The 2024 Happy Planet Index
Methodology Paper

Equation 1: Happy Planet Index (approximate)

$$Happy\ Planet\ Index\ \approx\ \frac{(\ Life\ expectancy\ x\ Self-reported\ wellbeing\ )}{Carbon\ Footprint}$$

Note: The equation is approximate because it leaves out the statistical adjustments described fully in Equation 2.

In essence, to calculate Happy Planet Index (HPI) scores, we begin by multiplying the mean life expectancy of residents of a given country by the mean self-reported wellbeing of residents in the same country, to calculate what we call 'Happy Life Years'.[1] We then divide this number by the country's Carbon Footprint per capita, to reveal the average number of 'Happy Life Years' produced per unit of demand on the natural environment from the country's residents.

[1] The combination of these two variables has been called 'happy life expectancy' (Veenhoven, R, 1996. Happy Life Expectancy: A comprehensive measure of quality-of-life in nations. *Social Indicators Research* 39:1-59). Chapter 8 of the World Happiness Report 2021 calls the same combination 'WELLBYs' (Layard, R. & Oparina, E., 2021. Living long and living well: The WELLBY approach. In J. Helliwell, R. Layard, J. Sachs, & J-E de Neve (eds) *World Happiness Report: 2021*. New York: Sustainable Development Solutions Network)

Box A: Overview of components of the Happy Planet Index

The Happy Planet Index is calculated for a given country by combining:

Life expectancy: the average number of years an infant born in that country is expected to live if prevailing patterns of age-specific mortality rates at the time of birth in the country stay the same throughout the infant's life. Life expectancy is commonly used as an overall indicator of the standard of health in a country.

Self-reported wellbeing: the average of all responses from within the population to the following question: *"Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. Suppose we say that the top of the ladder represents the best possible life for you; and the bottom of the ladder represents the worst possible life for you. On which step of the ladder do you feel you personally stand at the present time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?"* This measure of wellbeing, the 'Ladder of Life' is commonly used as an indicator of how people's lives are going overall.

Carbon Footprint: an estimate of the per capita greenhouse gas emissions associated with consumption and economic activity within a country. We have used the data from the World Inequality Database. This includes greenhouse gases produced directly within a country, for example for heating, electricity production or transport. But it also includes the greenhouse gases emitted in the production of goods and services consumed within that country, regardless of where they were produced. It includes emissions associated with individual consumption, but also emissions associated with the activities of government and business investment.

The precise formula used to calculate HPI scores requires some technical adjustments to be made, to ensure that no single component dominates overall HPI scores (see 'Calculating the Happy Planet Index scores' below).

The rest of this paper describes how data for each component of the HPI was prepared, how imputing was carried out to fill data gaps, and how the components were brought together to calculate the final HPI scores for all 147 countries.

Components of the Happy Planet Index

This section describes in detail how each component of the HPI is calculated. The following section explains how these components are brought together into the overall HPI score for each country.

Data period

We have calculated the HPI for every year between 2006 and 2021. Table 1 shows how many countries we have data for all years.

Year	No. of countries
2006	87
2007	117
2008	117
2009	122
2010	126
2011	139
2012	138
2013	138
2014	142
2015	141
2016	140
2017	144
2018	144
2019	141
2020	147
2021	147

Table 1: No. of countries for which we have calculated HPI for each year.

Life expectancy

We used estimates of life expectancy at age 0, both sexes, from the UN Population Division *World Population Prospects 2022* (UNDESA, 2022).[2]

Wellbeing – Ladder of life

We used data on wellbeing drawn from responses to the so-called 'Ladder of Life' question collected as part of the Gallup World Poll and gathered for the 2023 World Happiness Report.[3] The Poll asks samples of around 1,000 individuals per year[4] aged 15 or over in each of more than 150 countries the following question:

> *Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. Suppose we say that the top of the ladder represents the best possible life for you; and the*

[2] United Nations, Department of Economic and Social Affairs, Population Division (2022). *World Population Prospects 2022, Online Edition.*

[3] Helliwell, J. F., Layard, R., Sachs, J. D., Aknin, L. B., De Neve, J.-E., & Wang, S. (eds.) (2023). *World Happiness Report 2023* (11th ed). (New York: Sustainable Development Solutions Network). Data downloaded from: https://worldhappiness.report/ed/2023/#appendices-and-data. Accessed April 2023.

[4] A handful of smaller countries (e.g. Iceland and Haiti) had samples of around 500 respondents each year.

bottom of the ladder represents the worst possible life for you. On which step of the ladder do you feel you personally stand at the present time, assuming that the higher the step the better you feel about your life, and the lower the step the worse you feel about it? Which step comes closest to the way you feel?[5]

Gallup weights the responses to correct for unequal selection probability, non-responses, and to match the national demographics of each country.

Interpolating and extrapolating missing wellbeing data

The World Poll is not conducted in every country every year. Of the 2464 possible year-country data points between the years 2006 and 2021, 18% were missing. We estimated some of these from other years. If data was available for the two adjacent years, the year in between was estimated as the average of them. For 2020 and 2021 we also made extra effort to estimate values if they were missing, by looking at the trends of neighbouring years (we also had values for 2022 available), or by looking at the average of earlier years.

Wellbeing in Vanuatu

Lastly, we were keen to include Vanuatu in our dataset, because, based on an estimated life satisfaction score, Vanuatu came top of the first HPI produced in 2006[6], and the country's government has since given significant attention to the wellbeing of its population. Having a population of little more than 300,000, Gallup does not conduct its World Poll in Vanuatu. However, two representative surveys have been conducted in Vanuatu including questions on subjective wellbeing: in 2013, as part of the Pacific Living Standards Survey, and in 2020, as part of the country's National Sustainable Development Plan Baseline Survey.[7] The latter survey reached 4,289 households and both were weighted to match national demographics, as in the Gallup World Poll.

However, compared to Gallup, the Vanuatu National Statistics Office used a different question to measure wellbeing (a question on life satisfaction which is recommended by the OECD and used in most official surveys which measure wellbeing, including within the EU and the UK). The report produced by the Vanuatu National Statistics Office provides an equation to convert the mean score on the life satisfaction question to a score that is comparable to the Ladder of Life, based on an academic study by John Helliwell and colleagues.[8] However, researchers have found in previous analyses that national averages for the two questions diverge slightly in terms of how they correlate

[5] Gallup (n.d.) *Understanding How Gallup Uses the Cantril Scale* [webpage]. Retrieved from http://www.gallup.com/poll/122453/understanding-gallup-uses-cantril-scale.aspx

[6] Marks, N., Abdallah, S., Simms, A. and Thompson, S. (2006) *The (un)Happy Planet Index.* London: New Economics Foundation.

[7] Vanuatu National Statistics Office (2021) *Well-being in Vanuatu: 2019-2020 NSDP Baseline Survey*

[8] Helliwell J, Shiplett H & Bonikowska A (2020). 'Migration as a test of the happiness set-point hypothesis: Evidence from immigration to Canada and the United Kingdom.' *Canadian Journal of Economics/Revue Canadienne d`Economique*.

with economic conditions.[9] Specifically, the national averages for Ladder of Life correlate more strongly with GDP per capita than averages for life satisfaction. The problem we face here is that, given that Vanuatu is a country with a low GDP per capita, it is likely that using life satisfaction to estimate its Ladder of Life score will lead to an overestimate for self-reported wellbeing. Indeed, we note that if we were to use the formula included in the report by the Vanuatu National Statistics Office, then we would estimate Vanuatu to have a Ladder of Life score of 7.6, the fourth highest in the world, matching Switzerland and wealthy Scandinavian countries. This may not be inaccurate, but it would lead to unfair comparisons with other countries with similar economic conditions for which we have Ladder of Life data and not life satisfaction data. As such, we applied an adjustment based on a regression linking life satisfaction, Ladder of Life scores, and GDP per capita. Doing so led to a lower estimate of 7.0 for 2020. The years between 2013 and 2020 were interpolated for Vanuatu using a linear trend, and a value of 7.1 was estimated for 2021 based on extrapolating the trend.

Carbon Footprint

The primary variable used here was the national carbon footprint per capita, taken from the World Inequality Database (WID).[10] Data was available for all the countries analysed in the HPI from 1992 to 2020.

However, no carbon footprints estimated had been calculated for the WID for 2021. One data set which did have 2021 figures was the Global Footprint Network's (GFN) ecological footprint,[11] which also includes a specific carbon footprint component. However, because the methodology (and units) they use are different we needed to estimate a value consistent with the WID data using the GFN data. To do this, we used a general linear model to predict change in carbon footprint (WID method) based on change in carbon footprint (GFN method), with country fixed effects and a linear year effect that was allowed to vary by country.[12]

We then adjusted the estimates upwards to ensure that the overall change in per capita CO_2e emissions between 2020 and 2021 was consistent with the globally recorded increase in CO_2e emissions between those two years (there was a 3.8% increase globally).

[9] E.g. Bjørnskov C (2010) 'How comparable are the Gallup World Poll Life Satisfaction Data' *Journal of Happiness Studies* **11:**41-60; Helliwell J (2008) 'Life satisfaction and quality of development' NBER Working Paper Series #14507.
[10] https://wid.world/data/. Data downloaded in September 2023. Indicator knfghg_999_i
[11] https://data.footprintnetwork.org/#/
[12] SPSS Syntax available on request.

Calculating the Happy Planet Index scores

As noted earlier, when all the components are brought together to create final HPI scores, some technical adjustments are made to ensure that no single component dominates the overall score.

We begin by adjusting the wellbeing scores so that their coefficient of variance is equivalent to the coefficient of variance of the life expectancy scores. In effect, this involves adding a constant to the wellbeing score of each country (β in Equation 2 below). By doing so, we ensure that each of these two variables contribute the same amount of variance to the product term, which is 'Happy Life Years'. This can be understood as ensuring that the Happy Life Years measure is equally sensitive to changes in life expectancy and wellbeing.

An Adjusted Happy Life Years (AHLY) value (seen, for example, on Page 22 of the report) is then calculated such that a country with a self-reported wellbeing score of 7.67 (which was the highest value in 2006), would have an AHLY score equivalent to its life expectancy. For countries with lower self-reported wellbeing scores, their life expectancy is therefore adjusted downwards. But for the few countries with higher self-reported wellbeing scores, life expectancy is actually adjusted upwards. Making this adjustment is purely for communication purposes, so that a country with a good level of self-reported wellbeing can achieve an AHLY score that is similar to its life expectancy, rather than reporting HLY scores without the adjustment which will always be definition be lower than life expectancy. It makes no difference to the country rankings or the final HPI score.

We then subtract 22.5 years from this AHLY score. 22.5 is the AHLY score that would be calculated from the country with the lowest self-reported wellbeing (2.18 out of 10) and lowest life expectancy (42.9 years) during the time frame of the datasets. In effect this means that any country that has an AHLY score of 22.5 or lower will have a an HPI score of 0, no matter how small its carbon footprint is. The produced score is called the "AHLY above min" score.

Then, we adjust the Carbon Footprint scores so that their coefficient of variance is equivalent to that of the AHLY above min score. Again, this is done by adding a constant to the Carbon Footprint (ε in Equation 2). This can be understood as ensuring that the overall Happy Planet Index score is equally sensitive to changes in AHLY and in the Carbon Footprint.

The AHLY above min score is then divided by the adjusted Carbon Footprint. The final step is to multiply up this score (which averages at around 1.7 in 2021), such that a country that achieved a life expectancy of 85 years and a self-reported wellbeing score of 10 within the fair consumption space for the year in question would score 100 on the HPI.

Equation 2: Happy Planet Index

$$HPI = \frac{\alpha \times (Life\ Expectancy \times (Ladder + \beta) - \gamma) \times (Fair\ Consumption + \varepsilon)}{Carbon\ Footprint + \varepsilon}$$

where: $\alpha = 0.109$, $\beta = 3.884$, $\gamma = 260.2$, $\varepsilon = 14.07$ and *Fair Consumption* = 3.17 (for 2021)

Colour-coding the results

We colour-coded world maps using a traffic light system – red, amber, and green – to give a visual representation of how each country scores on average life expectancy, average self-reported wellbeing, Carbon Footprint, and for the overall HPI scores (see Table 2 for thresholds).

Life Expectancy	**Ladder of Life (Wellbeing)**	**Carbon Footprint**
Less than 65 years	Less than 5/10	Within fair consumption space (less than 3.17 tCO_2e per year)
65 – 75 years	5/10 – 6/10	Between 3.17 and 6.34 tCO_2e per year
75 years or more	6/10 or more	Over 6.34 tCO_2e per year

Table 2: Colour-codes for components

HPI scores for income groups

The most novel feature of this edition of the HPI is that we have looked within countries to calculate HPI scores for income groups, specifically income deciles.

To do this, of course we needed data on all three components for income deciles. We were only able to do this for 15 countries. These included five countries in Europe (Denmark, Finland, Netherlands, Norway and Sweden), six in Latin America (Argentina, Brazil, Chile, Costa Rica, Mexico and Panama), and four others (Ethiopia, India, South Africa and the USA). The limiting factor was data on life expectancy. In this section we summarise the data and methods we used for each component. HPI scores for income deciles were calculated using the same equation as for the country scores.

More details on these calculations are available on request.

Life expectancy

As noted, the most difficult data to find was on life expectancy for different income groups, and data for most countries was sourced from studies looking at just one country. In addition, the methodologies used by each study were not directly compatible, nor were the time frames. This meant we had to make adjustments to accommodate differences. The table below shows the relevant references for each country, the years for which the data was calculated, the age at which life expectancy inequalities were calculated and the income groups for which life expectancy was calculated (e.g. deciles, quintiles or percentiles). The reference methodology to which we attempted to match other studies was Kinge et al. (2019), which looked at life expectancy inequality in Norway. We used changes in life expectancy inequality over time to estimate inequalities for all countries for 2019.

Paper	Country	Relative income?	At age?	Years
Kinge, J. M., Modalsli, J. H., Øverland, S., Gjessing, H. K., Tollånes, M. C., Knudsen, A. K., Skirbekk, V., Strand, B. H., Håberg, S. E., & Vollset, S. E. (2019). Association of Household Income With Life Expectancy and Cause-Specific Mortality in Norway, 2005-2015. JAMA, 321(19), 1916–1925. https://doi.org/10.1001/jama.2019.4329	Norway	Percentiles	40	2011-2015
Brønnum-Hansen, H., Foverskov, E., & Andersen, I. (2020). Income inequality in life expectancy and disability-free life expectancy in Denmark. Journal of Epidemiology and Community Health, jech-2020-214108. https://doi.org/10.1136/jech-2020-214108	Denmark	Quintiles	50 & 65	2015-2016
Tarkiainen, L., Martikainen, P., Junna, L., & Remes, H. (2024). Contribution of causes of death to changing inequalities in life expectancy by income in Finland, 1997–2020. J Epidemiol Community Health, 78(4), 241–247. https://doi.org/10.1136/jech-2023-221705	Finland	Quintiles	30	1997-2020
Kalwij, A. S., Alessie, R. J. M., & Knoef, M. G. (2012). The Association Between Individual Income and Remaining Life Expectancy at the Age of 65 in the Netherlands. Demography, 50(1), 181–206. https://doi.org/10.1007/s13524-012-0139-3	Netherlands	Other	65	2007
Hederos, K., Jäntti, M., Lindahl, L., & Torssander, J. (2018). Trends in Life Expectancy by Income and the Role of Specific Causes of Death. Economica, 85(339), 606–625. https://doi.org/10.1111/ecca.12224	Sweden	Quintiles	35	2007
Chetty, R., Stepner, M., Abraham, S., Lin, S., Scuderi, B., Turner, N., Bergeron, A., & Cutler, D. (2016). The Association Between Income and Life Expectancy in the United States, 2001-2014. JAMA, 315(16), 1750–1766. https://doi.org/10.1001/jama.2016.4226	USA	Percentiles	40	2001-2014
Bilal, U., Alazraqui, M., Caiaffa, W. T., Lopez-Olmedo, N., Martinez-Folgar, K., Miranda, J. J., Rodriguez, D. A., Vives, A., & Diez-Roux, A. V. (2019). Inequalities in life expectancy in six large Latin American cities from the SALURBAL study: An ecological analysis. The Lancet Planetary Health, 3(12), e503–e510. https://doi.org/10.1016/S2542-5196(19)30235-9	Argentina, Brazil, Chile, Costa Rica, Mexico & Panama	P10, Median & P90	0	2010-2016
Tranvåg, E. J., Ali, M., & Norheim, O. F. (2013). Health inequalities in Ethiopia: Modeling inequalities in length of life within and between population groups. International Journal for Equity in Health, 12(1), 52. https://doi.org/10.1186/1475-9276-12-52	Ethiopia	Quintiles	0	2000 & 2011
Asaria, M., Mazumdar, S., Chowdhury, S., Mazumdar, P., Mukhopadhyay, A., & Gupta, I. (2019). Socioeconomic inequality in life expectancy in India. BMJ Global Health, 4(3), e001445. https://doi.org/10.1136/bmjgh-2019-001445	India	Quintiles	0	2011-2015

Bredenkamp, C., Burger, R., Jourdan, A., & Van Doorslaer, E. (2021). Changing Inequalities in Health-Adjusted Life Expectancy by Income and Race in South Africa. Health Systems & Reform, 7(2), e1909303. https://doi.org/10.1080/23288604.2021.1909303	South Africa	Quintiles	5	2001, 2007 & 2016

In many cases, life expectancy was only presented by income quintile, meaning we had to determine an income – life expectancy function to estimate values for income deciles.

It is important to note that, for the six Latin American countries, data is based on inequalities only within major cities, not for the country as a whole. Furthermore, the income groups for these countries are income groups for neighbourhoods, not individuals.

Wellbeing

We did not have micro-data from the Gallup World Poll which would allow us to determine self-reported wellbeing by income group. Instead we used life satisfaction from other surveys, including the European Social Survey, World Values Survey and Latinobarometer. We then applied the ratios we found in those surveys to the average self-reported wellbeing for the country in the Gallup World Poll. So, for example, if (in the Latinobarometer) life satisfaction in a given country in the top income decile was 5% higher than the mean life satisfaction in the country, we estimated that the self-reported wellbeing from the Gallup World Poll for the top income decile would also be 5% higher than the mean self-reported wellbeing in that survey.

Note that not all surveys used the same methodology for determining income deciles, so some inconsistencies may have been introduced there.

Carbon footprint

We used the personal carbon footprint (all sectors) by income decile from the World Inequality Database (variable lpfghg999i). Further information about the World Inequality Database's methodology for calculating carbon footprints for different income groups can be found in Chancel (2022) "Global Carbon Inequality, 1990-2019" (http://wordpress.wid.world/document/global-carbon-inequality-1990-2019-wid-world-working-paper-2021-22).