

Technical note. Planetary pressures–adjusted Human Development Index

The Planetary pressures–adjusted Human Development Index (PHDI) is an experimental index that adjusts the Human Development Index (HDI) for planetary pressures in the Anthropocene. The PHDI discounts the HDI for planetary pressures to reflect a concern for intergenerational inequality, similar to the Inequality-adjusted HDI adjustment, which is motivated by a concern for intragenerational inequality. The PHDI is computed as the product of the HDI and (1 – index of planetary pressures), where (1 – index of planetary pressures) can be seen as an adjustment factor.

The PHDI is the level of human development adjusted by carbon dioxide emissions per capita (production-based) and material footprint per capita to account for the excessive human pressure on the planet. It should be seen as an incentive for

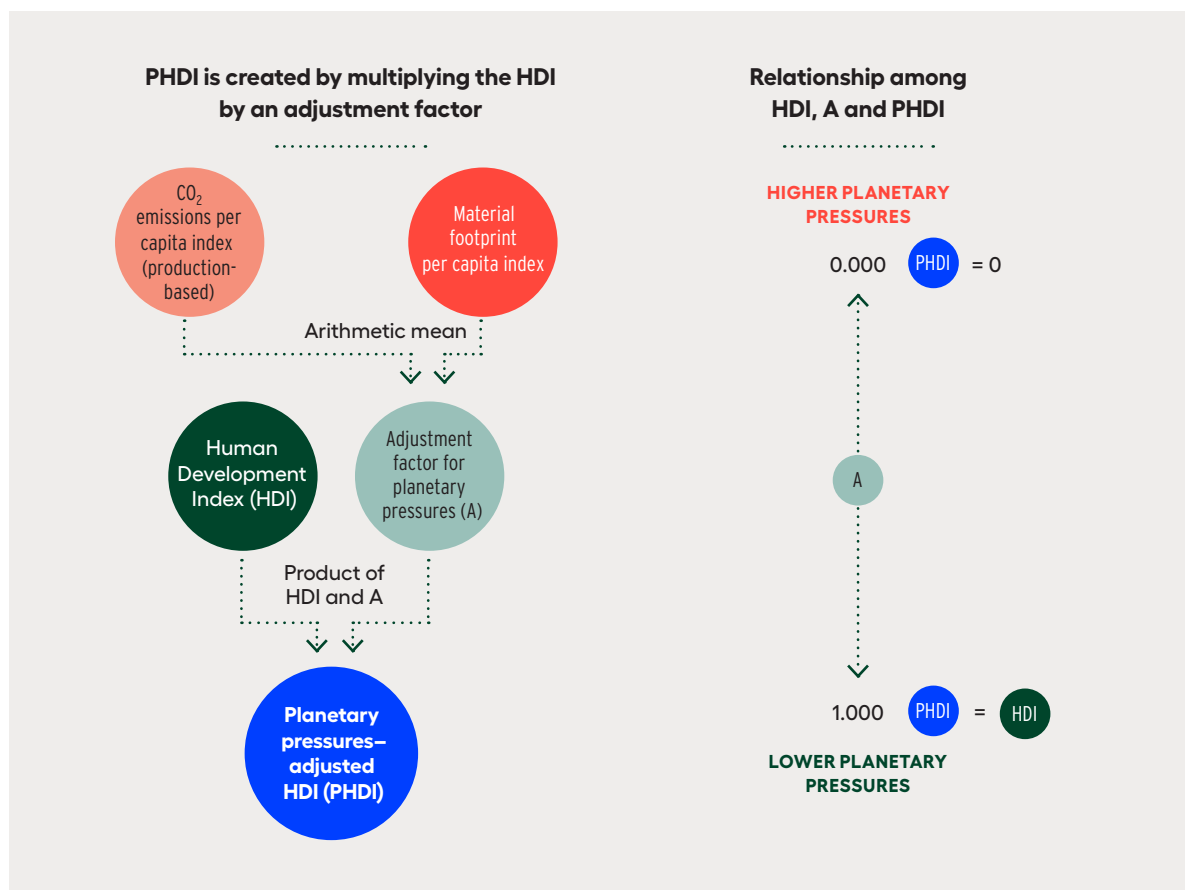
transformation. In an ideal scenario with no planetary pressures on the planet, the PHDI equals the HDI. However, as pressures increase, the PHDI falls below the HDI. In this sense the PHDI measures the level of human development when planetary pressures are considered.

Indicator definitions and data sources

In addition to the data used to calculate the HDI, the PHDI uses data on carbon dioxide emissions per capita (production-based) and material footprint per capita.

- Carbon dioxide emissions per capita (production-based): carbon dioxide emissions produced as a consequence of human activities (use of coal, oil and gas for combustion and industrial processes, gas flaring and cement manufacture), divided by

Figure 1 Visual representation of the Planetary pressures–adjusted Human Development Index



Source: Human Development Report Office.

midyear population. Values are territorial emissions, meaning that emissions are attributed to the country in which they physically occur. Data are from Global Carbon Project (2020).

- **Material footprint per capita:** material footprint is the attribution of global material extraction to domestic final demand of a country. Material footprint is calculated as raw material equivalent of imports plus domestic extraction minus raw material equivalents of exports. The total material footprint is the sum of the material footprint for biomass, fossil fuels, metal ores and nonmetal ores. Material footprint per capita describes the average material use for final demand. Data are from UNEP (2020).

Steps to calculate the Planetary pressures-adjusted Human Development Index (PHDI)

There are three steps to calculating the PHDI.

Step 1. Calculating the carbon dioxide emissions index and the material footprint index

Carbon dioxide emissions per capita and material footprint per capita are normalized in the same way as the components of the HDI. Through a min-max transformation each becomes an index with values between 0 and 1 calculated as:

$$A_j \text{ index} = (\text{maximum}_j - \text{observed value}_j) / (\text{maximum}_j - \text{minimum}_j)$$

where $j = 1, 2$ refers to the two included planetary pressure indicators.

Zero was set as minimum. The maximum corresponds to the maximum value observed historically for all countries since 1990, in line with the similar approaches in the literature, such as Biggeri and Mauro (2018). For carbon dioxide emissions per capita the maximum value is 69.85 tonnes, observed for Qatar in 1997. For material footprint per capita, the

maximum value is 152.58, observed for Guyana in 2000. The ranking of countries is sensitive to the selection of the maximum.

For both carbon dioxide emissions per capita and material footprint per capita, the higher the observed value and the closer to the maximum, the higher the pressures on the planet, implying a smaller value of the index and a larger adjustment to the HDI.

Step 2. Constructing the adjustment for planetary pressures

The adjustment factor for planetary pressures (A) is the arithmetic average of the indices measuring carbon dioxide emissions per capita and material footprint per capita, which assumes perfect substitution of these two indicators. Lower pressures on the planet result in a larger A and smaller adjustment to the HDI (see figure 1).

$$A = (\text{Carbon dioxide emissions index} + \text{material footprint index}) / 2$$

In addition, the index of planetary pressures, P , is defined as the complement of A : $P = (1 - A)$.

Step 3. Adjusting the Human Development Index to account for planetary pressures

The PHDI is the product of the HDI and the adjustment factor, A :

$$PHDI = HDI \cdot A,$$

or, equivalently, $PHDI = HDI \cdot (1 - P)$.

The difference between the HDI and the PHDI values due to planetary pressures, expressed as a percentage, is:

$$\begin{aligned} \text{Difference in HDI value} &= \left(\frac{HDI - PHDI}{HDI} \right) \cdot 100 \\ &= P \cdot 100 \end{aligned}$$

Example: Iceland

Indicator	Value
Human Development Index (HDI)	0.949
Carbon dioxide emissions per capita (production), tonnes	10.8
Material footprint per capita, tonnes	34.8
Carbon dioxide emissions index	$(69.85 - 10.8) / 69.85$ = 0.846
Material footprint index	$(152.58 - 34.8) / 152.58$ = 0.772
Adjustment for planetary pressures factor (A)	$(0.846 + 0.772) / 2$ = 0.809
Planetary pressures-adjusted HDI (PHDI)	$0.949 \cdot 0.809$ = 0.768
Difference in HDI value (%)	$[(0.949 - 0.768) / 0.949]$ $\cdot 100 = 19.1$

Note: Values are rounded.

Why is the Human Development Report Office releasing the PHDI?

- The PHDI signals changes that are needed to navigate the Anthropocene. It can help assess and encourage action that both advances human development and eases planetary pressures.
- The proposed adjustment to the HDI recognizes that easing the disruptions of planetary processes requires reducing carbon dioxide emissions and closing material cycles.
- The PHDI's focus on carbon dioxide emissions and material flows does not imply that other environmental concerns are less important or urgent, though reductions in the two included indicators reflect the transformation needed to ease some of the biggest planetary pressures.

What is the interpretation of the Planetary pressures-adjusted Human Development Index?

- The PHDI suggests that progress in human development has increased at a slower rate because planetary pressures have also risen.
- Caution should be used in interpreting the PHDI because it does not account for individual countries' responsibilities—current or historical.
- Country trajectories over the past three decades show different paths for different levels of human development. Low and medium human development countries have substantially improved social and economic conditions without imposing high planetary pressures. But in high and very high human development countries, improvements in wellbeing have been coupled with rising planetary pressures.
- The PHDI is intended to incentivize change by providing a metric for countries to assess their own progress over time, highlighting countries that are moving in the right direction so that others can learn from them. This interpretation is also consistent with the open-endedness of the human development journey in the Anthropocene. It is meant to provide a sense of possibility: how to achieve high HDI values with lower emissions and resource use.

References

- Biggeri, M., and Mauro, V. 2018.** "Towards a More 'Sustainable' Human Development Index: Integrating the Environment and Freedom." *Ecological Indicators* 91: 220–231.
- Global Carbon Project. 2020.** "Global Carbon Atlas." <http://www.globalcarbonatlas.org/en/CO2-emissions>. Accessed 27 August 2020.
- UNEP (United Nations Environment Programme). 2020.** "World Environment Situation Room, Data Downloader." <https://environmentlive.unep.org/downloader>. Accessed 17 September 2020.