

THE PLEES INDEX: CLIMATE CHANGE CHANGES NEEDS

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Abstract. Given the urgency to act against global warming, reaching a social tipping point appears to be one of the fastest way to trigger change. One way to get closer to such social tipping point is by informing people on the effect of climate change on their life. With the aim to raise awareness about the impact of climate change on rich european countries, we constructed an index called the PLEES index, based on the hierarchy of needs developed by Maslow. This index takes into account the psychological, social, and economical impact of climate change worldwide and can be projected under different scenarios of climate change. The PLEES index goes from 0 to 4, 0 corresponding to countries with a low development according to the pyramid of needs and 4 being the highest value corresponding to highly developed countries.

Keywords: climate change, climate awareness

1 Introduction

Paris Climate agreement was signed by 195 countries in 2015. The country leaders engaged to develop policies and actions in order to limit the rise in mean global temperature to below 2° above pre-industrial temperature, with a target goal of 1.5°. Recently, the Working Group 3 from the IPCC (Intergovernmental Panel on Climate Change) released the third and last report on the impacts of climate change, adaptation and vulnerability of countries (Prtner et al. 2022), revealing that Paris agreement's initial target of 1.5° increase was unreachable. While 2° target is still possible, they urge to act before it is too late.

A way to trigger a fast change in society relies on reaching the social tipping point. Malcolm Gladwell describes the social tipping point as "that magic moment when an idea, trend, or social behavior crosses a threshold, tips, and spreads like wild-fire" (Gladwell 2000). Otto et al. (2020) suggested that achieving such kind of social dynamics could enable the decarbonisation of our societies by 2050. They show that information feedbacks could very rapidly trigger this social tipping point. Informing consumers on the carbon footprint of their lifestyle choice, their purchases, could lead to awareness, followed by a change in their way of consuming, potentially leading to the decarbonisation of society.

Inspired by this idea of informing and raising awareness, we constructed an index called the PLEES. index, based on the hierarchy of needs developed by Maslow. This index takes into account the psychological, social, and economical impact of climate change worldwide and can be projected under different scenarios of climate change. The aim of our project is to diffuse knowledge on climate change, in an easy and understandable way, targeting wealthy nations, showing that their life comfort is at risk, to bring the society a step closer towards the tipping point. These countries, where the industrial revolution started, have the financial capability and political influence to create global positive change.

2 The PLEES index

Maslow argues that people's motivation is driven by five hierarchical levels of human needs. One starts at the lowest level represented by physiological needs and, as these needs are satisfied, one moves up the pyramid to the highest level, where one aspires to develop personal satisfaction and fulfilment. As the most basic needs are satisfied higher needs develop. Similarly the PLEES index covers four measurable aspects (Poverty, Life Expectancy, Employment, and life Satisfaction), which show at which stage, on the Maslow's pyramid of needs, each country of the world is.

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2.1 Methodology

We link each level of Maslow's pyramid to an already existing indicator:

Level 1 Physiological needs (eating, drinking, sleeping). As first indicator representative of this step, we choose the poverty rate (PR), representing the percentage of a population living below the poverty threshold for a given country. We call the corresponding index X_1 . X_1 should be the closest to 1 when the poverty rate is the lowest. Thus, we define $X_1 = 1 - \frac{PR}{100}$.

Level 2 Safety needs. We judged the life expectancy as being a fair indicator of the level of security and safety of a country, quantifying the general health situation of a population. We define $X_2 = \frac{LE_{EW}}{LE_{base}}$, where LE_{base} is the baseline life expectancy as described in Hauer & Santos-Lozada (2021), and LE_{EW} the life expectancy taking into account extreme weather events. If the loss of expected life years is small X_2 will approach 1, whereas a large reduction in life expectancy will move X_2 towards 0.

Level 3 Love and social belonging needs. To account for this belonging feeling, we used the employment rate (ER) as indicator of this third level. We write $X_3 = \frac{ER}{100}$.

Level 4 and 5 Esteem and self-fulfillment needs. We chose to merge them into one level, for simplicity. The life satisfaction indicator appeared as a good estimate for this step. We use the definition given in Maddison & Rehdanz (2011).

For each country, we sum the four indexes defined above and obtain the present PLEES index:

$$PLEES = X_1 + X_2 + X_3 + X_4 \quad (2.1)$$

PLEES varies from 0 to 4, 0 corresponding to countries with a low development according to the pyramid of needs, 4 being the highest value corresponding to highly developed countries, with low poverty rate, high life expectancy, high employment rate and high satisfaction with life.

2.2 Results: present day PLEES index

The results of our computation are presented in Fig. 1. Each country with available data is plotted in a color going from yellow (high PLEES index, close to the maximum value 4, corresponding to a country at the top of the pyramid of needs) to blue (low PLEES index, close to 1, corresponding to a country at the bottom of the pyramid of needs).

Northern and western European countries, Northern America, and Australia all have a PLEES index exceeds 3.5 while most African countries are displayed in salmon-pink, equivalent to an index around 2.5. While this figure shows the current state of the world, it also highlights how the PLEES index can easily represent the projected impact according to different climate change scenarios.

2.3 Projections according to different climate change scenarios

Inspired by the method presented in Krishnamurthy et al. (2014), we project each index X_i under different temperature rise scenarios (RCP). To project the PLEES index, we divide the reasoning in two parts. The first step consists in identifying the climate related variable having the strongest correlation with the indicator considered (droughts, floods, temperature increase, ...). For example, droughts impact agriculture yields, thus food security (Gregory et al. 2005; Lobell et al. 2008; Gornall et al. 2010). Krishnamurthy et al. (2014) found a positive correlation of 0.412 between the number of droughts and the exposure to hunger, making droughts the first direct climate phenomena correlated with food insecurity. Food insecurity has a direct impact on poverty. So, to project X_1 , we will use droughts as impacting factor. For the second step, we define the projected index:

$$PLEES^{j,RCP} = X_1^{j,RCP} + X_2^{j,RCP} + X_3^{j,RCP} + X_4^{j,RCP} \quad (2.2)$$

where j stands for the different time-steps and RCP for the climate change scenario used.

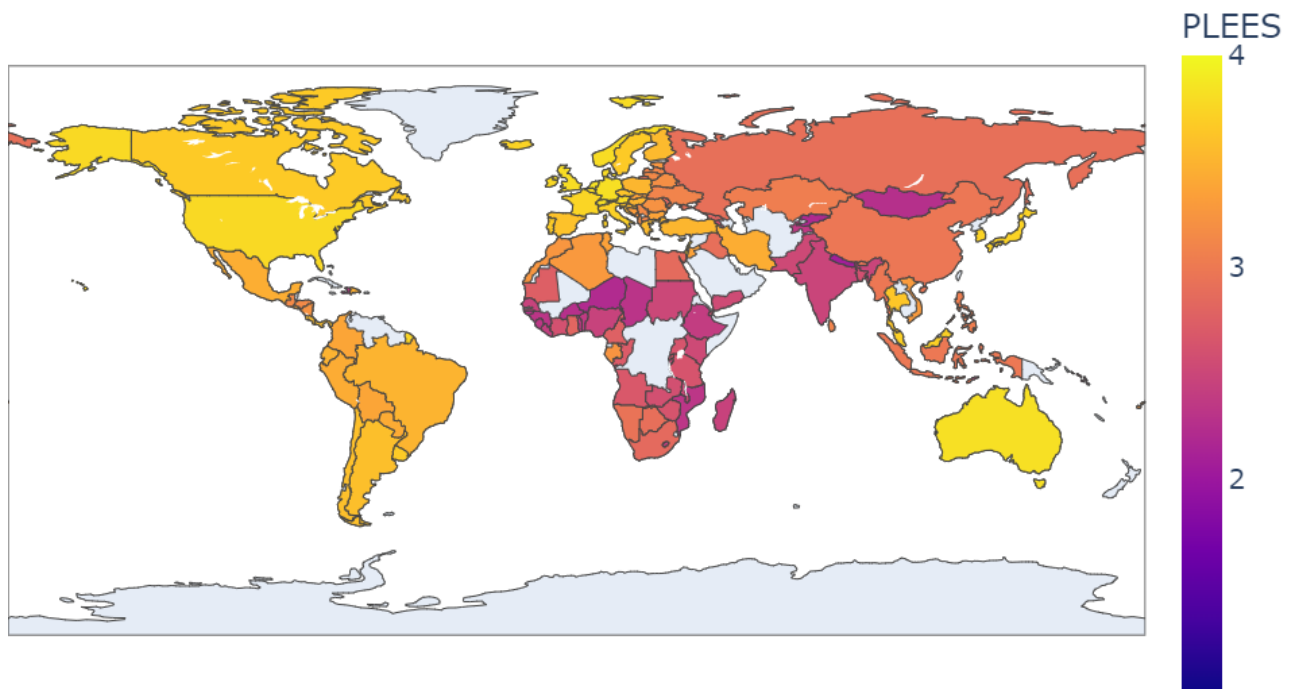


Fig. 1. The PLEES index computed for the present time. The index varies between 0 and 4, 0 corresponding to a country at the bottom of the pyramid of needs (poor country, high poverty rate, low life expectancy, low employment rate, low satisfaction with life, in blue in the map), 4 corresponding to a country at the top of the Maslow's pyramid, in yellow in the map. Countries in grey correspond to countries with missing data.

3 Conclusions

Climate change is one of the biggest threat modern generations have to face. To ensure a liveable future, urgent measures should be taken. One of the best way to obtain such quick change in our society is by informing citizens, to engage them, and try to reach the social tipping point as fast as possible. We introduce the PLEES index. This index is based on Maslow's hierarchy of needs and will be projected under different RCP scenarios, to quantify the psychological, social, and economical impact of climate change in the world. The PLEES index varies between 4 and 0. Rich European countries, Northern America and Australia show a very high PLEES index, close to the maximum value 4. This index is a visual tool, easily distributable in social medias, aiming to inform people about climate change, targeting in particular wealthier European countries, with financial and political means to generate a positive change, showing that their life comfort is at risk. We believe that popularising the idea of social tipping point is a good way to show that big changes can happen very fast if citizens act together.

This work makes use of the Global Burden of Disease Study 2019 (GBD 2019) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2020. Available from <https://vizhub.healthdata.org/gbd-results/>. This work makes use of data from the United Nations, Department of Economic and Social Affairs, Population Division (2022), the World Population Prospects 2022, Online Edition. This work makes use of the World bank (poverty rate) and ILO data (employment rate). We acknowledge the ETCCDI indices for CMIP6 provided through the Copernicus Climate Data Store, documented in Sillmann et al. (2013) and Kim et al. (2020). This work makes use of the population projections from KC & Lutz (2017), GDP marker projections by the OECD Dellink et al. (2017) and GDP projections by IIASA Cuaresma (2017). Data was downloaded in June 2022 from SSP database <https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=about>.

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