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Environmental destruction not avoided with the Sustainable Development Goals

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Abstract

The Sustainable Development Goals (SDGs) were designed to reconcile environmental protection with socioeconomic development. Here, we compare SDG indicators to a suite of external measures, showing that while most countries are progressing well towards environmental SDGs, this has little relationship with actual biodiversity conservation, and instead better represents socioeconomic development. If this continues, the SDGs will likely serve as a smokescreen for further environmental destruction throughout the decade.

Main text:

Despite much progress towards addressing social and economic issues, the world continues to face an unprecedented environmental and biodiversity crisis—with more than 6000 species threatened by overexploitation and over 230 million hectares of forest lost since 2000[1-3]. Integrating the protection of nature into the wider scope of human development, the Sustainable Development Goals (SDGs) were established as a blueprint for a more sustainable future for all[4,5].

The SDGs, a framework of 17 goals, 169 targets and 244 indicators, the SDGs were adopted by the UN General Assembly in 2015 to replace the now-expired Millennium Development Goals (MDGs)[4,5]. At their inception, the SDGs were touted as a major improvement over the MDGs, in part because of its integration of the environment across its entire framework[4,6]. This significantly revitalized the global focus on sustainability, and served as the basis of environmentally-driven national development agendas globally[4-6]. However, it also resulted in an intrinsic complexity that makes it dif- ficult to assess if such development agendas truly benefit or protect the environment[5]. For instance, SDG 9.1, the development of quality, reliable, sustainable and resilient infrastructure, cuts across all three pillars of development, but its associated indicators prioritize social and economic issues by focusing on rural population accessibility and passenger or freight volumes without accounting for the environmental impacts of such infrastructuredevelopment[7]. This inability to capture the nuances of complex targets, especially when it comes to environmental components has been the basis of much criticism recently[5].

To evaluate the ability of the SDGs to reflect actual progress towards biodiversity conservation, we: (i) assessed countries' performances on the prescribed set of indicators and (ii) compared these indicators against other independent and well-established measures of nature protection. We first isolated indicators and targets associated with the environment, and assessed the relative performance of 180 countries for each indicator towards achieving the associated target (see Methods). This formed a current baseline estimate of "environment-related" SDG indicators, which we then compared against external measures of nature. We also compared the SDG indicator performance to other external socioeconomic indices, testing the potential of other non-environmental factors to influence the environment-related SDGs.

Overall, we find that of the 247 SDGs indicators prescribed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs), 101 indicators were environment-related based on the description of their corresponding targets[7]. These included repeated indicators corresponding to different targets (see Supplementary Table 1 for details) [7]. Although 26 indicators possessed insufficient data for analyses, the remaining 75 indicators used suggest a relatively high global baseline performance towards environmental targets (Fig. 1 and 2). This positive trend, which, likely because of our country-specific approach, contrasts with other regional and global assessments[8], is apparent in all SDGs possessing at least one indicator where most countries performed close to the associated target, apart from SDG 2, no hunger (Fig. 1).

Yet globally, threats to nature are known to have accelerated over the past 50 years—resulting in changes to more than 75% of the Earth's surface and population declines of over 1 million species[9,10]. With the growing rates of extreme climate events and threats associated with the burgeoning human population expected to worsen in the coming years, a discrepancy between these trends and the results from prescribed environment-related SDG indicators is clear[9,11]. This mismatch is apparent in our results, with only ~7% of all correlations between SDG indicators and external indicators of biodiversity and nature protection being significantly positive (Fig. 1 and Supplementary Figure 3). Instead, a larger proportion (~14%) of these associations are negative and a majority (~78%) are non-significant (Fig. 1), suggesting that many indicators do not adequately reflect progress towards goals of environmental conservation goals. For instance, the ability of SDG 15.3.1 (percentage of degraded land in a country) to be a good indicator of efforts combating desertification, restoring land, and preserving life on land is unclear. While it reflects terrestrial wilderness change and the Living Planet Index, it depicts reversed trends for human footprint, terrestrial threats, and freshwater threats (Fig. 1). The discrepancy between the SDG indicators and external indicators is further reflected in the observation that of the 11 sepa- rate measures of the current state of the environment, most point to globally poorer performances, with human footprint being the only indicator for which majority of countries score over 75 (Fig. 1).

By contrast, global performances were higher for socioeconomic measures of development (Fig. 1 and Supplementary Figure 3). A notably higher percentage (~41%) of the correlations between the SDGs environmental indicators and external socioeconomic devel- opment measures are significantly positive ($P < 0.05$), while only ~7% are significantly negative ($P <$

0.05) and 51% are non-significant (Fig. 1). For example, countries with lower percentage of degraded land (SDG 15.3.1) tended to possess higher levels of social and economic development across all measures considered[12] (Fig. 1).

This disproportionate influence of social and economic factors is reflected across a large proportion of SDG indicators (~65%), including indicators within SDG 15 (degraded lands and invasive species) (Fig. 1 and Supplementary Figure 3). While 22 of these indi- cators are correlated with at least one measure of environmental conditions, some of these relationships appear to be less direct or even spurious — such as of the one between the Food Loss Index and temperature anomalies (Fig. 1). These indirect or spurious relationships, coupled with the high number of non-significant and negative correlations of environmental SDG indicators to measures of actual biodiversity state, points towards a masking rather than a synergistic effect of the SDGs on nature protection.

These findings suggest a lack of integration of environmental priorities into countries' developmental plans, which has been attributed to a dearth of technical capacity and difficulty in coordinating across administrative silos, especially in developing nations[13]. These issues, likely functioning in tandem with the lack of funds to monitor and measure complex target progress, lead to simpler indicators being used instead, resulting in the inability to adequately capture key nuances and the interlinkage of issues[8,13]. This, together with the uneven data coverage for indicators, tends to favor social and economic issues rather than the environment[5,13,14]. Additionally, with the current system of SDG indicators unable to incorporate telecoupled environmental impacts linked to international trade, the current prescribed SDG framework's efficacy in protecting biodiversity is uncertain[15].

However, a reformulation of the indicators would be more applicable in a post-2030 agenda. Within the 2030 agenda, a greater focus should instead be placed on data collection and quantification, both temporally and spatially, or the development of more reliable composite indicators within the existing framework. The treatment and formulation of such data has allowed for a more nuanced evaluation of some indicators in recent global assessments, which better reflects the current state of nature[8]. Concurrently, greater funding and incentive needs to be allocated to countries and administrative regions to aid the collection of data for applications at finer spatial scales, especially among developing nations[13].

Assessments of global SDG trends and performance, such as previous works related to health, income and education, are vital in shaping national and international policies[16,17]. These assessments have promoted suitable investments, and our findings demonstrate corresponding improvements towards achieving their socioeconomic development targets[16,17]. With biodiversity protection being a central theme of the SDGs, its role in shaping the global pursuit of sustainable development is undeniable[4-6]. Yet our results point out fundamental inadequacies in the ability of the set of prescribed indicators to protect biodiversity, and highlight the need for incorporating indicators that measure the actual state of, and threats to, global biodiversity. If these errors are not corrected, the SDGs could unknowingly promote environmental destruction in the name of sustainable development.

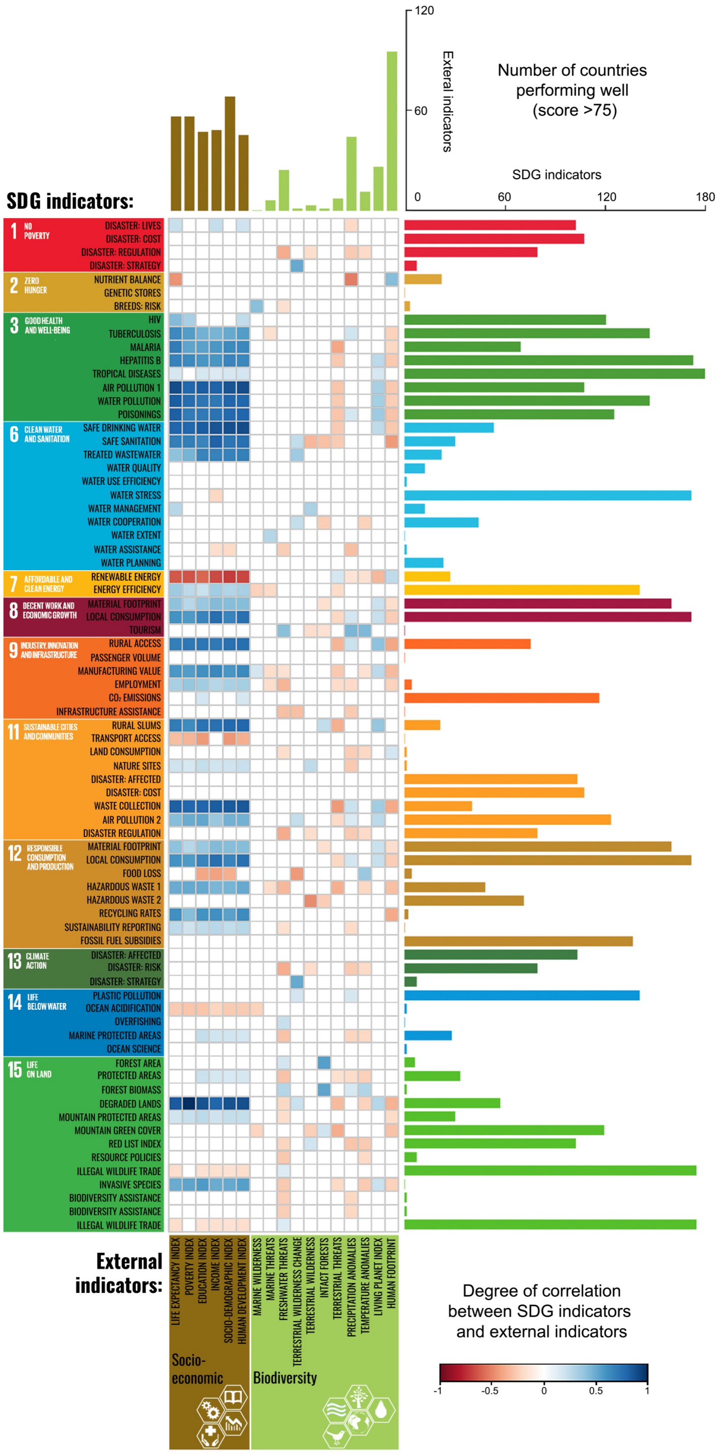

Figure 1: Many SDG indicators do not adequately reflect changes in external indicators of successful biodiversity conservation. Bar charts (top- and rightmost panels) show the number of countries performing well (score 75–100) relative to the rest of the world across 75 environment-related SDG indicators (leftmost panel) and 17 external indicators of socioeconomic state and of the actual state of, and threats to, biodiversity (bottom panel). A correlation matrix (middle panel), illustrated as a heatmap, shows the r values of significant correlations ($P < 0.05$) between SDG and external indicators, with darker blue representing greater positive correlations and darker red representing more negative correlations.

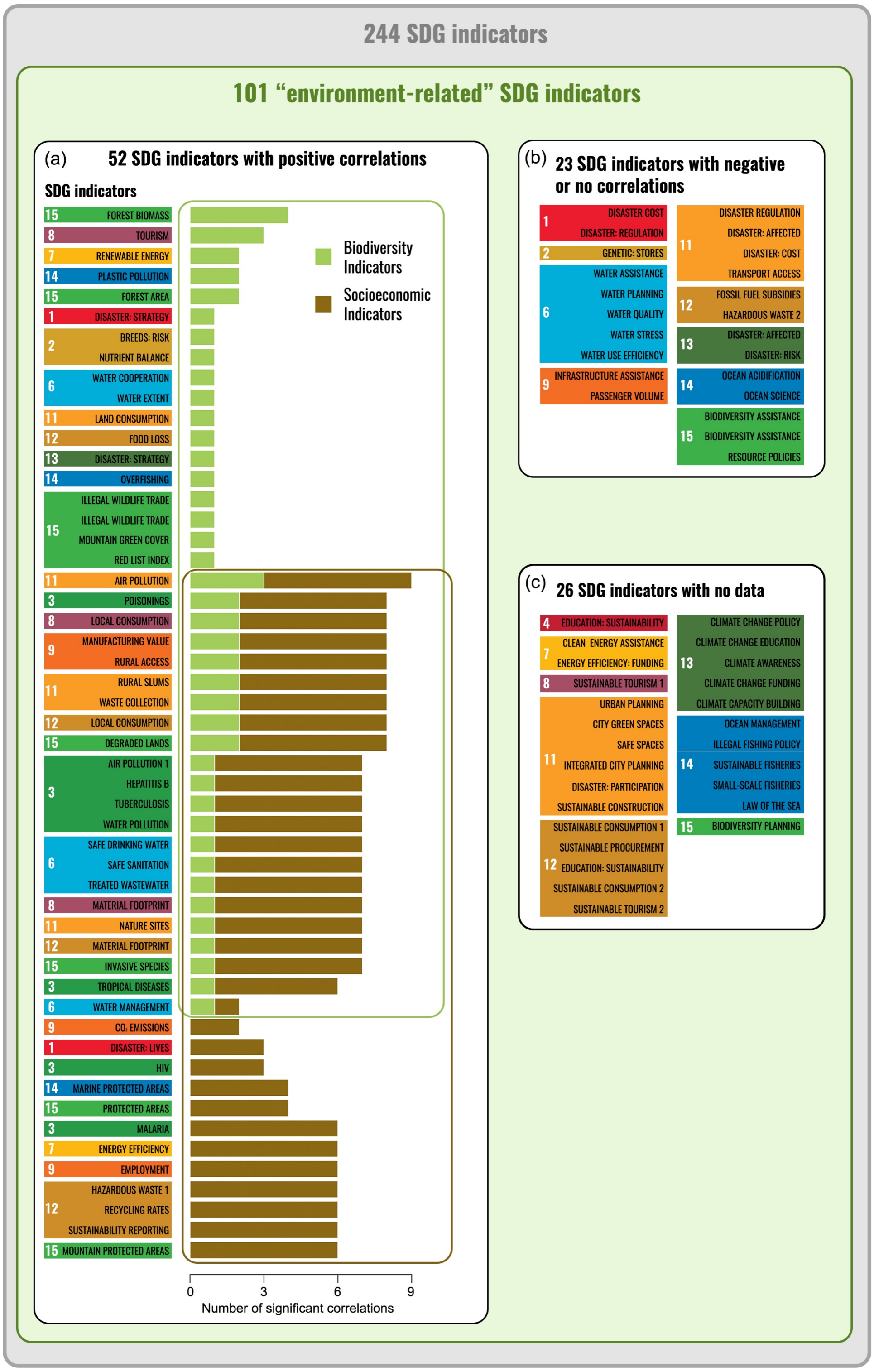

Figure 2: Evaluation of the efficacy of environment-related SDG indicators, based on 17 external indicators of the current state of biodiversity and socioeconomic development. Of the 247 SDG indicators, 101 were linked to the environment based on their associated targets. a,b, Of these, 52 indicators showed positive correlations to the external indicators (a), and 23 indicators showed either negative or no correlations (b). c, 26 indicators possessed insufficient data for this assessment of efficacy.

Methods

This study was conducted in three main steps. First, we selected the environment-related targets and indicators from the 244 indicators prescribed by IAEG-SDGs[7]. Specifically, we followed the environmental targets identified by Elder et al.[5], which is based on keywords such as 'environment', 'sustainability' or 'pollution' in their selection criteria[5]. We then gathered data for every indicator that matched up with these targets, aggregated to country-level, from a variety of sources (see Supplementary Table 1). These data were rescaled from 0 to 100 following previous publications on the health-related SDG index and Human Development Index[16]. Owing to the lack of specific numerical targets associated with most environmental SDG targets, we instead assume country performances to be relative to the lowest/worst global performance towards achieving the corresponding target (scoring 0), and highest/best (scoring 100) with the following formula (Supplementary Figure 1). In doing so, we provided a point of reference for comparison of performance which allows for country-specific evaluations rather than regional or global assessments[8].

Indicator performance = ((Actual Country Value - Minimum Global Value)) / ((Maximum Global Value – Minimum Global Value)) × 100.

Second, we correlated these SDG indicator datasets to 11 common and independent measures of environment or biodiversity via Pearson's correlation. These variables were chosen as they were previously shown and often cited to reflect the current state of biodiversity (e.g. Living Planet Index) or environment (e.g., terrestrial and marine wilderness) as well as the level of threats to them (e.g., marine, freshwater and terrestrial threats)[3,9,18,19]. Data were gathered from a variety of sources (see Supplementary Table 2), aggregated to country-level and rescaled following the above assumption and techniques[16] (Supplementary Figure 2). Higher scores here indicated lower impacts on biodiversity (e.g., higher population numbers) and the environment (e.g., greater amounts of wilderness), and lower levels of threats, reflecting general conservation goals.

Lastly, we applied the same correlation analyses to six measures of social and/or economic conditions that are commonly used to measure socioeconomic development[12,16]. These data represented previously determined indices (see Supplementary Table 2) which were calculated to country-level and we rescaled the data to match earlier analyses. Correlation coefficient

(Pearson's r) was used to denote the degree of correlation, while p-values less than 0.05 were considered significant. These parameters were used to form a correlation matrix between SDG indicators and other measures of environmental, social and economic performance, and illustrated as a heatmap (Fig. 1). All analyses were performed in R version 3.6.0[20].

Data availability: All data generated or analyzed during this study are included in Supplementary Figures 1 and 2, and raw data can be provided from the corresponding authors upon request. All processing R codes are available from the corresponding authors upon request.

Competing interests: The authors declare no conflict of interest.

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Author contributions: Z.Y. and L.R.C. conceived the study. Z.Y. carried out the analyses. Z.Y. S.M., R.K.R., O.V., J.E.M.W. and L.R.C. contributed discussions and modeling insights. Z.Y. S.M., R.K.R., O.V., J.E.M.W. and L.R.C. wrote the article.

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