

Supplementary Information

Auditing urban nature access claims for sustainable city governance

This Supplementary Information provides tabular source evidence, sensitivity diagnostics and figures for the npj Urban Sustainability manuscript. Source-file names are retained so that each display item can be traced to the data/code package.

Supplementary Tables

Supplementary Table 1. Policy-screen evidence map

Biodiversity-policy evidence used to contextualize the city cases. Scores record evidence presence, not policy effectiveness.

Criterion	City	Document	Page/section	Evidence summary	Score	Confidence
Biodiversity goals	Berlin	berlin_lapro	1176-1184; 1771-1783	Berlin's LaPro includes a landscape programme with species protection, biotope/species protection and biological diversity components.	2	high
Green-blue area	Berlin	berlin_charta_stadtgruen	source_ screen	Berlin's city-green charter aims to protect, strengthen and expand high-quality green infrastructure through an action programme to 2030.	2	high
Ecological quality	Berlin	berlin_bff	source_ screen	Berlin's Biotope Area Factor is a planning instrument that evaluates ecologically effective surfaces in development.	2	high
Connectivity	Berlin	berlin_lapro	1181-1183; 1503-1508	LaPro includes biotope networks and biological diversity; Berlin's nature pages include biotope-network materials.	2	high
Equitable access	Berlin	berlin_lapro	1757-1760	LaPro's recreation and open-space programme aims for all Berliners to have sufficient nearby recreational spaces.	1	medium
Health or heat benefits	Berlin	berlin_bff	source_ screen	BFF and city-green planning connect green surfaces to climate adaptation, microclimate and livability.	2	high
Implementation or governance	Berlin	berlin_charta_stadtgruen	source_ screen	The city-green charter is paired with an action programme, monitoring and administrative implementation structures.	2	high
Anti-displacement safeguards	Berlin	berlin_green_corpus	corpus_ screen	Reviewed landscape and green-planning sources do not directly include rent protection, tenant protection or anti-green-gentrification mechanisms.	0	medium
Biodiversity goals	Cape Town	cape_town_lbsap	249-254; 1171-1180	Cape Town's LBSAP focuses on protection and conservation of biodiversity/natural assets, invasive species control and commitment to biodiversity goals.	2	high
Green-blue area	Cape Town	cape_town_lbsap	611-614; 2149-2151	The LBSAP sets a target of conserving 65% of the Biodiversity Network and increasing conservation land through partnerships, stewardship and land acquisition.	2	high
Ecological quality	Cape Town	cape_town_lbsap	1186-1194; 1210-1216	The LBSAP recognizes unique biodiversity, ecosystem functioning, restoration needs and conservation targets across protected areas.	2	high
Connectivity	Cape Town	cape_town_lbsap	79-83; 1186-1194	BioNet spatially locates sites needed to meet conservation targets and includes river corridors/wetlands; the plan notes that connectivity between conserved areas needs improvement.	2	high

Criterion	City	Document	Page/section	Evidence summary	Score	Confidence
Equitable access	Cape Town	cape_town_lbsap	1171-1177; 1623-1647; 2153-2162	The LBSAP includes equitable access to biodiversity areas, annual review of reserve entrance fees, visitor-profile research and multipurpose recreation/education facilities where lower-income communities can benefit.	2	high
Health or heat benefits	Cape Town	cape_town_climate_policy_2017	803-831; 925-929	Cape Town's Climate Change Policy promotes ecosystem restoration, ecological infrastructure, urban greening to reduce heat-island impacts and health-aware design of recreational spaces.	2	high
Implementation or governance	Cape Town	cape_town_lbsap	1433-1482; 2106-2115	The LBSAP defines timeframes, budget approval processes, implementation outputs, protected-area expansion tools, funding mechanisms and quarterly/annual reporting templates.	2	high
Anti-displacement safeguards	Cape Town	cape_town_lbsap	document_screen	Reviewed LBSAP and Climate Change Policy materials discuss lower-income community benefits and equitable distribution but do not directly include rent protection, affordable housing or anti-displacement safeguards around greening.	0	medium
Biodiversity goals	São Paulo	sao_paulo_pmma	87-92	PMMA is a legal instrument for conservation and recovery of native Atlantic Forest vegetation and biodiversity, with priority areas/actions and monitoring.	2	high
Green-blue area	São Paulo	sao_paulo_planpavel	31-34; 211-225; 281-283	PLANPAVEL aims to increase public and private vegetation cover, expand and requalify green public areas, and prioritize densely occupied territories lacking vegetation and public leisure areas.	2	high
Ecological quality	São Paulo	sao_paulo_pmau	140-143	PMAU prioritizes native tree species, recognizes 673 native Atlantic Forest tree species in the city, and includes actions to manage invasive exotic species.	2	high
Connectivity	São Paulo	sao_paulo_trilha_interparques	132-137	Trilha Interparques connects municipal conservation units and other protected areas across a 182 km route, strengthening connection between protected natural areas and valuing biodiversity.	2	medium
Equitable access	São Paulo	sao_paulo_planpavel	33; 83-87; 281-283; 1196-1198	PLANPAVEL explicitly prioritizes green-area expansion/requalification in densely occupied districts with social vulnerability, leisure-space deficits and high climate-risk vulnerability.	2	high
Health or heat benefits	São Paulo	sao_paulo_planpavel	83-86; 225-226; 2287-2303	PLANPAVEL links green-space planning to climate change, high surface temperatures, health, well-being and ecosystem-service benefits.	2	high
Implementation or governance	São Paulo	sao_paulo_pmau	144-150	PMAU was prepared through multi-secretariat and public participation, has a 20-year term, five-year reviews, 170 actions and an implementation-monitoring panel.	2	high
Anti-displacement safeguards	São Paulo	sao_paulo_planpavel	page_screen	Reviewed PMAU, PMMA and PLANPAVEL materials prioritize vulnerable territories and participation but do not directly include rent protection, affordable housing, tenant protection or anti-green-gentrification safeguards.	0	medium

Source file: urban_nature_policy_screen_evidence_v1.3.csv

Supplementary Table 2. Source-specification crosswalk

Operational source definitions behind each inventory and geometry claim.

City	Source layer	Year/access	Included categories	Public access interpretation	Entrance/access points	Specification	Expected bias/limitation
Berlin	OSM green-blue	2026 extraction	parks/gardens/recreation/nature + broad blue tags	mixed; private/no access excluded	no	core policy specification	OSM completeness and tag semantics
Berlin	Official core green-blue	2026 service pulls	Gruenanlagen core + ATKIS hydrography core	official mapped inventory, not all public-use access	no	core policy specification	conservative official categories may omit informal usable spaces
Berlin	Official broad green-blue	2026 service pulls	broad official green-blue categories	official mapped inventory, not all public-use access	no	extended stress-test	category expansion can overstate usable access
Berlin	Official broad green walking	2026 network run	official green-only boundary targets	mapped green targets; entrances not harmonized	boundary sampled, not entrances	construct-sensitivity layer	pure distance penalty uses 84.87% green Euclidean baseline
Cape Town	OSM green-blue	2026 extraction	parks/gardens/recreation/nature + broad blue tags	mixed; private/no access excluded	no	core policy specification	OSM under/over-representation and informal access uncertainty
Cape Town	Official core green-blue	2026 service pulls	City parks + core blue service categories	official mapped inventory, publicness varies by category	no	core policy specification	official categories can expand near-home exposure
Cape Town	Official broad green-blue walking	2026 network run	broad official green-blue boundary targets	publicness and entry points not harmonized	boundary sampled, not entrances	construct-sensitivity layer	historical 2015 informality overlay limits current equity interpretation
São Paulo	OSM green-blue	2026 extraction	parks/gardens/recreation/nature + broad blue tags	mixed; private/no access excluded	no	core policy specification	tag completeness and blue-feature semantics
São Paulo	Official core green-blue	2026 GeoSampa/Habitasampa pulls	municipal green + core hydrography	official mapped inventory, not all public-use access	no	core policy specification	core hydrography can change favela/precario-housing gaps
São Paulo	Official broad green-blue walking	2026 network run	broad official green-blue boundary targets	publicness and entry points not harmonized	boundary sampled, not entrances	construct-sensitivity layer	broad hydrography can overstate practical access
Bogotá	Official green-blue prototype	2026 cached service probe	official parks + water layers	available-layer source check	no	transfer check only	tests source-definition sensitivity only
Los Angeles	Official green-blue prototype	2026 cached service probe	county/city parks + blue layers	available-layer source check	no	transfer check only	tests source-definition sensitivity only
London	OS Open Greenspace access points	2026 OS product	official pedestrian-capable access points	official mapped access-point layer	yes, official mapped	transfer access-point validation	not field/image verified; validates operational distance model

Source file: [urban_nature_source_specification_crosswalk_v1.3.csv](#)

Supplementary Table 3. Fixed 300 m access-point values

Population-weighted access percentages under the fixed 300 m protocol.

City	Scenario	Target	Metric	m	Access (%)	Specification
Berlin	OSM 300	green-blue	euclidean	300	85.92	core_300m_main
Berlin	Official core 300	green-blue	euclidean	300	81.46	core_300m_main
Berlin	Official broad 300	green-blue	euclidean	300	89.45	core_300m_main
Berlin	Broad walking 300	official_green_only	boundary-sampled walking	300	57.28	core_300m_main
Cape Town	OSM 300	green-blue	euclidean	300	58.07	core_300m_main
Cape Town	Official core 300	green-blue	euclidean	300	91.16	core_300m_main
Cape Town	Official broad 300	green-blue	euclidean	300	95.41	core_300m_main
Cape Town	Broad walking 300	mixed scope	boundary-sampled walking	300	71.38	core_300m_main
São Paulo	OSM 300	green-blue	euclidean	300	86.04	core_300m_main
São Paulo	Official core 300	green-blue	euclidean	300	83.85	core_300m_main
São Paulo	Official broad 300	green-blue	euclidean	300	96.49	core_300m_main
São Paulo	Broad walking 300	mixed scope	boundary-sampled walking	300	75.89	core_300m_main

Source file: urban_nature_fixed_300m_access_points_v1.3.csv

Supplementary Table 4. Fixed 300 m diagnostic summary

City-level robustness-envelope diagnostics reported in the main text.

City	Available-layer range (pp)	Source range (pp)	Distance penalty (pp)	Median (%)	IQR (%)	Leave-one-extreme range (pp)	Interpretation
Berlin	32.17	7.99	27.59	83.69	11.39	7.99	same-city green-only distance penalty: broad green Euclidean 84.87% minus broad green walking 57.28%
Cape Town	37.34	37.34	24.03	81.27	24.17	24.03	green-blue distance penalty: official broad Euclidean 300 m minus boundary-sampled walking 300 m
São Paulo	20.6	12.64	20.6	84.94	6.79	10.15	green-blue distance penalty: official broad Euclidean 300 m minus boundary-sampled walking 300 m

Source file: urban_nature_fixed_300m_access_summary_v1.3.csv

Supplementary Table 5. Extended threshold envelope values

The 500 m and 1000 m tiers act as threshold-sensitivity checks rather than replacement targets.

City	Scenario	Target	Metric	m	Access (%)	Specification
Berlin	OSM 300	green-blue	euclidean	300	85.92	core_300m_main
Berlin	Official core 300	green-blue	euclidean	300	81.46	core_300m_main
Berlin	Official broad 300	green-blue	euclidean	300	89.45	core_300m_main
Berlin	Broad walking 300	official_green_only	boundary-sampled walking	300	57.28	core_300m_main
Berlin	Broad walking 500	official_green_only	boundary-sampled walking	500	81.73	extended_threshold_sensitivity
Berlin	Broad walking 1000	official_green_only	boundary-sampled walking	1000	96.86	extended_threshold_sensitivity
Cape Town	OSM 300	green-blue	euclidean	300	58.07	core_300m_main
Cape Town	Official core 300	green-blue	euclidean	300	91.16	core_300m_main
Cape Town	Official broad 300	green-blue	euclidean	300	95.41	core_300m_main
Cape Town	Broad walking 300	mixed scope	boundary-sampled walking	300	71.38	core_300m_main
Cape Town	Broad walking 500	mixed scope	boundary-sampled walking	500	92.81	extended_threshold_sensitivity
Cape Town	Broad walking 1000	mixed scope	boundary-sampled walking	1000	99.57	extended_threshold_sensitivity
São Paulo	OSM 300	green-blue	euclidean	300	86.04	core_300m_main
São Paulo	Official core 300	green-blue	euclidean	300	83.85	core_300m_main
São Paulo	Official broad 300	green-blue	euclidean	300	96.49	core_300m_main
São Paulo	Broad walking 300	mixed scope	boundary-sampled walking	300	75.89	core_300m_main
São Paulo	Broad walking 500	mixed scope	boundary-sampled walking	500	95.21	extended_threshold_sensitivity
São Paulo	Broad walking 1000	mixed scope	boundary-sampled walking	1000	99.9	extended_threshold_sensitivity

Source file: urban_nature_extended_threshold_envelope_points_v1.3.csv

Supplementary Table 6. Environmental-justice gap classification

Gaps are vulnerability-zone no-access share minus outside-zone no-access share.

City	Overlay	Scenario	Gap (pp)	Gap	Directional class	Overlay note
Berlin	Berlin MSS 2023 low/very low Status-Index	OSM 300	-7.2	7.2	vulnerable lower no-access	Planungsraum Status-Index overlay; walking points are official green-only
Berlin	Berlin MSS 2023 low/very low Status-Index	Official core 300	-11.64	11.64	vulnerable lower no-access	Planungsraum Status-Index overlay; walking points are official green-only
Berlin	Berlin MSS 2023 low/very low Status-Index	Official broad 300	-7.72	7.72	vulnerable lower no-access	Planungsraum Status-Index overlay; walking points are official green-only
Berlin	Berlin MSS 2023 low/very low Status-Index	Broad walking 300	-16.3	16.3	vulnerable lower no-access	Planungsraum Status-Index overlay; walking points are official green-only
Berlin	Berlin MSS 2023 low/very low Status-Index	Broad walking 500	-9.36	9.36	vulnerable lower no-access	Planungsraum Status-Index overlay; walking points are official green-only
Berlin	Berlin MSS 2023 low/very low Status-Index	Broad walking 1000	0.2	0.2	uncertain within +/-2 pp	Planungsraum Status-Index overlay; walking points are official green-only
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	OSM 300	17.6	17.6	vulnerable higher no-access	historical-informality stress test
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Official core 300	0.62	0.62	uncertain within +/-2 pp	historical-informality stress test
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Official broad 300	0.6	0.6	uncertain within +/-2 pp	historical-informality stress test
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Broad walking 300	-4.64	4.64	vulnerable lower no-access	historical-informality stress test
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Broad walking 500	-1.76	1.76	uncertain within +/-2 pp	historical-informality stress test
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Broad walking 1000	-0.41	0.41	uncertain within +/-2 pp	historical-informality stress test
São Paulo	São Paulo broader precarious-housing overlay	OSM 300	9.58	9.58	vulnerable higher no-access	local housing vulnerability overlay
São Paulo	São Paulo broader precarious-housing overlay	Official core 300	-2.44	2.44	vulnerable lower no-access	local housing vulnerability overlay
São Paulo	São Paulo broader precarious-housing overlay	Official broad 300	-3.09	3.09	vulnerable lower no-access	local housing vulnerability overlay
São Paulo	São Paulo broader precarious-housing overlay	Broad walking 300	1.62	1.62	uncertain within +/-2 pp	local housing vulnerability overlay
São Paulo	São Paulo broader precarious-housing overlay	Broad walking 500	-0.13	0.13	uncertain within +/-2 pp	local housing vulnerability overlay
São Paulo	São Paulo broader precarious-housing overlay	Broad walking 1000	-0.14	0.14	uncertain within +/-2 pp	local housing vulnerability overlay
São Paulo	São Paulo favela-zone overlay	OSM 300	6.87	6.87	vulnerable higher no-access	local housing vulnerability overlay
São Paulo	São Paulo favela-zone overlay	Official core 300	-3.04	3.04	vulnerable lower no-access	local housing vulnerability overlay
São Paulo	São Paulo favela-zone overlay	Official broad 300	-1.77	1.77	uncertain within +/-2 pp	local housing vulnerability overlay
São Paulo	São Paulo favela-zone overlay	Broad walking 300	3.82	3.82	vulnerable higher no-access	local housing vulnerability overlay
São Paulo	São Paulo favela-zone overlay	Broad walking 500	0.89	0.89	uncertain within +/-2 pp	local housing vulnerability overlay
São Paulo	São Paulo favela-zone overlay	Broad walking 1000	-0.19	0.19	uncertain within +/-2 pp	local housing vulnerability overlay

Source file: urban_nature_ej_gap_classification_v1.3.csv

Supplementary Table 7. Equity directional-rule sensitivity

Directional labels are reclassified under ± 1 , ± 2 and ± 5 percentage-point materiality rules.

City	Overlay	Scenario	Gap (pp)	+/-1 pp	+/-2 pp	+/-5 pp	1 to 2 change	2 to 5 change
Berlin	Berlin MSS 2023 low/very low Status-Index	OSM 300	-7.2	vulnerable lower no-access	vulnerable lower no-access	vulnerable lower no-access	False	False
Berlin	Berlin MSS 2023 low/very low Status-Index	Official core 300	-11.64	vulnerable lower no-access	vulnerable lower no-access	vulnerable lower no-access	False	False
Berlin	Berlin MSS 2023 low/very low Status-Index	Official broad 300	-7.72	vulnerable lower no-access	vulnerable lower no-access	vulnerable lower no-access	False	False
Berlin	Berlin MSS 2023 low/very low Status-Index	Broad walking 300	-16.3	vulnerable lower no-access	vulnerable lower no-access	vulnerable lower no-access	False	False
Berlin	Berlin MSS 2023 low/very low Status-Index	Broad walking 500	-9.36	vulnerable lower no-access	vulnerable lower no-access	vulnerable lower no-access	False	False
Berlin	Berlin MSS 2023 low/very low Status-Index	Broad walking 1000	0.2	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	OSM 300	17.6	vulnerable higher no-access	vulnerable higher no-access	vulnerable higher no-access	False	False
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Official core 300	0.62	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Official broad 300	0.6	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Broad walking 300	-4.64	vulnerable lower no-access	vulnerable lower no-access	uncertain within +/-5 pp	False	True
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Broad walking 500	-1.76	vulnerable lower no-access	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
Cape Town	Cape Town historical informal-settlement stress test (2015 metadata)	Broad walking 1000	-0.41	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
São Paulo	São Paulo broader precarious-housing overlay	OSM 300	9.58	vulnerable higher no-access	vulnerable higher no-access	vulnerable higher no-access	False	False
São Paulo	São Paulo broader precarious-housing overlay	Official core 300	-2.44	vulnerable lower no-access	vulnerable lower no-access	uncertain within +/-5 pp	False	True
São Paulo	São Paulo broader precarious-housing overlay	Official broad 300	-3.09	vulnerable lower no-access	vulnerable lower no-access	uncertain within +/-5 pp	False	True
São Paulo	São Paulo broader precarious-housing overlay	Broad walking 300	1.62	vulnerable higher no-access	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
São Paulo	São Paulo broader precarious-housing overlay	Broad walking 500	-0.13	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
São Paulo	São Paulo broader precarious-housing overlay	Broad walking 1000	-0.14	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
São Paulo	São Paulo favela-zone overlay	OSM 300	6.87	vulnerable higher no-access	vulnerable higher no-access	vulnerable higher no-access	False	False
São Paulo	São Paulo favela-zone overlay	Official core 300	-3.04	vulnerable lower no-access	vulnerable lower no-access	uncertain within +/-5 pp	False	True
São Paulo	São Paulo favela-zone overlay	Official broad 300	-1.77	vulnerable lower no-access	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
São Paulo	São Paulo favela-zone overlay	Broad walking 300	3.82	vulnerable higher no-access	vulnerable higher no-access	uncertain within +/-5 pp	False	True
São Paulo	São Paulo favela-zone overlay	Broad walking 500	0.89	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True
São Paulo	São Paulo favela-zone overlay	Broad walking 1000	-0.19	uncertain within +/-1 pp	uncertain within +/-2 pp	uncertain within +/-5 pp	True	True

Source file: urban_nature_ej_gap_threshold_sensitivity_v1.3.csv

Supplementary Table 8. London target-reclassification diagnostic

Target-set overlap between access-point Euclidean proximity and entrance-aware network distance.

m	LSOAs	Population	Euclidean no.access LSOAs	Network no.access LSOAs	Jaccard LSOA	Jaccard pop.	Reclassified pop.	Newly underserved pop.
300	4994	8799776.0	619	2450	0.253	0.251	3251463.0	3251463.0
500	4994	8799776.0	38	851	0.045	0.042	1444990.0	1444990.0
1000	4994	8799776.0	0	26	0.0	0.0	45595.0	45595.0

Source file: urban_nature_london_target_reclassification_v1.3.csv

Supplementary Table 9. London access-point and network validation

Operational validation comparing site polygons, official access points and entrance-aware walking-network reachability.

Panel	Method	m	Value
access	site_polygon_euclidean	300	92.6
access	site_polygon_euclidean	500	99.58
access	site_polygon_euclidean	1000	100.0
access	euclidean_pedestrian_capable_access_points	300	87.61
access	euclidean_pedestrian_capable_access_points	500	99.29
access	euclidean_pedestrian_capable_access_points	1000	100.0
access	network_pedestrian_capable_access_points	300	50.66
access	network_pedestrian_capable_access_points	500	82.86
access	network_pedestrian_capable_access_points	1000	99.48
imd_gap	site_polygon_euclidean	300	-3.63
imd_gap	site_polygon_euclidean	500	-0.3
imd_gap	site_polygon_euclidean	1000	-0.0
imd_gap	euclidean_pedestrian_capable_access_points	300	-7.05
imd_gap	euclidean_pedestrian_capable_access_points	500	-0.66
imd_gap	euclidean_pedestrian_capable_access_points	1000	-0.0
imd_gap	network_pedestrian_capable_access_points	300	-17.75
imd_gap	network_pedestrian_capable_access_points	500	-9.09
imd_gap	network_pedestrian_capable_access_points	1000	-0.27

Source file: urban_nature_london_entrance_penalty_v1.3.csv

Supplementary Table 10. Population-allocation uncertainty

Bounds for the effect of unallocated population on OSM green-blue 300 m access.

City	Allocated/clipped pop. ratio	Lower bound (%)	Upper bound (%)	Range width
Berlin	0.9725	83.5556968586224	86.30905348193241	2.753356623310012
São Paulo	0.9395	80.82963264165312	86.88450090901398	6.05486826736086
Cape Town	0.993	57.658768947774384	58.36284271002277	0.7040737622483846

Source file: urban_nature_population_allocation_uncertainty_v1.3.csv

Supplementary Table 11. Grid-resolution proxy sensitivity

Scale sensitivity using coarsened GHSL-cell access rules.

City	Fine grid	Any-access	Majority-access	All-access
Berlin	85.9214200833361	91.0373869781411	90.66098330896828	80.51688557977312
Cape Town	58.06760768340382	67.09940844379851	64.18967008505092	48.80563021416563
São Paulo	86.03919239403012	90.68618313405857	90.62766061890125	80.36318591953307

Source file: urban_nature_grid_resolution_proxy_sensitivity_v1.3.csv

Supplementary Table 12. OSM blue-tag sensitivity

Effect of broad versus core blue-space tags on OSM green-blue access.

City	Core blue features	Broad extra blue features	Core green-blue access (%)	Broad green-blue access (%)	Broad-core delta (pp)	Top waterway tags
Berlin	2106	2951	83.39	85.92	2.53	(none):1870; ditch:1753; stream:923; drain:275; canal:145
Cape Town	2288	2502	51.56	58.07	6.5	(none):2092; stream:1335; drain:773; ditch:394; river:102
São Paulo	1152	2500	75.86	86.04	10.18	stream:2460; (none):625; river:516; drain:35; canal:11

Source file: urban_nature_osm_blue_tag_sensitivity_v1.3.csv

Supplementary Table 13. Transfer checks

Layer-specific transfer diagnostics outside the three core cases.

City	Transfer check	Implemented layer	Layers tested	Layers not tested	Interpretation rule
Bogotá	source definition	official green-blue available-layer prototype	inventory/source breadth	distance, threshold series, population uncertainty, vulnerability overlay, entrances	available-layer range only
Los Angeles	source definition	official green-blue available-layer prototype	inventory/source breadth	distance, threshold series, population uncertainty, vulnerability overlay, entrances	available-layer range only
London	access-point distance model	ONS LSOA demand + OS Open Greenspace access points + OSM walking graph	access-point geometry, entrance-aware network distance, IMD 2025 overlay	inventory-source envelope and core-city GHSL allocation	entrance-aware validation, not a fourth core city

Source file: urban_nature_transfer_checks_v1.3.csv

Supplementary Table 14. First-wave expansion evidence

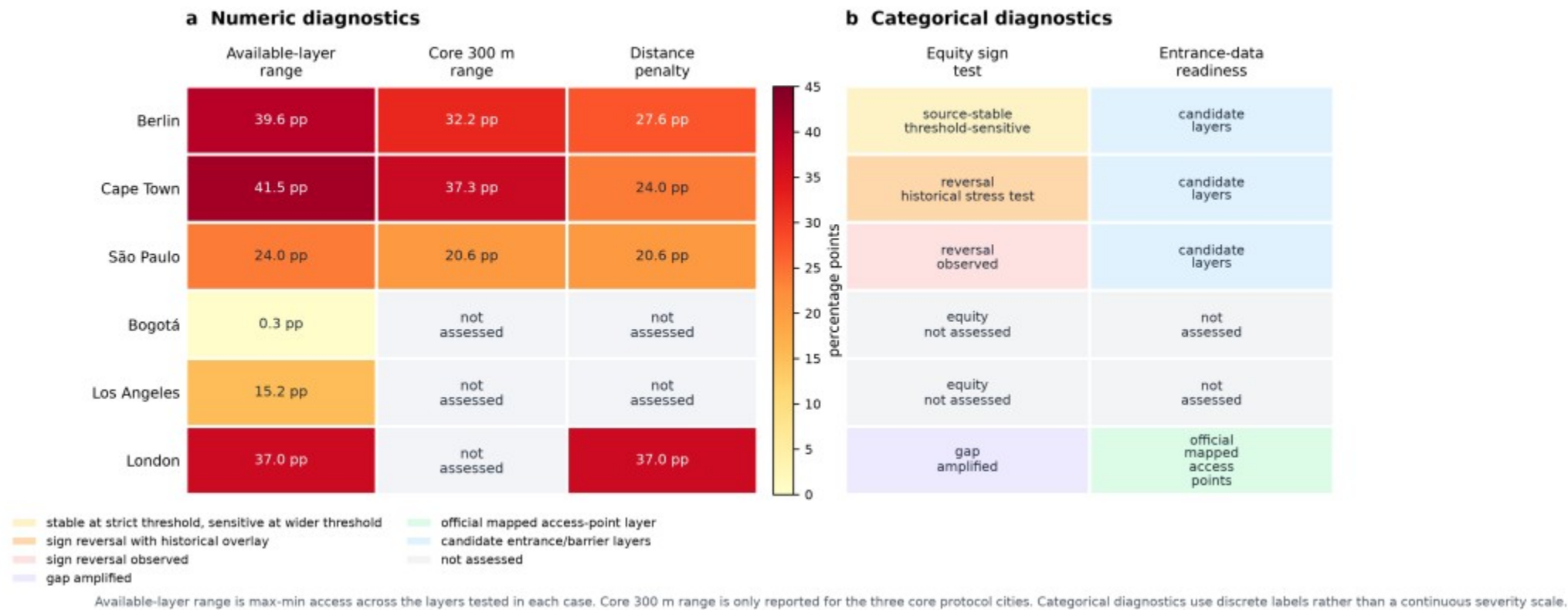
Additional feasibility and transfer evidence for city expansion design.

City	Diagnostic	m	Demand basis	Access contrast	Access delta (pp)	Equity contrast	Equity delta (pp)	Interpretive signal
Bogota	source_definition_sensitivity	500	unweighted 500 m-radius hex centroids within official urban perimeter	0.9791 to 0.9826	0.35	-0.0122 to 0.0060	1.82	EJ gap direction changes
Los Angeles	source_definition_sensitivity	500	ACS2019 population-weighted CalEnviroScreen tract representative points	0.5674 to 0.7190	15.16	0.0366 to -0.0641	-10.07	EJ gap direction changes
London	entrance_definition_sensitivity	300/500/1000	ONS Census 2021 TS001 population at LSOA population-weighted centroids	5.0 pp at 300 m; 0.3 pp at 500 m; 0.0 pp at 1000 m		IMD2025 gap +3.6 pp polygon / +7.0 pp entrance at 300 m; +0.7 pp entrance at 500 m	3.42	Entrance definition amplifies short-threshold IMD gap
London	network_distance_sensitivity	300/500/1000	ONS Census 2021 TS001 population at LSOA population-weighted centroids	87.6% Euclidean vs 50.7% network at 300 m; 99.3% vs 82.9% at 500 m; 100.0% vs 99.5% at 1000 m	-36.95	IMD2025 gap +7.0 pp Euclidean / +17.8 pp network at 300 m; +0.7 pp / +9.1 pp at 500 m	10.7	Network distance sharply lowers access and amplifies IMD gap

Source file: urban_nature_transfer_screen_evidence_v1.3.csv

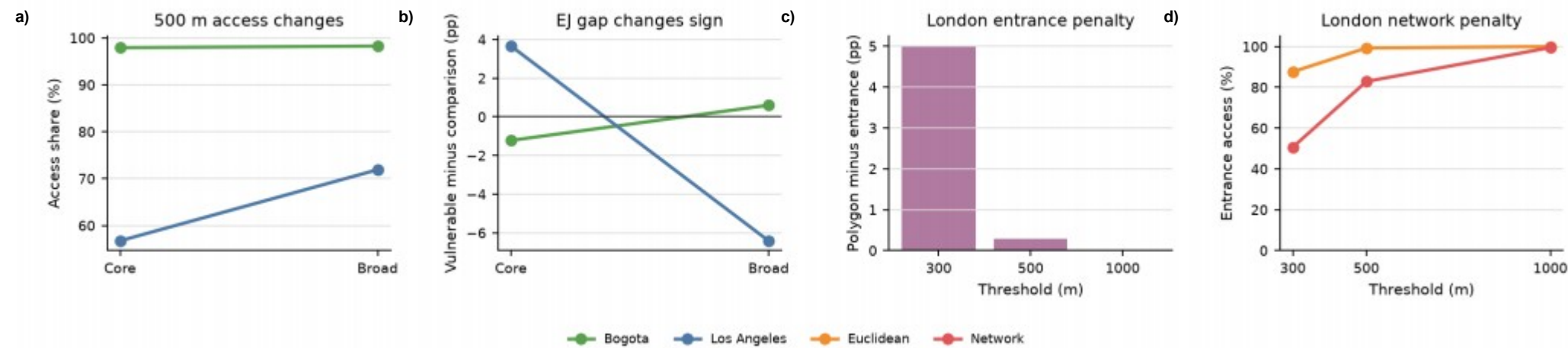
Supplementary Figures

Extended diagnostic overview across urban nature-access tests



Supplementary Figure 1. Decision-stability diagnostic overview. a) Numeric diagnostics compare available-layer ranges, core 300 m ranges and distance penalties across cases. b) Categorical diagnostics summarize equity-direction stability and entrance-data readiness.

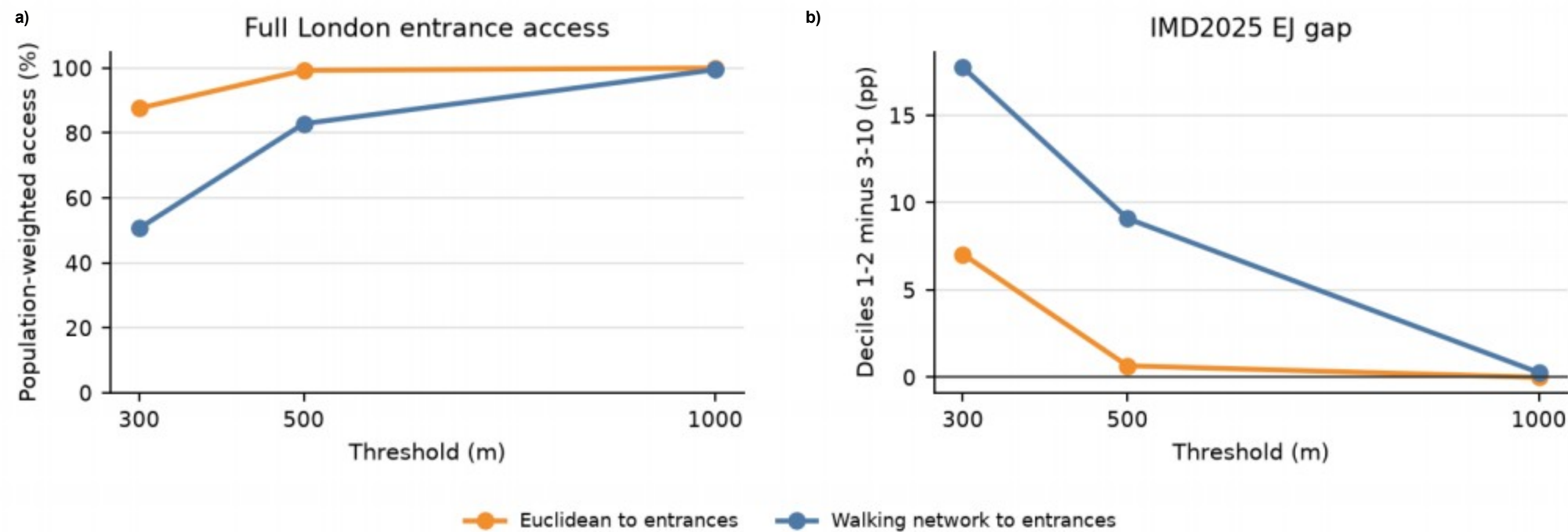
First-wave expansion prototypes test different robustness modes



Bogota and Los Angeles compare official core/broad source definitions at 500 m. London compares OS Open Greenspace polygon proximity, entrance-point proximity and full walking-network entrance access.

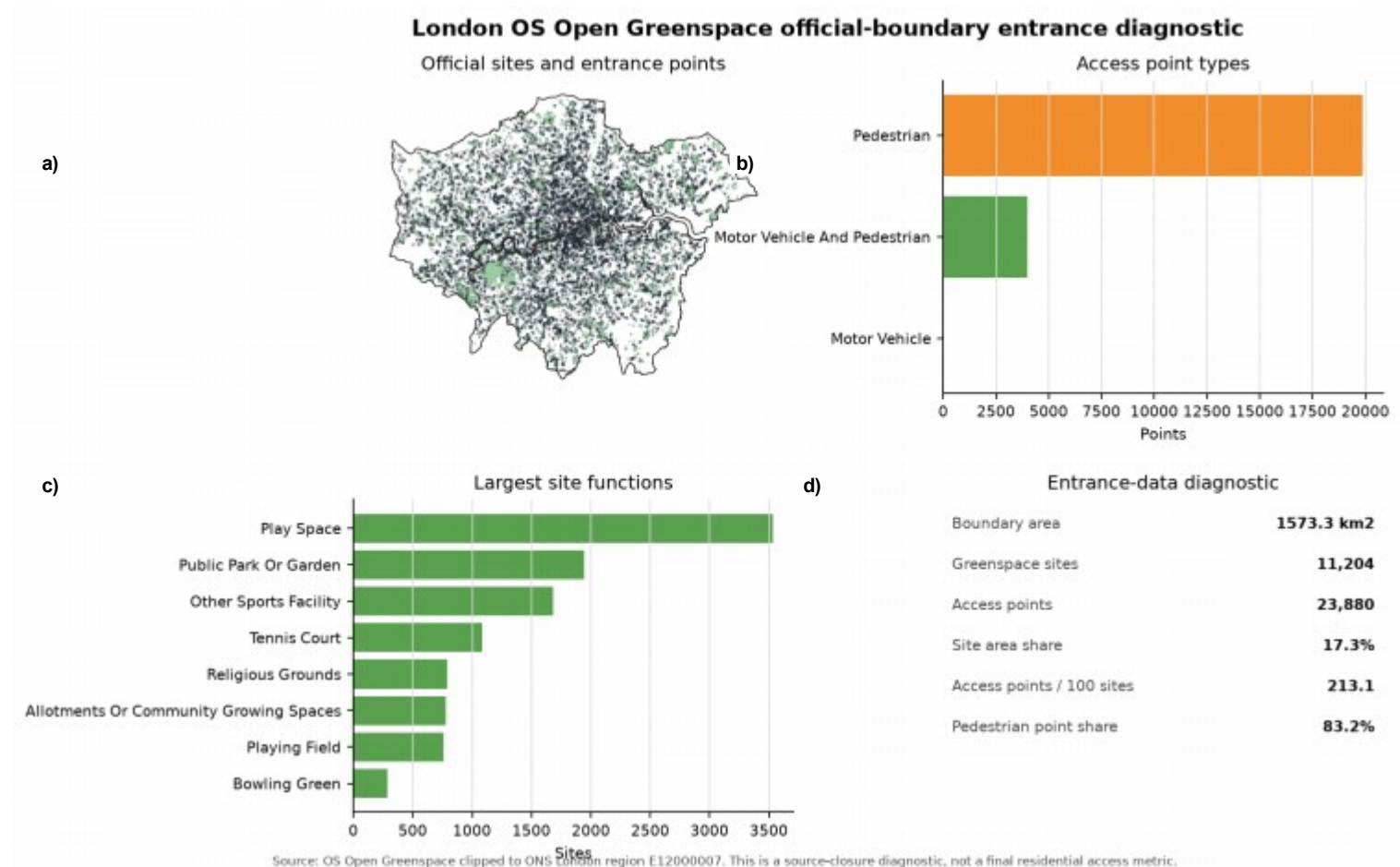
Supplementary Figure 2. First-wave transfer evidence. a) Source-definition changes in 500 m access for Bogota and Los Angeles. b) Direction and magnitude of the corresponding environmental-justice gap changes. c) London's polygon-to-entrance penalty across thresholds. d) London's Euclidean-to-network entrance-access penalty across thresholds.

London full entrance-aware walking-network result



Scope: full ONS London region, all five borough/LAD tiles. Distances include demand-to-node and entrance-to-node offsets.

Supplementary Figure 3. London completed-network tile validation. a) Population-weighted London entrance access under Euclidean and walking-network distance at 300 m, 500 m and 1000 m. b) IMD2025 environmental-justice gaps under the same distance specifications and thresholds.



Supplementary Figure 4. London official entrance-source diagnostic. a) Official OS Open Greenspace sites and mapped access points. b) Access-point counts by access type. c) Largest mapped site functions. d) Summary diagnostics for boundary area, sites and pedestrian-capable access points.

Supplementary Table 15. Thirty-city data-infrastructure audit

Rapid source-readiness audit used to test whether the reporting bundle can travel beyond the core protocol and transfer-check cities. Scores are ordinal feasibility assessments; licence risk is reported separately because high risk means lower reproducibility readiness.

City	Country	Region	Priority	Official green	Official blue	EJ overlay	Entrance/barrier	Walking network	Licence risk	Audit confidence
Cape Town	South Africa	Africa	Anchor	High	High	High	Low	High	Low-Medium	High
Berlin	Germany	Europe	Anchor	High	High	Medium	Low	High	Low	High
Sao Paulo	Brazil	Latin America	Anchor	High	High	High	Low	High	Low	High
London	United Kingdom	Europe	A	High	High	High	High	High	Low	High
Bogota	Colombia	Latin America	A	High	High	High	Low	High	Low-Medium	High
Mexico City	Mexico	Latin America	A	High	Medium	High	Low	High	Low-Medium	High
Los Angeles	United States	North America	A	High	High	High	Medium	High	Low	High
New York City	United States	North America	A	High	Medium-High	High	Medium	High	Low	High
Melbourne	Australia	Oceania	A	High	High	High	Low-Medium	High	Low	High
Buenos Aires	Argentina	Latin America	A-	High	Medium	High	Low-Medium	High	Low	High
Rio de Janeiro	Brazil	Latin America	A-	Medium-High	High	High	Low	High	Low-Medium	High
Barcelona	Spain	Europe	B+	High	Medium	High	Low-Medium	High	Low	High
Paris	France	Europe	B+	High	Medium-High	Medium-High	Medium	High	Low	High
Chicago	United States	North America	B+	High	High	Medium-High	Low-Medium	High	Low	High
Toronto	Canada	North America	B+	High	Medium-High	Medium-High	Low-Medium	High	Low	Medium-High
Singapore	Singapore	Asia	B	High	High	Low-Medium	Low	High	Low-Medium	High
Amsterdam	Netherlands	Europe	B	High	High	Medium	Low-Medium	High	Low	High
Medellin	Colombia	Latin America	B	Medium-High	Medium	High	Low	High	Medium	Medium
Vancouver	Canada	North America	B	High	Medium	Medium	Low-Medium	High	Low	High
Hong Kong	China	Asia	B-	Medium-High	High	Medium	Low-Medium	High	Medium	Medium
Seoul	South Korea	Asia	B-	Medium-High	Medium-High	Medium	Low	High	Medium	Medium
Jakarta	Indonesia	Asia	C+	Medium	Medium-High	Medium-High	Low	Medium-High	Medium-High	Low-Medium
Tokyo	Japan	Asia	C+	Medium	Medium	Low-Medium	Low	High	Medium	Medium
Santiago	Chile	Latin America	C+	Medium	Medium	Medium-High	Low	High	Medium	Low-Medium
Accra	Ghana	Africa	C	Low	Low-Medium	Medium	Low	Medium	High	Low
Kigali	Rwanda	Africa	C	Medium	Medium	Medium	Low	Medium-High	Medium-High	Low-Medium
Lagos	Nigeria	Africa	C	Low	Medium	Medium	Low	Medium	High	Low
Nairobi	Kenya	Africa	C	Low-Medium	Medium	Medium-High	Low	Medium	High	Low
Delhi	India	Asia	C	Low-Medium	Medium	Medium-High	Low	Medium-High	High	Low
Mumbai	India	Asia	C	Low-Medium	Medium	High	Low	Medium-High	High	Low-Medium

Source file: npj_urban_sustainability_30_city_data_infrastructure_audit_v1.3.csv

Supplementary Table 16. Observed layer-specific contribution diagnostic

Paired contrasts quantify the observed change attributable to one disclosed specification where the available data support a matched comparison.

Layer	Paired contrast	Observed absolute change or range (pp)	Maximum (pp)	Interpretive limit
Inventory	OSM, official core and official broad; Euclidean, 300 m	Berlin 7.99; Cape Town 37.34; São Paulo 12.64	37.34	Eligible supply changes
Access-point geometry	Site polygon versus official mapped access points; Euclidean, 300 m	London 4.99	4.99	Observed only in London
Distance model	Matched official Euclidean versus walking specification; 300 m	Berlin 27.59; Cape Town 24.03; São Paulo 20.60; London 36.95	36.95	Walking target differs by city as disclosed
Threshold	Same walking specification, 300 to 1000 m	Berlin 39.58; Cape Town 28.19; São Paulo 24.01; London 48.82	48.82	Policy service level changes
Population allocation	Lower-to-upper allocation bound width	Berlin 2.75; Cape Town 0.70; São Paulo 6.05	6.05	Not estimated for London in this form
Vulnerability definition	São Paulo precarious-housing versus favela overlays, matched scenarios	São Paulo 0.05–2.71	2.71	Changes comparison group; observed only in São Paulo

Source file: *urban_nature_layer_contribution_diagnostic_v2.0.csv*

Note: Values are absolute changes or ranges. They are not variance shares, are not additive, and are conditional on the paired contrasts available in each city.