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ARTICLE

Institutional Breakpoints in Equity-Oriented Green Infrastructure Planning: Ordinal Evidence from 122 U.S. City Plans

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Abstract

Urban green infrastructure planning initiatives are becoming increasing likely to include promises related to climate change, stormwater management, urban heat mitigation, ecological restoration, and enhanced quality of public space. The question of the equity effectiveness of these plans hinges upon whether promises translate into institution-building around definition, recognition of disparate vulnerability, transfer of community control into design and implementation, impact assessment, anti-displacement, and just allocation of green jobs. This paper investigates 122 green infrastructure plans across 20 American cities in relation to ten categories of equity practice, namely definition, framing, justice, planning, design, implementation, evaluation, hazard, value, and labor. The research includes development of Ordinal Sufficiency Partitioning as a method of reading five-state plan quality ratings as ordered distributions rather than interval-scale scores. Results show an institutional discontinuity. Value, planning, and hazard practices exhibit the greatest development, characterized by sufficiency ratios of 45.0%, 43.4%, and 41.2%, respectively. Definition and justice exhibit least sufficiency, scoring at 8.8% and 11.9% with non-operative drag above 86%. Design and labor categories have been minimally developed with functional sufficiency at 2.0% and 4.0%, respectively. With respect to life-cycle practice, value has lower sufficiency compared to procedure and distribution; that is, plans often articulate potential benefits while failing to specify a definition of equitable benefit, identify decision makers and provide oversight thereafter. In terms of addressing the fundamental questions asked, the findings speak to themselves, revealing that officially-sanctioned green infrastructure plans lack a cohesive and effective process of building equity-operability.

Keywords: green infrastructure; equity planning; environmental justice; plan quality; ordinal sufficiency; urban governance

1. Introduction

The physical components of urban green infrastructure include canopy coverage, parks, bioswales, rain gardens, green roofs, restoration of riverine corridors, community gardens, and interconnected open space networks. When well-planned, implemented, financed, and governed, they can decrease environmental risk and enhance urban environments more broadly. However, the positive consequences are not inherently distributed [2, 5, 7, 32, 51, 54].

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While greening efforts aimed at better drainage or improved shading can have positive implications, they can also lead to rising land prices, shifting maintenance costs, outside development without local protection, and resident involvement without resident influence over the plan design [3, 14, 19, 24, 38, 56].

Equity cannot, therefore, simply be treated as an afterthought to green infrastructure. It must be explicitly incorporated into the content of the plan itself. To be meaningful, plans would identify whose environmental conditions need improvement, why they became unequal, who holds decision-making power, how implementation is accountable, how social impacts are monitored, and how the economic value of green improvements is distributed. Absent these commitments, equity becomes a descriptive term, not a planning practice. That distinction is significant because a wide range of planning documents use the language of sustainability, resilience, social justice, or inclusiveness without providing any meaningful mechanism for institutional change [11, 13, 21, 25, 33].

This article evaluates the presence of an effective equity chain in U.S. green infrastructure plans from an institutional perspective. Rather than asking whether disadvantaged communities are mentioned and whether green infrastructure has value, the study examines equity as the combination of commitments across the green infrastructure planning lifecycle. The lifecycle is structured around three interrelated dimensions: vision, procedure, and distribution. Vision is the process of defining equity, conceptualizing green infrastructure, and recognizing justice claims. Procedure is the process of involving communities in planning, design, implementation, and evaluation. Distribution is the process of recognizing hazards, evaluating economic value, and assigning labor.

The empirical data for the study consist of aggregated percentages for 122 plans from 20 U.S. cities. Plans were coded according to 10 equity categories: definition, framing, justice recognition, planning participation, design authority, implementation accountability, evaluation, hazard recognition, value distribution, and labor. Categorical scores used five ordered states: absence, problematic treatment, cautionary treatment, functional treatment, and ideal treatment. That allows distinguishing plans that mention equity, justice, or resilience from plans that define, operationalize, and protect equity. These distinctions are critical because even if a plan refers to flood events, health risks, public concerns, or community needs, it may not discuss decision authority, anti-displacement measures, evaluation obligations, or labor conditions.

To interpret the ordered coding results, this paper employs ordinal sufficiency partitioning. The procedure decomposes the data into five components: normalized sufficiency, non-operable drag, minimum operability, functional capacity, and threshold distance. The technique preserves the ordering of the ordinal values and assumes no equally spaced distances between categories. Thus, the results provide an analytical framework for interpreting the distribution by identifying which categories are sufficient in terms of operationality, which are deficient, and what the necessary distance is to achieve operationality or functionality.

The findings reveal that plans contain relatively substantial content in the areas of environmental value, hazard recognition, and planning participation. The weakness of the record lies in institutional aspects of equity governance: definition, justice recognition, design authority, implementation accountability, evaluation, anti-displacement protection, and labor. This suggests that although green infrastructure planning incorporates the vocabulary of equity, much of equity governance remains under-developed.

2. Literature Review

2.1. Green infrastructure as urban policy

The history of green infrastructure planning spans many fields: landscape ecology, open space preservation, stormwater management, ecological design, sustainability planning, and resilience governance. In its early spatial form, it referred to landscape networks that could preserve habitat connections and support ecological processes in cities. In its stormwater form, green infrastructure provided means for distributing, retaining, and treating stormwater through a series of green installations [2, 7]. Climate change, adaptation to climate stress, public health, and infrastructure redundancy led to the development of a resilience-based green infrastructure paradigm [32–34].

The multidimensionality of green infrastructure can be a useful asset for municipalities but also creates uncertainty

about the concept's meaning. The stormwater-focused green infrastructure may prioritize volume control and infiltration rates. Green infrastructure viewed as a landscape network tends to emphasize ecological connectivity. Public health approaches to green infrastructure planning may focus on mitigating environmental hazards, improving physical activity opportunities, and providing recreational amenities. In an equity-centered approach, a definition of the social problem, identification of the populations facing unequal environmental conditions, and specification of benefit-sharing are required [11, 21, 57].

2.2. Environmental justice and urban greening

Environmental justice studies have shown that the distribution of environmental risk factors is determined by social stratification rather than physical characteristics of the environment [12, 15, 39, 52]. Similarly, planning studies show that socially beneficial projects are achieved through advocacy, public engagement, procedural fairness, and correction of procedural failures [4, 20, 40, 41]. Urban greening involves these concepts within a specific policy area. Parks, canopy, and stormwater facilities provide amenities that improve the environment and reduce health risks. They may also contribute to green gentrification if they raise rents, increase housing prices, or accelerate redevelopment processes without protections for vulnerable communities [3, 14, 19, 24, 38].

In "just green enough" literature, green infrastructure planning requires that the improvements be accompanied by anti-displacement measures, community empowerment, and socially appropriate amenity configurations [17, 56]. Research on urban parks, tree canopy, and green spaces shows that access is influenced by income and race [28, 30, 35, 36, 43, 44, 58]. Therefore, urban greening is subject to equity considerations of recognition, procedural power, value capture, displacement threats, and labor. Simply placing green assets in disadvantaged neighborhoods may not result in fair distribution if communities do not have decision-making power, influence on design, receive benefit from implementation, and protected against market effects of improvement.

2.3. Plan quality and institutional operability

The literature on plan quality provides useful tools for analyzing whether the official document contains well-formulated goals, factual basis, commitment to certain policies, implementation plan, evaluation procedures, and internal consistency. The tradition is essential because a plan document has a dual nature, acting both as a rhetorical tool and as a planning instrument. As the latter, a plan should contain clear instructions and actions to implement its purpose. In this regard, mere mention of equity, resilience, sustainability, or social justice is insufficient. Although recent publications show increasing attention to equity planning in the context of green infrastructure, plan content remains inadequate [25, 33, 47, 48]. This article analyzes how far the current green infrastructure planning record falls short in terms of equity.

3. Materials and Methods

3.1. Plan corpus and scoring categories

The empirical data for the article consists of percentage score distributions for 122 plans from 20 cities. In addition to mentioning green infrastructure, each plan was coded according to 10 equity categories. These categories cover the most relevant institutional aspects of green infrastructure planning, including equity definition, framing of the problem, recognition of the justice claim, community involvement in planning, design authority, implementation accountability, evaluation, recognition of environmental hazard, value distribution, and labor. Ten categories were grouped into three planning lifecycle dimensions: vision, procedure, and distribution.

The corpus view in Fig. 1 locates the empirical work at the level of official planning documents rather than abstract policy categories. The figure links the 122-plan record, the 20-city document base, and the ten coded equity categories used throughout the analysis. This visual placement is important because the study evaluates how equity appears inside formal plans, not how green infrastructure performs as a physical installation after construction.

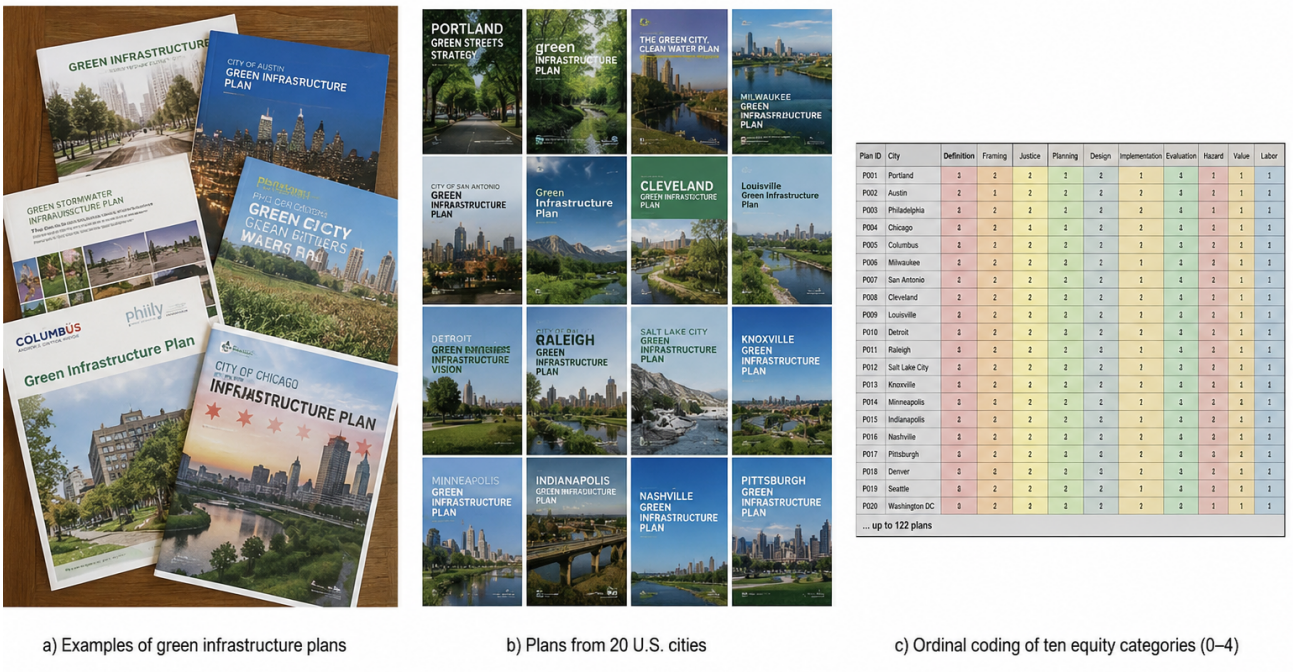

Figure 1. Plan corpus and coding structure.

Each category was scored on a five-state ordinal scale from 0 to 4. A score of 0 indicates absence. A score of 1 indicates problematic or very weak treatment. A score of 2 indicates cautionary but usable treatment. A score of 3 indicates functional treatment. A score of 4 indicates ideal treatment. The percentage distribution of scores within each category is shown in Table 1. Minor normalization was applied only to correct rounding so that category percentages sum to one before derived values were calculated.

Table 1. Score distribution.

Category	Score 0	Score 1	Score 2	Score 3	Score 4
Definition	84.0	2.0	9.0	5.0	0.0
Framing	8.0	54.0	30.0	8.0	0.0
Justice	66.7	20.2	12.1	1.0	0.0
Planning	11.1	20.2	52.5	16.2	0.0
Design	20.2	61.6	16.2	2.0	0.0
Implementation	15.8	37.6	45.5	1.0	0.0
Evaluation	27.0	36.0	33.0	4.0	0.0
Hazard	6.0	34.0	49.0	11.0	0.0
Value	2.0	28.0	58.0	12.0	0.0
Labor	22.0	48.0	26.0	4.0	0.0

The distribution in Table 1 establishes the central empirical pattern. Definition and justice are dominated by absent or weak treatment, while value, hazard, and planning contain larger shares of cautionary and functional content. The complete absence of score 4 across all ten categories is also important. It shows that no equity domain reaches ideal treatment in the aggregate record, even where plans contain usable language.

The evidence texture in Fig. 2 highlights why an average mean would provide too little information here. Definition suffers from an abundance of absence, whereas design, framing, and labor suffer from weak treatment. Planning, hazard, and value have more significant cautionary segments, though the size of their functional segments is still restricted. Finally, the absence of category scores in all ten equity categories becomes evident as a structural feature of these plans: no category is at the point of ideal treatment when all records are considered collectively.

Figure 2. Ordinal evidence texture.

3.2. Ordinal sufficiency partitioning

Let p_{cs} represent the normalized proportion of plans in category c that receive score s ($s \in \{0, 1, 2, 3, 4\}$). Normalized sufficiency is calculated as follows:

$$A_c = \sum_{s=0}^{4} \frac{s}{4} p_{cs}$$

It represents the progress that a category has made in terms of moving away from absence and toward ideal treatment. However, normalized sufficiency cannot be considered an interval-scale score. Instead, it should be seen as an ordered measure of category strength.

Non-operable drag is calculated as

$$D_c = p_{c0} + p_{c1}$$

It measures the share of plans in which a category is either absent or too weak to promote equitable planning practices. A large number indicates that, despite the use of stronger language in a small percentage of plans, most records lack adequate references to equity issues.

Minimum operability is defined as

$$O_c = p_{c2} + p_{c3} + p_{c4}$$

It denotes the share of plans that have moved past absence and weak treatment. As a result, minimum operability includes cautionary segments of categories and should be interpreted as a measure of basic usability rather than advanced performance.

Functional capacity is given by

$$F_c = p_{c3} + p_{c4}$$

Unlike the previous indicator, functional capacity includes the top-two categories only. As there is not a single score 4 in the entire evidence pool, the current record relies on score 3 exclusively for measuring this type of category capacity.

Dimension-level indicators are calculated as the arithmetic means of category-level variables. The grouping does not consider categories as exchangeable. It serves as a way to detect whether equity is recognized, promoted, and addressed throughout the planning process and its consequences.

3.3. Threshold distances

Two threshold distances determine the scale of change required for early institutional movement. The first one estimates the gain needed for achieving minimum operability for a simple majority of plans within a certain category:

$$T_c = \max(0, 0.50 - O_c)$$

It represents the minimum level of usability necessary for effective planning practice.

The second distance estimates the gain needed for 15% of the plans within a category to achieve functional capacity:

$$H_c = \max(0, 0.15 - F_c)$$

Its low threshold reflects the actual state of things, according to which there is a very low score-3 share in most categories. Instead, this metric is meant to identify where the initial movement toward functional practices is particularly urgent.

4. Results

4.1. Ordinal distribution across equity categories

According to the findings, the green infrastructure planning practices that incorporate elements of equity are mostly developed where they are associated with other common elements of environmental planning. Among the three categories that achieved the highest levels of normalized sufficiency, the leader is value (45.0%), followed by planning (43.4%) and hazard (41.2%). In terms of achieving minimum operability, value has reached 70.0%, planning – 68.7%, and hazard – 60.0%. Concerning functional capacity, value has achieved 12.0%, planning – 16.2%, and hazard – 11.0%. As a result, many documents include some relevant information on green benefits, hazard reduction, and participation in the development process.

Low scores reveal important institutional bottlenecks. Thus, definition has normalized sufficiency of 8.8%, non-operable drag of 86.0%, and absence of 84.0%. The same applies to justice, which has normalized sufficiency of 11.9%, non-operable drag of 86.9%, and functional capacity of 1.0%. Such numbers confirm the hypothesis that the majority of the documents refer to issues of equity using adjacent concepts without defining these concepts clearly and setting historical precedents that can ground claims. Without the proper definition of equity, it is impossible to understand whether the plan intends to pursue equal provision, need-based investments, reparations, authority, or any other approach to promoting justice.

Design is the third most important procedural bottleneck after definition and justice. It has normalized sufficiency of 25.0%, non-operable drag of 81.8%, and functional capacity of 2.0%. The indicator confirms the hypothesis that plan-stage engagement does not always extend to discussions of design criteria, site selection, project form, and priorities at the level of neighborhoods. Implementation and evaluation show the same pattern. Implementation has achieved minimum operability of 46.5% but has only functional capacity of 1.0%. Evaluation has managed to reach 37.0% minimum operability but lacks functional capacity (only 4.0%). Consequently, the plans discuss issues of implementation and evaluation without creating mechanisms for community-based control.

Finally, labor has normalized sufficiency of 28.0%, non-operable drag of 70.0%, and functional capacity of 4.0%. This indicator is particularly important since green infrastructure is both an environmental-ecological system and a

work system in the economic sense of the word. Labor determines the distribution of opportunities for employment, accountability, and durability of the impact of the planned activities.

Table 2. Category operability.

Category	Sufficiency	Non-operable drag	Minimum operability	Functional capacity	Absent share
Definition	8.8	86.0	14.0	5.0	84.0
Framing	34.5	62.0	38.0	8.0	8.0
Justice	11.9	86.9	13.1	1.0	66.7
Planning	43.4	31.3	68.7	16.2	11.1
Design	25.0	81.8	18.2	2.0	20.2
Implementation	32.9	53.5	46.5	1.0	15.8
Evaluation	28.5	63.0	37.0	4.0	27.0
Hazard	41.2	40.0	60.0	11.0	6.0
Value	45.0	30.0	70.0	12.0	2.0
Labor	28.0	70.0	30.0	4.0	22.0

The measures in Table 2 confirm that strong environmental language is not equivalent to equity capacity. Value and hazard are comparatively developed, but the categories that make equity governable are much weaker. The distance between planning and design is especially revealing because it shows where participation loses institutional force.

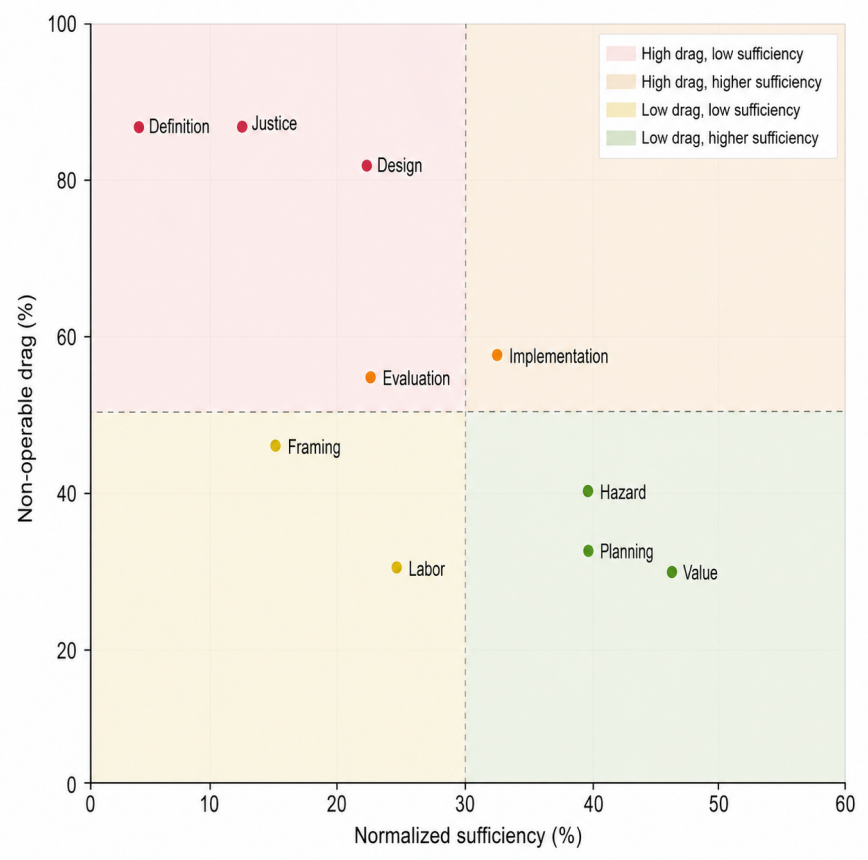

Figure 3. Sufficiency–drag positions.

The category positions in Fig. 3 make the bottleneck structure visible. Definition and justice combine very low sufficiency with extremely high drag, while value and planning combine higher sufficiency with lower drag. Design stands out because its drag is almost as high as definition and justice despite a lower absent share. That pattern means design content is often present in weak form, so improvement requires conversion of consultation language into authority-bearing design provisions.

4.2. Lifecycle pattern

The dimension-level results show that weakness is not randomly scattered across categories. Vision is the weakest dimension, with 18.4% sufficiency, 78.3% non-operable drag, 21.7% minimum operability, and 4.7% functional capacity. This result is driven by the near absence of definition and justice content. Framing is stronger than those two categories, but it does not compensate for the lack of specific meaning. Vision therefore lacks the conceptual stability needed to guide later planning stages.

Procedure performs better than vision but remains fragile. Its sufficiency is 32.5%, minimum operability is 42.6%, and functional capacity is 5.8%. The internal contrast is important: planning-stage participation is much stronger than design, implementation, and evaluation. This pattern indicates a front-loaded participation model in which residents may comment during plan preparation while receiving much less authority over project design, delivery, monitoring, and correction.

Distribution has the strongest dimension-level sufficiency, at 38.1%, and the highest minimum operability, at 53.3%. That strength is uneven. It is produced mainly by hazard and value, while labor remains weak. Distributional content therefore shows that plans are more prepared to discuss environmental goods and risk reduction than the economic and institutional conditions through which those goods are produced and protected.

Table 3. Dimension means.

Dimension	Sufficiency	Non-operable drag	Minimum operability	Functional capacity
Vision	18.4	78.3	21.7	4.7
Procedure	32.5	57.4	42.6	5.8
Distribution	38.1	46.7	53.3	9.0

The lifecycle values in Table 3 show that equity weakens at the beginning of the plan and only partly recovers through distributional claims. Vision should provide the interpretive foundation for later stages, but it is the least sufficient dimension. This inversion creates a governance problem: plans discuss benefits before they have adequately established what equitable benefit means.

The lifecycle display in Fig. 4 shows a misalignment rather than a simple low-performance pattern. Distribution has the best minimum operability, but vision has the highest drag. A lifecycle chain cannot be considered equity-capable when the categories that define the meaning of equity are weaker than the categories that claim to distribute benefits.

4.3. Terminology and institutional authority

The results expose two linked separations. The first is between terminology and definition: 45% of plans used the word equity, yet only 13% defined it; 44% used the word justice, while only 11% defined it. The second is between engagement and authority. Planning has the highest functional capacity among all categories, at 16.2%, but design, implementation, and evaluation fall to 2.0%, 1.0%, and 4.0%. These proportions show that plans are more comfortable documenting participation than transferring community influence into the decisions that shape projects after adoption.

The procedural contrast in Fig. 5 identifies the main loss point between plan preparation and post-adoption authority. Planning-stage content reaches the highest functional value in the study, but the design, delivery, and monitoring stages remain much weaker. This means that a plan can appear participatory while still withholding influence from the phases where siting, design standards, funding, maintenance, and correction are decided.

Definition exceeds framing in terms of operational capacity, but falls behind in first order gain requirement to reach functional capacity and minimum operability thresholds. Justice lags both framing and definition in first order gain requirements, although plans frequently incorporate justice issues as a sign of awareness of such issues rather than using them in decision-making process. Undefined equity might refer to equal provision, general inclusion, service expansion, or rhetorical concern without identifying specific historical and institutional circumstances that should be addressed.

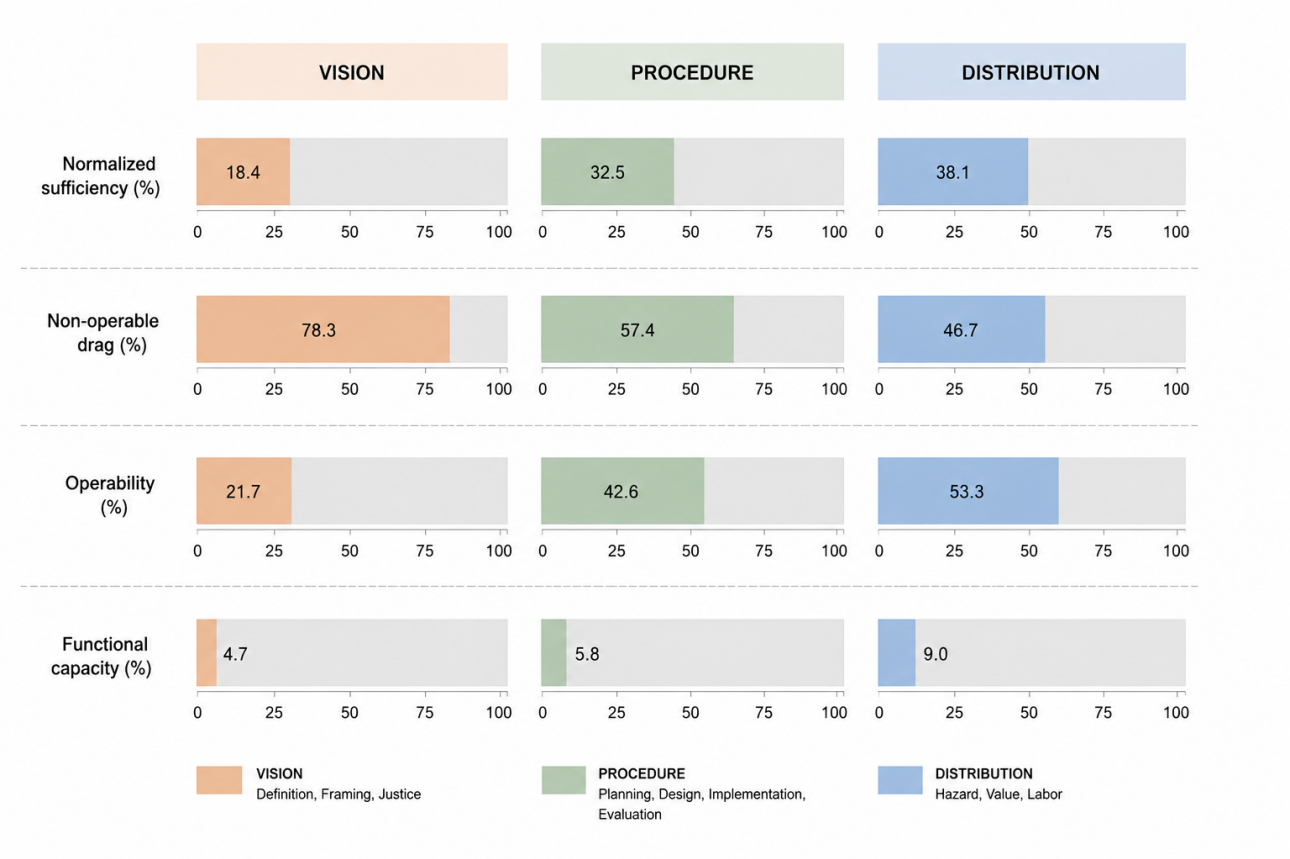

Figure 4. Lifecycle imbalance.

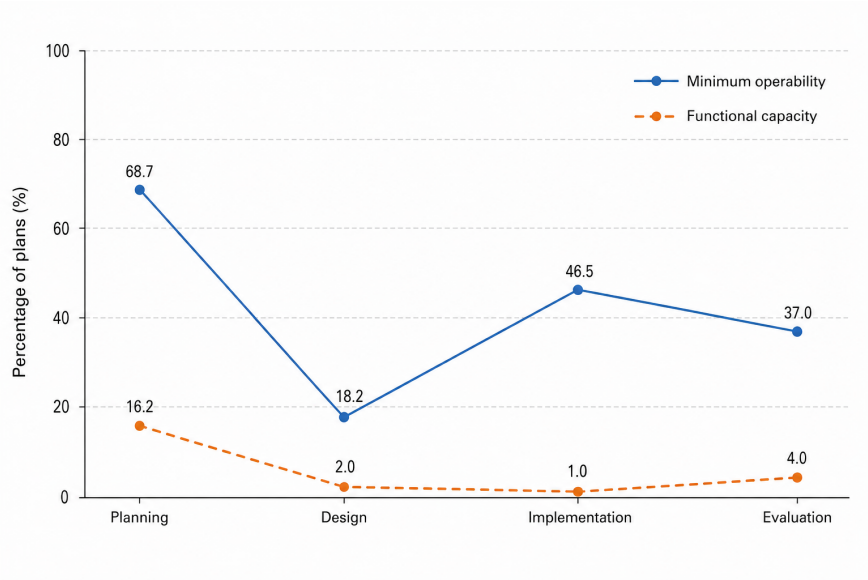

Figure 5. Participation-to-authority loss.

Labor stands out as a category different from environmental benefit and economic consequence. While planning and environmental benefit share the same high levels of minimum operability, labor has 30.0% minimum operability and 4.0% functional capacity. Thus, labor is loosely related to environmental benefit claimed by the green infrastructure. The gap between environmental benefits of green infrastructure and labor shows limited relevance of environmental benefit for the development of strong and relevant equity practices.

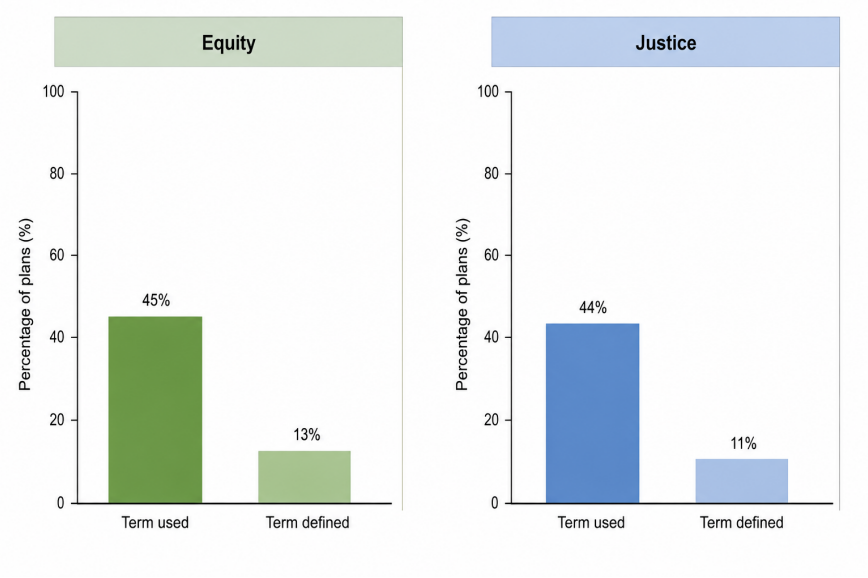

Figure 6. Terminology-definition gap.

4.4. Threshold priorities

Threshold analysis indicates categories with the highest first order gain requirements. In order to include at least half of the plans in minimum operability group, justice requires the gain of 36.9 percentage points, definition - 36.0, design - 31.8, labor - 20.0. Framing and evaluation categories require the gain of 12.0 and 13.0 respectively, while implementation requires only 3.5. Hazard, planning and value already meet the 50% minimum operability criterion.

Fifteen percent functional capacity threshold analysis shows an even more stringent picture. There is only one category meeting this criterion - planning. For justice and implementation categories 14.0 percentage points gain are required, for design - 13.0, for labor and evaluation - 11.0, definition - 10.0, framing - 7.0, hazard - 4.0, value - 3.0.

Table 4. Threshold gains.

Category	Current score ≥ 2	Gain to reach 50%	Current score ≥ 3	Gain to reach 15%
Definition	14.0	36.0	5.0	10.0
Framing	38.0	12.0	8.0	7.0
Justice	13.1	36.9	1.0	14.0
Planning	68.7	0.0	16.2	0.0
Design	18.2	31.8	2.0	13.0
Implementation	46.5	3.5	1.0	14.0
Evaluation	37.0	13.0	4.0	11.0
Hazard	60.0	0.0	11.0	4.0
Value	70.0	0.0	12.0	3.0
Labor	30.0	20.0	4.0	11.0

The gains in Table 4 change the interpretation of priority. Categories with moderate minimum operability may still require substantial functional gains. Implementation is the clearest example: it is close to majority minimum operability but almost entirely absent from functional practice. Definition and justice require improvement at both levels, meaning that they need basic inclusion as well as deeper operational content.

The priority display in Fig. 7 identifies four urgent categories for minimum operability: justice, definition, design, and labor. A different set becomes visible at the functional threshold: justice, implementation, design, labor, and evaluation. The combined result shows that plans need both conceptual repair and procedural strengthening, not only additional references to equity.

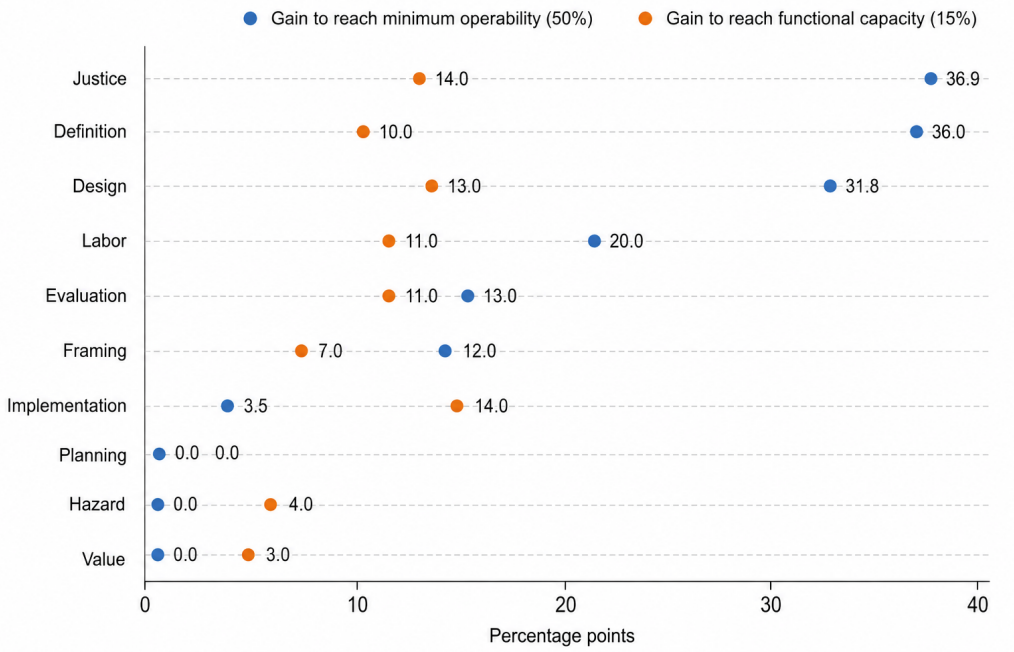

Figure 7. Threshold repair priorities.

5. Discussion

5.1. Equity vocabulary lacking definition

The most obvious implication of the findings is that equity terminology is becoming common before equity definition in U.S. green infrastructure planning. It appears in the comparison between the proportion of plans containing equity or justice terms and the proportion defining them. Undefined equity is not just a technical problem in plan drafting; it undermines the plan's ability to distinguish between equality of distribution and needs-based distribution, procedural inclusion and community power, and greening value and anti-displacement policy. Environmental justice research has shown that unequal environmental conditions are produced by historical and ongoing institutions [12, 15, 45, 52, 53]. An equity plan unable to articulate this causality will not be able to change it.

This also explains the relatively low sufficiency of vision, the first life-cycle dimension. Vision is meant to provide guidance and direction to the rest of the plan by defining the goal of equity-oriented green infrastructure. With only 18.4% sufficiency and 78.3% non-operability, it leaves later claims about environmental hazard, value, or protection on uncertain conceptual footing. Plans might discuss improved parklands, cooler streets, stormwater retention, and health benefits while still leaving the harder question of authority and protection unanswered.

5.2. Losing procedure from planning to design

The second prominent trend is the dramatic drop-off from participation to implementation capacity. Participation reaches 16.2% functional capacity, the highest score of all ten categories. Implementation is down to 1.0%, design 2.0%, and evaluation 4.0%. This pattern indicates that participation has been more common in the act of plan-making than in the exercise of design, implementation, and evaluation authorities. This is consistent with participation studies which show that consultation does not guarantee inclusion and empowerment [4, 40].

This has direct implications for the development of green infrastructure. Design authority determines site location, tree species, maintenance, stormwater management, accessibility, safety, cultural appropriateness, and resident protection during construction. Implementation authority determines how the project will be carried out, through contracts, phase scheduling, funding, agency responsibilities, and monitoring. If these decisions are not guided by community participation, a participatory plan can mask a closed institution.

5.3. Distributional strength and labor weakness

While distribution is the strongest category overall, its strength is unevenly distributed. While hazard and value dimensions have made good progress, the labor dimension remains relatively weak. This suggests that plans find it easier to talk about flooding, heat mitigation, amenity value, and multiple benefits than labor conditions associated with building and maintaining a green system. But labor is a critical issue in green infrastructure, especially after ribbon cutting. Trees need watering, pruning, maintenance; bioswales need regular cleaning and replanting; parks require management; vacant-land greening involves community stewardship; and stormwater management requires inspection.

This makes labor a distributional issue. Labor-related equity issues include green gentrification caused by new environmental investments, unpaid community stewardship roles, or underpaid and undertrained work. On the positive side, paid maintenance by the community itself, community contracting and training, durable employment, and local job training programs can help transform environmental investment into wealth-building opportunities [10, 29, 42, 55]. Low labor scores indicate that many plans do not yet see the link between environmental value and labor.

5.4. Anti-displacement as a distributional condition

The comparatively strong value category merits further qualification. Value can refer to health benefits, stormwater control, coolness, recreational use, and increased community identification. However, it can also refer to real estate value, redevelopment interest, and housing cost increases. The ecological and green gentrification literature has shown that public investments in green infrastructure without appropriate safeguards can contribute to displacement pressures [3, 6, 14, 19, 24, 49, 50].

These findings point to a potential risk in planning: U.S. green infrastructure plans are better at describing their benefits but less successful at mitigating the adverse market effects of those benefits. This is particularly problematic in areas that have undergone environmental degradation and have become the targets of environmental repair policies. Without appropriate safeguards, environmental repair can end up facilitating the extraction of value from populations that suffered the initial disinvestment.

Therefore, in the process of making environmental investments, equity-oriented plans should explicitly address anti-displacement protections. Anti-displacement policies, which can range from housing protection and ownership rights to economic protections, belong to the domain of environmental implementation, not independent urban planning.

5.5. Strengths and limitations of ordinal partitioning

There are two important strengths of Ordinal Sufficiency Partitioning. First, it highlights both presence and absence, functional capacity, and ideal status of evidence, avoiding an average-only assessment. Second, it allows for a sharper distinction between categories. For instance, while design shows less absence than definition, most design content is still weak. Implementation is near 50% operability, but almost entirely absent from functional capacity. The differences have important implications for plan revision since different types of revision may be needed to improve different categories.

On the other hand, there are three important limitations. First, the analysis is limited to category distribution patterns. Aggregate patterns cannot tell us whether certain plans or cities do well across several categories or whether high-hazard scores go along with anti-displacement or labor-related measures. Second, the category distributions were converted into ordinal sufficiency scores. Therefore, they should be understood as ordered data, not precise interval measures. Nevertheless, the main finding still holds true: the weakest categories correspond to the governance links needed to implement equity.

6. Conclusion

The article evaluated the existence of an equity chain condition in U.S. green infrastructure plans. The empirical evidence indicates that while the plans contain significant environmental intentionality around hazard reduction, multiple value creation, and community participation, they do not connect this intentionality to necessary definitions, recognition of injustice, community design and implementation authority, labor issues, and anti-displacement policies.

The equity-operability chain presents the answer to the study's question. The weaknesses are evident from the diagram: the equity chain requires a set of connections that have yet to materialize in U.S. green infrastructure plans.

The priorities for plan improvement are clear from the threshold statistics. Definition, justice recognition, design authority, labor, and corrective evaluation require the most improvement to become operational in more than half of plans. Design authority, labor, and evaluation require the most work to achieve functional capacity.

Cities aiming to adopt equity-oriented green infrastructure planning should start by identifying and addressing inequitable environmental conditions, connecting their causes to specific institutions, empowering the community over design and implementation, measuring and monitoring social impacts, protecting residents from displacement, and promoting community-paid work and training.

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