstrated both the potential of a vertical forest and its price: such a system requires constant professional care, including rope access for pruning.
- **Copenhagen: cloudburst plans.** After the devastating downpour of 2011 the city shifted to blue-green infrastructure: streets that act as channels, parks that act as reservoirs, squares that become basins during a flood. Climate adaptation here became a construction programme rather than a declaration.

- **The Biophilic Cities network.** An international partnership of cities that maintain open nature metrics — canopy cover, park accessibility, biodiversity. It is precisely open reporting that separates a working programme from a handsome declaration.

7. The link to open planning

Green infrastructure is an almost ideal proving ground for open planning. Its results are physically measurable, confirmed by independent data sources, and directly relevant to every resident. None of these properties holds for, say, "digitalizing public administration in general".

Pathology of ordinary urban greening	Open planning mechanism
Goals come down from above — "green N hectares" — with no connection to what residents of a particular block need	Democratic goal-setting: residents of a neighbourhood vote on canopy share, tree count and priority — shade, water or a playground. The centre sets only a minimum frame and limits
A contractor's report cannot be verified: planted or not, survived or not	Independent verification: canopy cover is measured from satellite imagery, temperature and air quality from a sensor network — not from a report
"Planted and forgotten": paying for the act of planting makes the death of saplings economically irrelevant to the contractor	Payment tied to survival: a smart contract releases the bulk of the payment not for planting but for living trees two or three years later
Opacity: finding out what was planted in your courtyard and when requires an official request	Open registry: every tree, its species, planting date, contractor and status are publicly visible

Note the shared logic across all four rows: technology does not replace the decision, it makes the decision verifiable. The goal is still set by people — the residents of the block; the smart contract merely guarantees that payment follows the result rather than the spending of a budget. This is exactly the separation of goal-setting from execution that underpins the whole open planning model.

8. Risks and honest caveats

Biophilic urbanism is not a problem-free solution, and glossing over its costs leads to the same errors as technological optimism in digital planning.

GREEN GENTRIFICATION

A well-landscaped green district becomes expensive, and existing residents are displaced by those who can pay more. Without housing policy, greening works as a mechanism of displacement: the winners are not the people the project was meant for. This is the most serious and best-documented risk.

GREENWASHING

Renderings with trees on facades are used to get approval for projects that in reality contain neither greenery nor a budget to maintain it. Hence the demand for verifiable indicators instead of renderings: a rendering is not a commitment.

MAINTENANCE COSTS

A green roof, a vertical forest and a daylighted river require irrigation, pruning and specialists for decades. A project without a built-in operating budget turns into a ruin within a few years and discredits the whole approach.

GAMING THE INDICATORS

An indicator like "number of trees planted" instantly produces mass plantings of cheap saplings that do not survive. This is Goodhart's law in its purest form. Only a living-canopy metric with deferred verification works — that is, an indicator that cannot be satisfied at the moment of reporting.

A separate honest caveat concerns the evidence base. The effects of greenery on health are reliably established as correlations, but isolating the causal contribution of greening itself from the bundle of confounding factors (income, density, transport) is difficult. This is no reason to abandon the approach, but it is a reason not to ascribe miraculous properties to trees and not to let greenery substitute for tackling emission sources.

9. Directory: projects like this around the world

Behind every principle there are working municipal programmes, international networks and open methodologies. Below are verified primary sources where you can read the standards, the reporting and the actual projects without relying on second-hand summaries. All links were verified working at the time of publication.

9.1. International networks and platforms

Biophilic Cities Network

The biophilic cities network founded by Timothy Beatley (University of Virginia). Partner cities maintain open nature metrics and publish reports.

<https://www.biophiliccities.org/>

CitiesWithNature

A global platform by ICLEI and partners: cities register their urban-nature commitments and report on them publicly.

<https://citieswithnature.org/>

The Nature of Cities

An international forum of urban-nature researchers, designers and practitioners: essays, cases, debates.

<https://www.thenatureofcities.com/>

C40 Cities

A network of major cities on the climate agenda. Its adaptation and green-infrastructure sections carry city plans and calculations.

<https://www.c40.org/>

9.2. Cities and specific projects

NParks Singapore

Singapore's national agency responsible for the "City in Nature" policy and the landscape replacement rules applied to new development.

<https://www.nparks.gov.sg/>

Gardens by the Bay

Singapore's flagship park and a showcase of biophilic engineering: biodomes, supertrees, closed energy and water loops.

<https://www.gardensbythebay.com.sg/>

Seoul Metropolitan Government

The Seoul city government portal, with material on the restoration of the Cheonggyecheon river where an elevated highway once stood.

<https://english.seoul.go.kr/>

Bosco Verticale — Stefano Boeri Architetti

The Vertical Forest project page from its authors: planting composition, engineering, and follow-up projects.

<https://www.stefanoboeriarchitetti.net/en/project/vertical-forest/>

State of Green (Denmark)

Denmark's official green-solutions portal: Copenhagen's blue-green infrastructure and its cloudburst management plans.

<https://stateofgreen.com/en/>

Wellington City Council

Wellington is one of the partner cities of the biophilic cities network; programmes on natural capital and urban ecological corridors.

<https://wellington.govt.nz/>

Birmingham City Council

Birmingham is a network partner; greening and urban forestry programmes in a large industrial city.

<https://www.birmingham.gov.uk/>

9.3. Standards, methods, certifications

Nature Based Solutions Institute

The institute where the 3–30–300 rule was published and argued for (Cecil Konijnendijk).

<https://nbsi.eu/>

Terrapin Bright Green — 14 Patterns of Biophilic Design

The baseline methodology for biophilic design at the building and interior scale.

<https://www.terrapinbrightgreen.com/reports/14-patterns/>

Living Future Institute

The Living Building Challenge — one of the strictest "living building" standards, including requirements for connection to nature.

<https://living-future.org/>

The directory is informational and does not imply endorsement of the organizations listed.

10. Conclusion

A biophilic city is not a city with more flower beds but a city in which natural systems are part of the engineering calculation and have their own budget, indicators and responsible parties. The difference between the two is not aesthetic but institutional: a flower bed has no function it can fail to perform, whereas a green roof sized to retain stormwater does.

This approach requires planning precisely. A connected green network cannot be built through one-off projects: connectivity is a property of the whole, not of the sum of the parts. The market on its own does not solve the problem either, since shade, clean air and a living river are public goods that cannot be charged for per user — which means nobody has an interest in producing them in the required volume.

Shade, clean air and a living river are public goods that cannot be sold by the unit. That is exactly why they require a plan — and the transparency of that plan is the only protection against greening that exists only on paper.

11. Sources

1. Wilson E. O. Biophilia. Harvard University Press, 1984 — the original formulation of the biophilia hypothesis.
2. Beatley T. Biophilic Cities: Integrating Nature into Urban Design and Planning. Island Press, 2011 — systematization of the approach and founding of the Biophilic Cities network.
3. Konijnendijk C. C. The 3-30-300 Rule for Urban Forestry and Greener Cities — the rationale for the standard, Nature Based Solutions Institute.
4. Browning W., Ryan C., Clancy J. 14 Patterns of Biophilic Design. Terrapin Bright Green, 2014.
5. Municipal programme materials: NParks Singapore, Seoul Metropolitan Government, State of Green (Denmark), Wellington City Council, Birmingham City Council.
6. Materials of the gosplan2.ru analytical platform: "The Open Planning System", "Answer to the Critique of Technocracy", "Neocameralism vs Open Planning".