Perspective matters: An interpretational lens to understand environmental performance indices

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Abstract

Environmental performance indices play a crucial role in evaluating countries' environmental efforts and advancing global environmental governance. This study critically examines disparities among prominent climate performance indices, including the Environmental Performance Index (EPI), Climate Change Performance Index (CCPI), and Climate Action Tracker (CAT). We reveal significant divergences in country rankings, particularly between 'developed' and 'least developed' nations, underscoring how methodological choices profoundly impact outcomes and interpretability. We develop an analytic tool, called EPI-equity, to demonstrate how integrating equity principles can substantially alter performance assessments. We propose a conceptual framework to classify indices based on the perspectives they embody, highlighting how these can shape the interpretation of performance. Our results suggest that the outcomes of environmental performance indices are more likely to concur when they represent similar perspectives. We propose that explicitly articulating the perspective implied by the formalism of performance indices can enhance transparency, guide developers in aligning methodological choices with intended interpretations, and equip users with a clearer understanding of the results. Our analysis highlights the importance of employing multiple indices that encompass a range of perspectives for a comprehensive evaluation of countries' environmental performance. Our adaptable framework provides a structured approach to guide the selection of indices ensuring that they span a broad spectrum of viewpoints. This method mitigates the likelihood of conflicts arising from fragmented worldviews on complex socio-environmental issues.

Keywords: Climate performance indicators, Environmental Performance Index, Climate Action Tracker, Equity, Fairness, Perspectives

1. Introduction

Environmental indices are critical tools for interpreting complex multi-dimensional information and for monitoring progress towards desirable sustainability goals (Meadows 1998; Parris and Kates 2003; Singh et al. 2012). In so doing, they serve as an information basis to advance environmental governance (UNCED 1992; DeLoyde and Mabee 2020). Various indices have been developed to assess countries' environmental performance, such as the Sustainable Development Goals Index (Sachs et al. 2016), Ecological Footprint (Wackernagel et al. 1999), and the Comprehensive Environmental Performance Index (Latif 2022). These indices serve as a critical resource to policymakers, international agencies, researchers and the public in gauging progress on environmental goals.

Careful design of indices is critical, encompassing considerations for contextualisation, data quality, and transparent methodologies (Nardo et al. 2008). Additionally, environmental indices must be comprehensive and multidimensional (Bonnet et al. 2021), transparent and replicable (Cendrero et al. 2003), with sensitivity analysis to quantify uncertainties in outcomes (Uwizeye et al. 2017). While some of these concerns are well-addressed in the design of the SDG-index dashboard (Schmidt-Traub et al. 2017), we lack a conceptual framework to understand how normative choices in index design can predispose them towards certain outcomes. This work demonstrates how methodological decisions in constructing indices influence their results, offering a conceptual framework to evaluate the perspectives embodied by indices.

Our analysis focuses on three prominent climate performance indices: the Climate Change Performance Index (CCPI) (Burck et al. 2023), Environmental Performance Index (EPI) (Wendling et al. 2018; Wolf et al. 2022a; Block et al. 2024), and the Climate Action Tracker (CAT) (CAT 2023).

Our analysis centres on the EPI, established in 2006 and updated every two years since, which has established itself as a comprehensive, data-driven, replicable measure of environmental performance (Hsu and Zomer 2016). The EPI assesses environmental performance of over 180 countries, covering climate change, environmental health, and ecosystem vitality. While widely recognized for offering a holistic perspective on environmental performance, the EPI's results are influenced by normative choices in its formalism (Pinar 2022), including indicator selection, data imputation, weighting, aggregation, and normalisation methods. These considerations apply to the creation of all composite indicator (Greco et al. 2019; Mazziotta and Pareto 2022; Libório et al. 2022).

To address these concerns, the EPI's methodology and results undergo periodic audits and tests for data and statistical validity (Smallenbroek et al. 2023). Sensitivity analysis on the previous EPI (EPI-2022; Wolf et al. 2022a) has revealed significant uncertainty in performance for over half of the participating countries (Smallenbroek et al. 2023). This issue has also been noted in previous EPI releases (Pinar 2022). These findings raise concerns about how the outcomes on composite indicators may be predisposed by their methodology.

Such concerns have entailed real-world impacts. India lowest rank on EPI-2022 stirred extensive debate in the Indian media, involving stakeholders from academia, civil society organisations, think tanks, and non-governmental organisations (e.g. Dubash and Lele 2022; Bhushan 2022). The Indian *Ministry of Environment, Forest and Climate Change* challenged the EPI's findings, claiming that they were based on unfounded assumptions and unscientific methods (PIB 2022), to which the EPI issued a rebuttal (Wolf 2022). India remains among the bottom 5 on the latest EPI (Block et al. 2024). This exchange between the Indian government and the EPI developers was not without precedent. In 2019, the CCPI issued a rebuttal to the then-Australian Prime Minister's claim that the CCPI's 2019 index lacked credibility in response to Australia's poor performance on it (Germanwatch 2019).

How does the ostensibly objective task of gauging environmental performance get mired in such contentious debates? In this paper, we demonstrate that the divergence between well-known climate performance indices likely arises from differences in their emphasis on equity. We posit that these divergences in outcomes, and the associated real-world impacts, can emerge from contrast in the overall perspective embodied by the index's methodology.

The paper is organised as follows: Section 2 outlines the construction of EPI-equity and the framework to quantify perspectives embedded in performance indices. Section 3 presents an analysis of multiple climate indices, the role of equity and its implications by region and development status, and discusses the findings from our framework on 'perspectives.' Finally, we discuss why transparency on the perspective embodied by environmental performance metrics may help to better address future disagreements arising from the results of performance indices.

2. Data and Methods

2.1 Methods

We analyze three climate performance indices: EPI, CCPI, and CAT. Our methods include developing EPI-equity, a modification of EPI-2022, and creating a conceptual framework to classify indices based on their embodied perspectives. Detailed methodologies are provided in the Supplementary Information (SI).

2.1.1 Environment Performance Index (EPI)

We examine EPI-2022 and EPI-2024 (Wolf et al. 2022a; Block et al. 2024), focussing only on their climate change objective.

2.1.2 The Equity-based EPI (EPI-equity)

We develop EPI-equity as an analytic tool to illustrate the role of equity in performance assessment. The EPI-equity, representing a 'national emissions fair share' approach (Matthews 2016), is a modification of the EPI-2022 (Wolf et al. 2022b) since the Technical Appendix of current EPI-2024 was not publicly available at the time of analysis.

The EPI-equity is identical to EPI-2022's climate change objective except for modifying two terms that together account for 72% of the weight: 1. Projected 2050 GHG Emissions (GHN), and 2. CO_2 growth rate over 2010-2019 (CDA).

GHN was modified to 'EQA' which scores a country based on whether it remains within its *fair share* of the total global cumulative (historical + projected) emissions from 1850 to 2050. Fair shares for each country were calculated as cumulative emissions scaled by the ratio of the national average population of the country to the global average population over 1850-2050. EPI-2020's methodology was adopted to project emissions from 2020 to 2050 by extrapolating a simple linear trend in emissions over 2010-2019. Countries remaining within their fair share budget were scored from 0-100 based on the *quantum of the remaining budget*, and those exceeding their allocation were scored 0.

CDA was modified to 'EQI,' the *rate of depletion* of the 2010-2019 fair share carbon budget allocation based on the observed cumulative global emissions during that decade. Countries remaining within their fair share allocation are scored from 0-100 based on the *rate of depletion*, and countries exceeding their fair share were scored 0.

We note that since the EPI-equity differs from EPI-2022 in only two modifications, the change in score can be expressed as:

$$Score\ EPI\text{-}equity\ - Score\ EPI\text{-}2022$$
$$= 0.36\ (EQA - GHN) + 0.36\ (EQI - CDA), \qquad \dots\ Eq\ (1)$$

where 0.36 is the weight for CDA and GHN each in EPI-2022.

2.1.3 The 'perspectives' framework

We develop a conceptual framework to analyze climate indices based on two perspectives: the physical science perspective, which considers absolute GHG emissions, and the equity perspective, which considers per capita emissions. This framework aims to illustrate how different approaches can lead to varying interpretations of climate performance. Detailed methodology is developed in the SI.

2.2 Data

This study uses the same emissions datasets as EPI (2022 and 2024). These are detailed in the Extended Methods in SI. It additionally uses population data to calculate fair share budgets (Gapminder 2022; UN WPP 2024; Klein Goldewijk 2024).

3. Results

In Fig. 1, we compare EPI-2024 (only the climate change objective), CCPI-2024, and CAT to reveal striking differences among these metrics.

The bars in Fig. 1a illustrate the average EPI-2024 score for the countries belonging to each CAT category, with the full range of scores denoted by the black lines. The number of available data points are given in brackets. Countries rated "critically insufficient," "highly insufficient" and "insufficient" by CAT exhibit progressively higher average EPI-2024 scores. However, there is a notable drop in the performance of group with the highest CAT rating of "almost sufficient," with its average approximately matching the "critically insufficient" group's score.

In contrast, we see in Fig. 1b, that the average CCPI-2024 score progressively rises for each higher-rated CAT group. Thus, higher performance on CAT signifies better performance on CCPI, but this cannot be said for the EPI. This suggests that, on aggregate, the CCPI's assessment of climate performance is more closely aligned with CAT's than is the EPI's.

In order to diagnose why these metrics differ, we compare performance on EPI and CCPI in Fig 1c, distinguishing developing (blue squares) and developed countries (red circles). No developing country exceeds a score of 50 on the EPI (range: 0-100), meaning that higher scores on the EPI are occupied exclusively by developed countries. In contrast, both developing and developed countries attain high scores (> 60) on the CCPI. As a consequence, countries with the highest departure from the 1:1 line are exclusively the developing countries, which results in a much weaker correlation between EPI and CCPI scores considering all countries ($r^2 = 0.17$) than for only developed countries ($r^2 = 0.44$). This suggests that the EPI tends to assess developing countries as performing more poorly on climate change than the CCPI and CAT. These disparities in performance across metrics underscore the profound impact of methodological choices, affecting the interpretability of outcomes.

In subsequent analysis, we demonstrate that these divergences in outcomes may be related to the relative emphasis on equity.

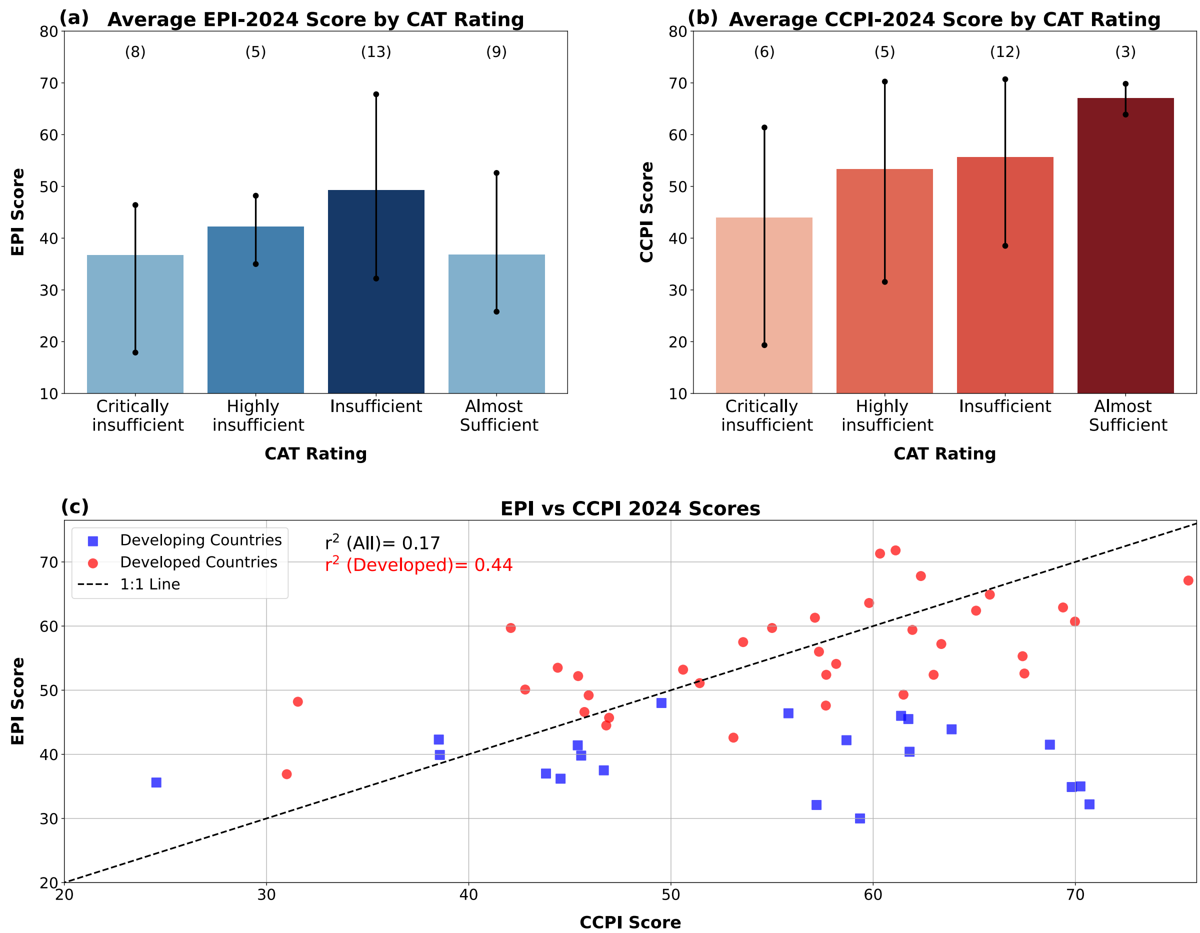


Figure 1. Intercomparison of three climate performance indices. Panel (a) shows the average EPI-2024 score for countries in each CAT category, with the full range represented by black lines. Panel (b) is identical to panel (a) for the CCPI-2024 scores. The number of countries contributing to each bar is indicated above it in parentheses. Panel (c) is a scatter plot of EPI-2024 and CCPI-2024 scores for 58 countries, categorized as Developing (blue squares) or Developed (red circles) following UNDP classification. A dashed black line represents the 1:1 line. Higher scores indicate better performance.

The role of equity in performance outcomes

To illustrate the impact of internalising equity in assessments of climate performance, we compare EPI-2024 and EPI-2022 with EPI-equity. An examination of the geographical variations in performance on these three metrics reveals distinctive patterns (Fig. 2).

In general, Europe performs well on EPI-2022, whereas the poorest performers are Africa, the Middle East, and South and Southeast Asia (Fig. 2a). The Americas, China and Russia occupy intermediate ranks. On EPI-2024, European countries and Japan witness considerably improved performance to occupy the top ranks, with other Global North countries also exhibiting better performance, especially the USA (Fig. 2b). The poorest performers are Africa, South and Southeast Asia, as with EPI-2022. These observations align with the inferences drawn from Fig. 1b on the relatively poor performance of developing countries on the EPI.

Performance on the EPI-equity exhibits considerably different patterns (Fig. 2c). Most of the top-performing countries on EPI-2024 perform poorly on EPI-equity, whereas many poorly performing countries on EPI-2024 exhibit a significant improvement in performance. Europe, North America, Japan, Australia, and New Zealand rank among the bottom 80 countries on EPI-equity. Asia's performance is mixed, with South and Southeast Asia ranking in the top 50, but West Asia and China occupying lower ranks, similar to the Global North countries. Most countries in Sub-Saharan Africa that perform poorly on EPI-2022/2024 exhibit greatly improved performance on EPI-equity, whereas South America's performance remains intermediate. On aggregate, the Global South appears to benefit, while the Global North suffers a decline in performance under the equity perspective of the new metric. This analysis demonstrates that incorporating equity into a climate performance metric can significantly influence outcomes and, consequently shape narratives.

To further diagnose the disparities in performance on EPI and EPI-equity, we analyse Eq. 1. The first term on the right hand side $(EQA - GHN)$ represents the anomaly arising from the difference in scores based on the exceedance of a country's fair share of the 1850-2050 carbon budget relative to the score based on absolute GHG emissions in 2050. The second term $(EQI - CDA)$ is the anomaly arising from the difference in scores based on the rate of depletion of the 2010-2019 fair share CO2 budget relative to the score based on the absolute rate of CO2 emissions over that decade. These two terms are plotted in Supplementary Fig. S1.

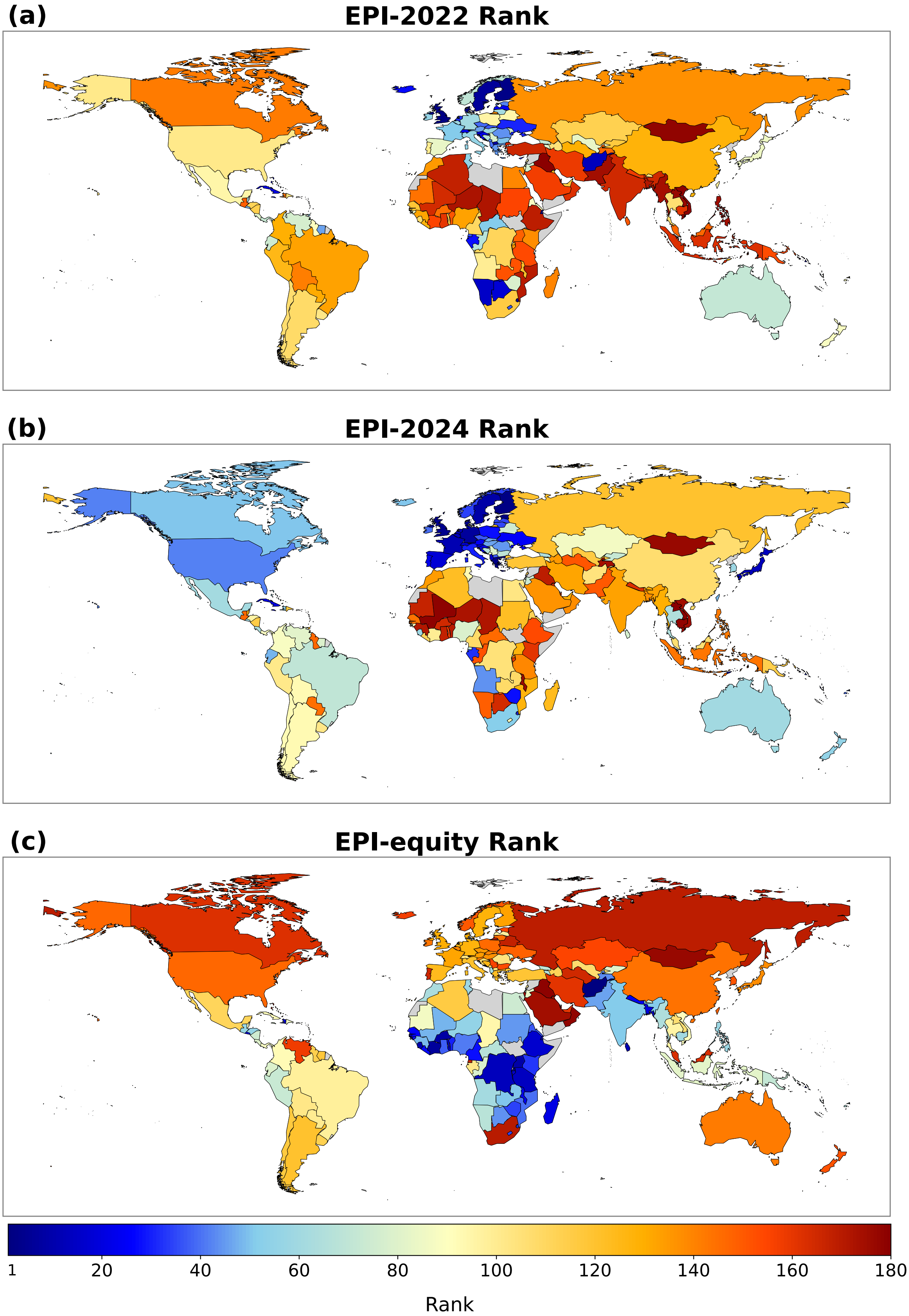

(a)
EPI-2022 Rank
(b)
EPI-2024 Rank
(c)
EPI-equity Rank
1
20
40
60
80
100
120
140
160
180
Rank

Figure 2. Spatial variation in ranks on (a) EPI-2022, (b) EPI-2024, and (c) EPI-equity. Lower ranks (blues) indicate better performance. Countries without data are shaded in grey. Political boundaries may not be representative of all perspectives.

Anomalies in the Global North countries' scores on the first term of Eq. 1 are generally small (Fig. S1a), primarily because they obtain low scores on both GHN and EQA due to high 2050 projected emissions that exceed their fair share emissions allocation. Conversely, many Global South countries exhibit positive anomalies on the first term, which can be attributed to their projected cumulative emissions (1850-2050) remaining within their allocated fair share.

Interestingly, a much more pronounced contrast emerges between the Global North and Global South on the second term of Eq. 1 (Fig. S1b). As on the first term, the Global South features positive anomalies on the second term. Concurrently, the Global North features substantial negative anomalies on the second term, unlike on the first. This can be understood from the fact that EPI-2022 ascribed high scores to countries achieving absolute decoupling, which are mainly Global North countries (Hubacek et al. 2021). The decline in their scores under equity considerations indicates that these countries, despite achieving emissions decoupling in the past decade, have nevertheless exceeded their decadal fair share allocation i.e. the rate of decoupling is deemed inadequate from an equity perspective. On the other hand, most Global South countries feature positive anomalies on the second term since they remain within their decadal fair share allocations despite rising emissions.

It is also noteworthy that a striking difference emerges with regards to some of the top scoring countries on EPI-2022, i.e., Denmark, the UK, Finland, and Sweden. Unlike most other Global North countries, the performance of these countries declines prominently on *both* terms of Eq. 1. This suggests that many of the countries performing best on EPI-2022 are the ones least compatible with this formulation of equity. China’s performance is also notable, declining on EPI-equity relative to EPI-2022/2024. Examination of Fig. 2 and Fig. S1 suggests that China’s performance now bears greater similarity with Global North countries than with the Global South, aligning with Hickel 2020’s inference.

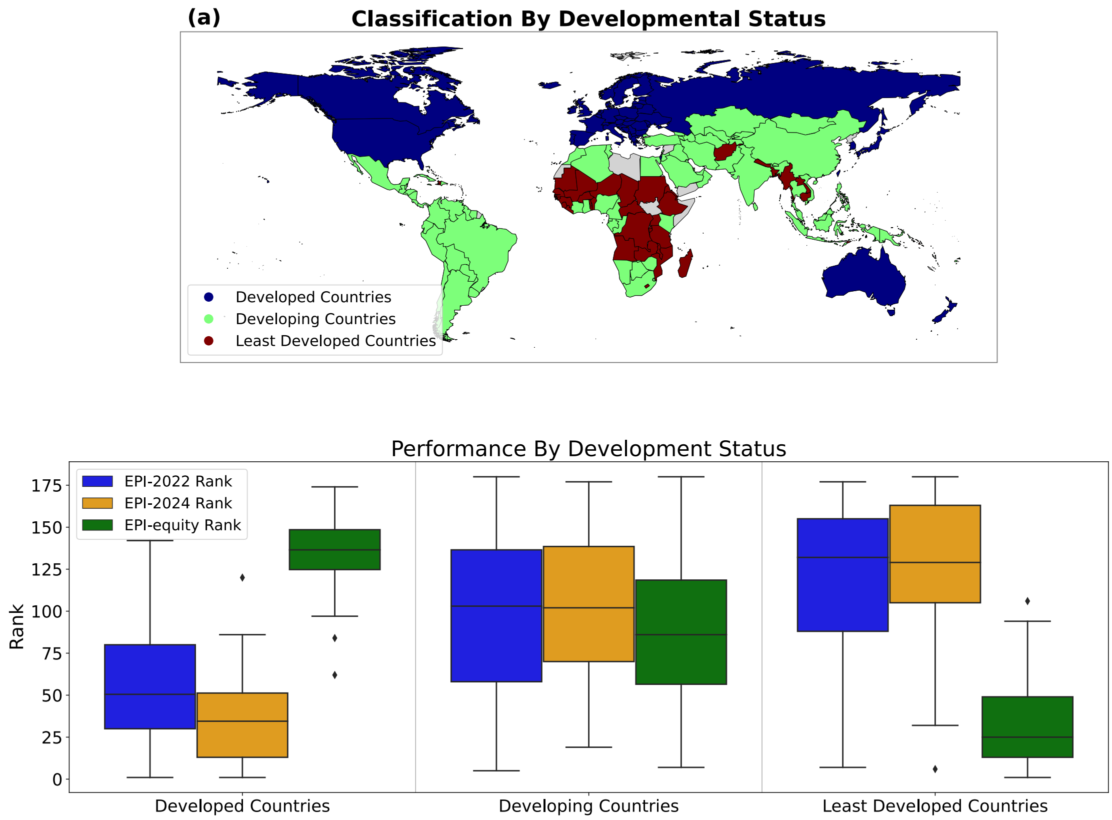
This analysis illustrates how normative choices and conceptual frameworks can significantly shape outcomes, and therefore perceived performance, as noted in previous studies (Greco et al. 2019).

Aggregate performance by region and developmental status

Here, we look beyond individual countries to groups of countries to identify how internalizing equity affects aggregate performance. In Fig. 3, we assess performance of groups classified by income and region.

Fig. 3a represents classification by developmental status as ‘Developed,’ ‘Developing,’ and ‘Least Developed’ following the United Nations Development Programme (UNDP) classification (UNDP 2022). The spatial map indicates the countries classified in each group, and the box-whisker plots indicate the performance on the three metrics.

The performance on EPI-2022 and EPI-2024 demonstrates no significant difference for any developmental category. However, a pronounced difference emerges between the EPI-equity and the others, particularly for the ‘Developed’ and ‘Least Developed’ groups. The ‘Developed’ group performs well on the original EPI metrics with a median rank around 50 on EPI-2022, with 75% of the countries ranking in the top 80. This group’s performance improves further on EPI-2024 update with a median rank around 30, with 75% of this group ranking in the top 50. However, there is a pronounced drop in performance on EPI-equity with a median rank around 135, and 75% of this group occupying ranks in the bottom 60. Based on the analysis using Eq. 1 and Fig. S1, we infer that the decline in performance of the Developed group on EPI-equity is largely contributed by the rapid rate of depletion of their 2010-2019 fair share carbon budget because of inadequate rates of emissions decoupling (second term of Eq. 1).


(a)
Classification By Developmental Status
Developed Countries
Developing Countries
Least Developed Countries
Performance By Development Status
EPI-2022 Rank
EPI-2024 Rank
EPI-equity Rank
Rank
0
25
50
75
100
125
150
175
Developed Countries
Developing Countries
Least Developed Countries

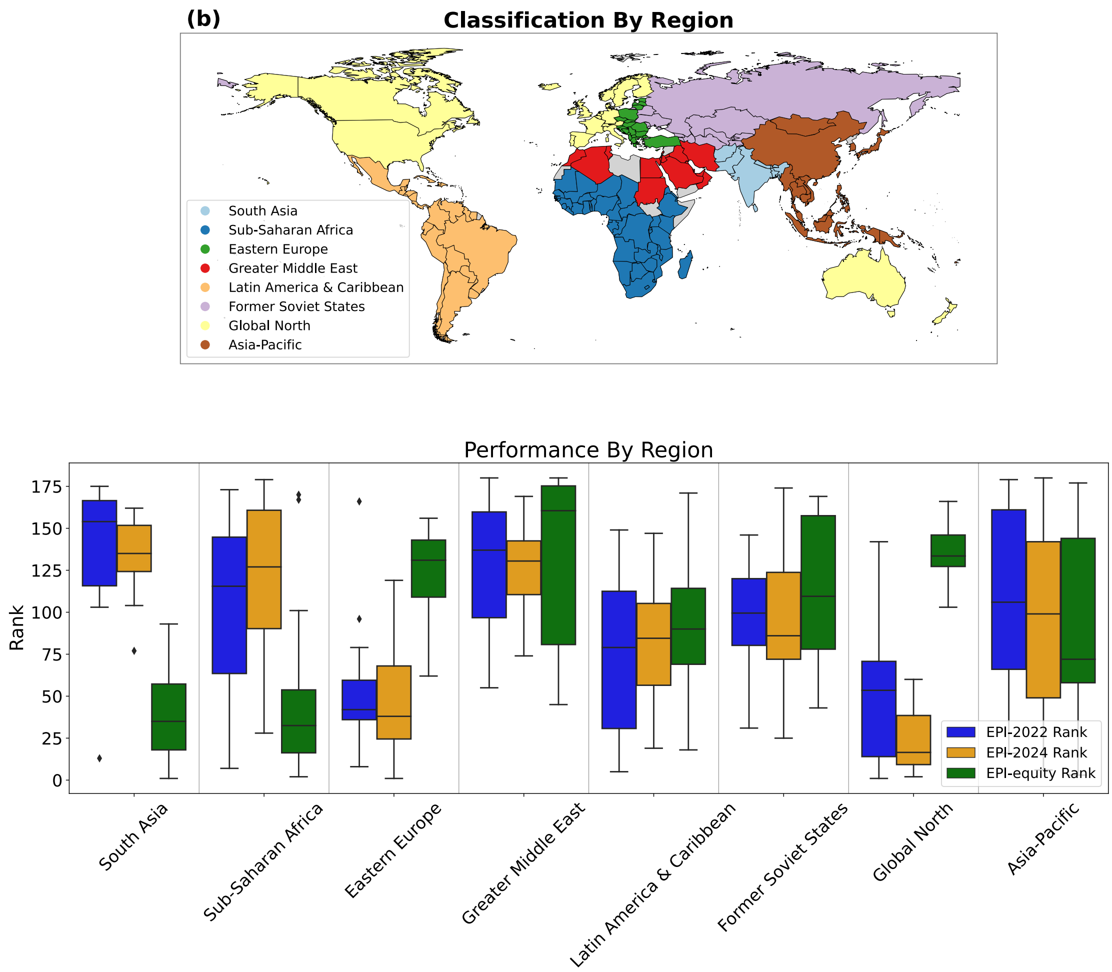

(b)
Classification By Region
South Asia
Sub-Saharan Africa
Eastern Europe
Greater Middle East
Latin America & Caribbean
Former Soviet States
Global North
Asia-Pacific
Performance By Region
Rank
0
25
50
75
100
125
150
175
EPI-2022 Rank
EPI-2024 Rank
EPI-equity Rank
South Asia
Sub-Saharan Africa
Eastern Europe
Greater Middle East
Latin America & Caribbean
Former Soviet States
Global North
Asia-Pacific

Figure 3. Performance on EPI-2022, EPI-2024, and EPI-equity categorized by (a) developmental status, and (b) region. The spatial maps in panels (a) and (b) indicate the country groupings for each classification considered. The box-whisker plots represent the performance (ranks) of each group on the three metrics. Boxes span the interquartile range and the central lines in each box represent the median. Whiskers denote 1.5 x interquartile range. Lower ranks indicate better performance. Countries without data are shaded in grey. Political boundaries may not be representative of all perspectives.

The performance of the Least Developed (LD) group exhibits the opposite trend: the LD group performs poorly on EPI-2022, and even poorer on EPI-2024. However, performance improves considerably on EPI-equity with 75% of this group occupying the top 50 ranks, indicating that these countries benefit from being assessed on equity criteria. Following the previous analysis, we deduce that the enhancement in the LD group's performance can be attributed to their emissions remaining within fair share allocations both in the past and the future, despite projected emissions increases.

Likewise, the regional analysis of Fig. 3b yields interesting insights. We find that the Global North, Eastern European, South Asian, and Sub-Saharan African regions exhibit the most conspicuous difference in performance between the EPI-equity and the original EPI metrics. The Global North and Eastern Europe perform well on EPI-2022/2024, whereas the South Asia and Sub-Saharan Africa perform poorly. Under EPI-equity, these patterns are reversed. Notably, the contrast in the performance of the "Global North" group is even more pronounced compared to the "Developed" group of countries, since the former is a subset of the latter (see the spatial maps of Fig. 3).

In summary, based on developmental criteria, the 'Least Developed' group benefits most by being assessed from the equity perspective, whereas the 'Developed' group is most disadvantaged. In regional terms, South Asia and Sub-Saharan Africa benefit most from the equity perspective, whereas the Global North and Eastern Europe are most disadvantaged.

‘Perspectives’ embodied by environmental performance indices

Indicators inevitably encode values or worldviews, often imperceptibly (Meadows 1998). The preceding analysis has demonstrated that, in the context of climate indices, divergent underlying values can result in conflicting outcomes. Thus, identifying broad principles, or ‘perspectives’, underpinning indices can help uncover the source of their disparities, thereby facilitating the expansion, correction or integration of worldviews. To this end, we aim to develop an illustrative conceptual framework to interrogate climate indices on the perspectives they embody.

We motivate our framework using Indonesia as an example. From a cumulative GHG emissions approach, Indonesia is considered one of the largest contributors to climate change (Jones et al. 2023). However, when viewed from the perspective of national fair shares of a safe global carbon budget based on per capita emissions, Indonesia is found to have contributed substantially towards avoiding climate breakdown (Hickel 2020).

This example illuminates two contrasting approaches. The first is an exclusively biophysical approach underpinned on the polluter-pays principle (OECD 1974; UNCED 1992), since global warming is proportional to the accumulated CO_2 in the atmosphere (Allen et al. 2009; Matthews et al. 2009). The second is a socio-economic approach grounded in the principle of equitable access to the atmospheric commons of every individual (Smith 1991; Grübler and Fujii 1991; Ghosh 1993; Neumayer 2000). These two approaches, each justified by established scientific and ethical principles, lead to strikingly different interpretations of Indonesia’s climate performance.

Based on these observations, we discern two distinct perspectives embodied in climate performance indices. The concept of cumulative GHG emissions, with its direct link to global warming, represents what we term the ‘physical climate perspective’. This approach is indifferent to socio-economic concerns such as the distinction between ‘luxury emissions’ of the rich and ‘survival emissions’ of the poor (Agarwal and Narain 1991). Conversely, the per capita emissions based approach offers insights into the disparities in consumption patterns, representing what we term the 'equity perspective'. However, per capita emissions are not direct linked to warming as are absolute emissions.

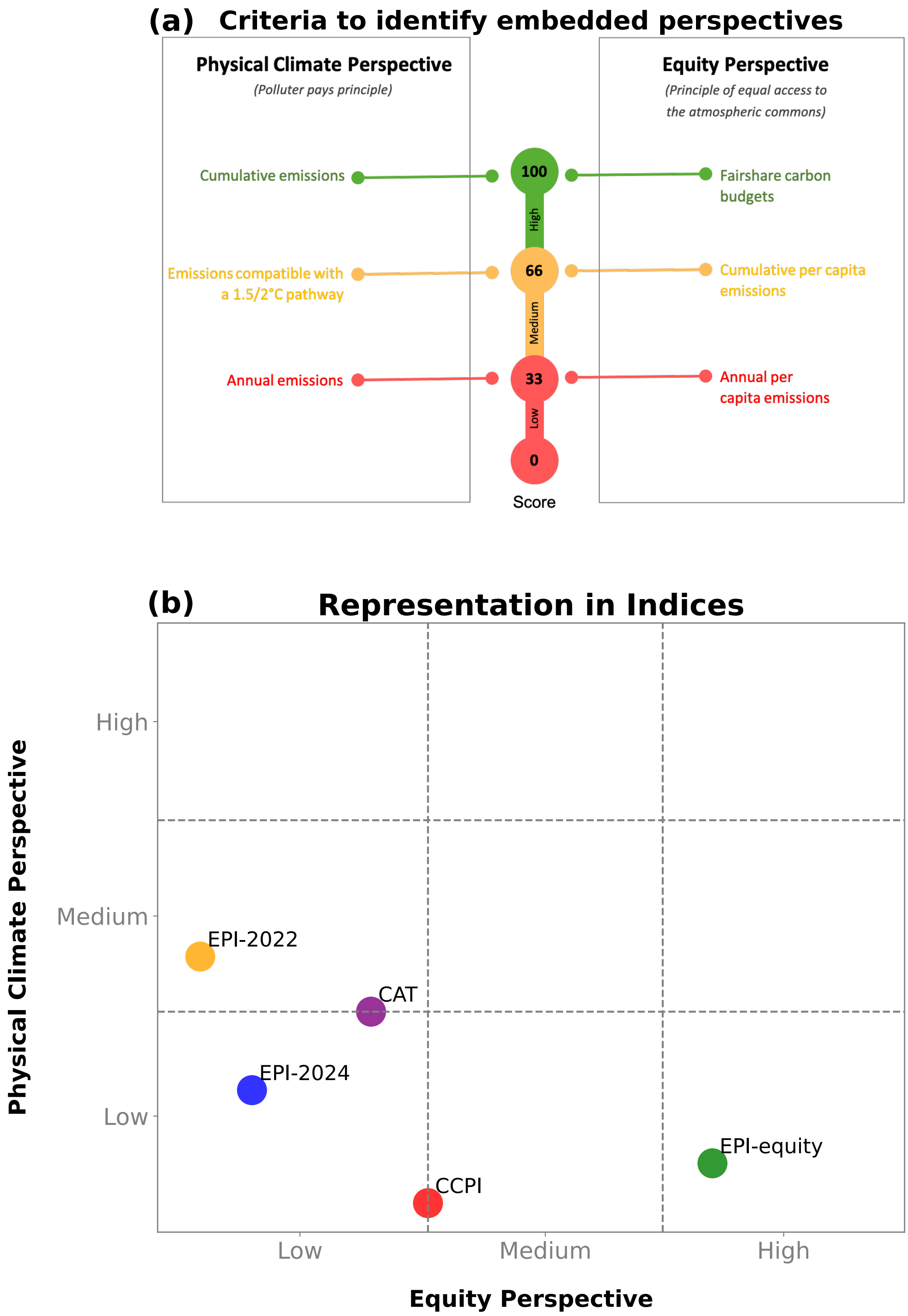


Figure 4. Panel (a) summarizes the operationalization of the 'perspectives framework' listing the three criteria chosen to represent each dimension. Discrete scores of 33%, 66% and 100%

are associated with each criterion. Panel (b) represents a "perspective space" categorizing multiple climate indices based their representation of each perspective. The vertical axis denotes the 'physical climate perspective' and the horizontal axis denotes the 'equity perspective'. The score of an index on a given perspective is determined as a weighted sum of the discrete scores for that perspective specified in panel (a), as described in the SI. A 0-33% emphasis on a given perspective is qualified as "Low," 34-66% is as "Medium", and 67-100% as "High." Refer to the SI for details.

We construct the 'perspectives framework' based on this conceptual division. Indicators based on absolute emissions are considered representative of the physical climate perspective, and those prioritizing per capita emissions are considered representative of the equity perspective. The schematic in Fig. 4a summarizes the operationalization of this framework, with further details in the SI.

Fig. 4b illustrates the application of our framework to climate indices, revealing significant differences among them in their representation of each perspective. EPI-2022 emerges as the metric most strongly aligned with the climate perspective, albeit with minimal representation of the equity perspective. Its successor, EPI-2024, exhibits a recalibration: a decreased emphasis on the climate perspective is counterbalanced by a modest increase in equity representation. This shift towards equity is limited since equity-based indicators are allocated only 2% weight on EPI-2024's climate change objective (Block et al. 2024).

In contrast, the CCPI focuses exclusively on per-capita emissions, thereby aligning solely with the equity perspective. Its position on the equity axis reflects the specific criteria of equity employed in our framework (refer to SI for details).

The CAT demonstrates a more balanced approach, representing both perspectives more robustly than EPI-2024, although neither to high degree. Its stronger alignment with the equity perspective explains its higher concurrence with CCPI ratings seen in Fig. 1.

These observations suggest that metrics representing similar perspectives are more likely to align in their outcomes.

The EPI-equity stands out by exhibiting the strongest representation of the equity perspective, primarily due to its use of fair share budgets in performance assessment. However, this enhanced focus on equity comes at the expense of the climate representation, which is even lower than in EPI-2024.

The positioning of indices in Fig. 4b is based on the criteria outlined in Fig. 4a. While adjustments to these criteria would likely alter the relative positions of indices, the fundamental insight that indices inherently embody multiple perspectives to varying degrees is expected to remain valid. Using this demonstration, we illustrate the principle and utility of a 'perspectives' analysis. Future research could include sensitivity analyses to further refine the framework and explore its robustness across different sets of criteria and scoring.

4. Discussion

This study critically examines three prominent indices – EPI, CCPI and CAT – revealing significant disparities in how they evaluate countries. We demonstrate that these differences likely stem from differing emphases on equity, which we illustrate through our EPI-equity modification that significantly altered country rankings. We further develop a conceptual framework to illustrate that indices can embody certain perspectives over others, potentially predisposing outcomes.

Our inferences extends beyond climate indicators to encompass broader environmental indicators. That indices do not merely reflect objective data but are shaped by normative choices embedded in their methodologies is already well-recognised in terms of the impact of indicator selection, weighting, and aggregation methods (Booysen 2002; Böhringer and Jochem 2007; Singh et al. 2012; Greco et al. 2019). Indeed, a clear connection can be drawn between our approach and the conclusions of Greco et al. (2019) by recognizing that the normative selection of indicators and weights fundamentally alters the perspective represented by a composite indicator. The strength of our concept of 'perspective' lies in the interpretative lens that it provides to probe an index's underlying value system (Meadows 1998). This framework helps translate methodological choices into a conceptual understanding of what an index truly measures. The intent is to facilitate a comparison between indices that may differ widely in their methodological details and serve as a bridge between technical experts, policymakers, and civil society.

Based on our analysis, we posit that the rejections of the EPI and CCPI by the Indian and Australian governments stemmed from clashing perspectives. The Indian government's rejection of the EPI was an articulation of the need for equity in performance assessments, which was at odds with the EPI’s predominant focus. Conversely, the Australian government response amounted to the rejection of the CCPI’s predominant focus on equity.

We propose that articulating the implied perspective would serve as an useful addition to the process of developing a composite indicator (Nardo et al. 2008). This would guide developers in aligning their methodological choices with intended interpretations, and equipping users with a clearer understanding of how to contextualize the results. We conjecture that if the EPI and CCPI developers had explicitly stated the perspective represented by their methodological choices, the basis for governmental objections may have been more readily apparent and, perhaps, more constructively addressed.

Our analysis demonstrates that multiple perspectives, seemingly irreconcilable, can co-exist for complex social-environmental problems, yet each justified by well-established scientific and ethical principles. Prioritising a subset of perspectives to the exclusion of others can risk conflicts arising from fragmented worldviews. However, incorporating multiple indicators sampled from different parts of the “perspective space” can reduce the likelihood of such conflicts by ensuring a balanced representation of viewpoints. The methods we have developed enable this approach.

We acknowledge that our framework is not comprehensive and that the binary division of perspectives might appear to be an oversimplification. However, this approach is deliberately chosen, adhering to the Occam's razor principle (Spade et al. 2024). For instance, while many equity and fairness principles have been proposed in the environmental literature (Adger et al. 2006; Höhne et al. 2014; Wallimann-Helmer et al. 2019; Kanitkar and Jayaraman 2019; Muttitt and Kartha 2020; van den Berg et al. 2020), we focus on a subset to provide a clear, interpretable framework. We believe that this parsimonious model, despite its simplicity, effectively illuminates the key drivers of divergence in performance indices. Nevertheless, future research may explore extensions of this framework, should additional dimensions prove necessary for specific contexts. Thus, our formulation is not a rigid or a definitive proposal, but an adaptable one. Indeed, the choice of criteria to operationalize our framework, meant to identify the perspectives implied by normative choices in index development, is itself normative, reflecting our view on equity. For example, our approach rewards 'fair share budgets' but disregards 'grandfathering' since we subscribe to the view that the latter is incompatible with the central equity tenet of protecting the most vulnerable (Moellendorf 2020; Dooley et al. 2021). We expect that these criteria will also be refined in future work. The ultimate goal is to develop a generalized formalism that can discern values, assumptions and worldviews embedded in wide range of environmental indices, towards facilitating enhanced transparency, fostering dialogue between differing viewpoints, and eventually leading to more thoughtfully designed indices to guide policy (Meadows 1998).

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Data and code availability

Available from the corresponding author upon request.

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