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UNIVERSITÀ DI BOLOGNA



POPCLIMA (Grant agreement: 101002973)



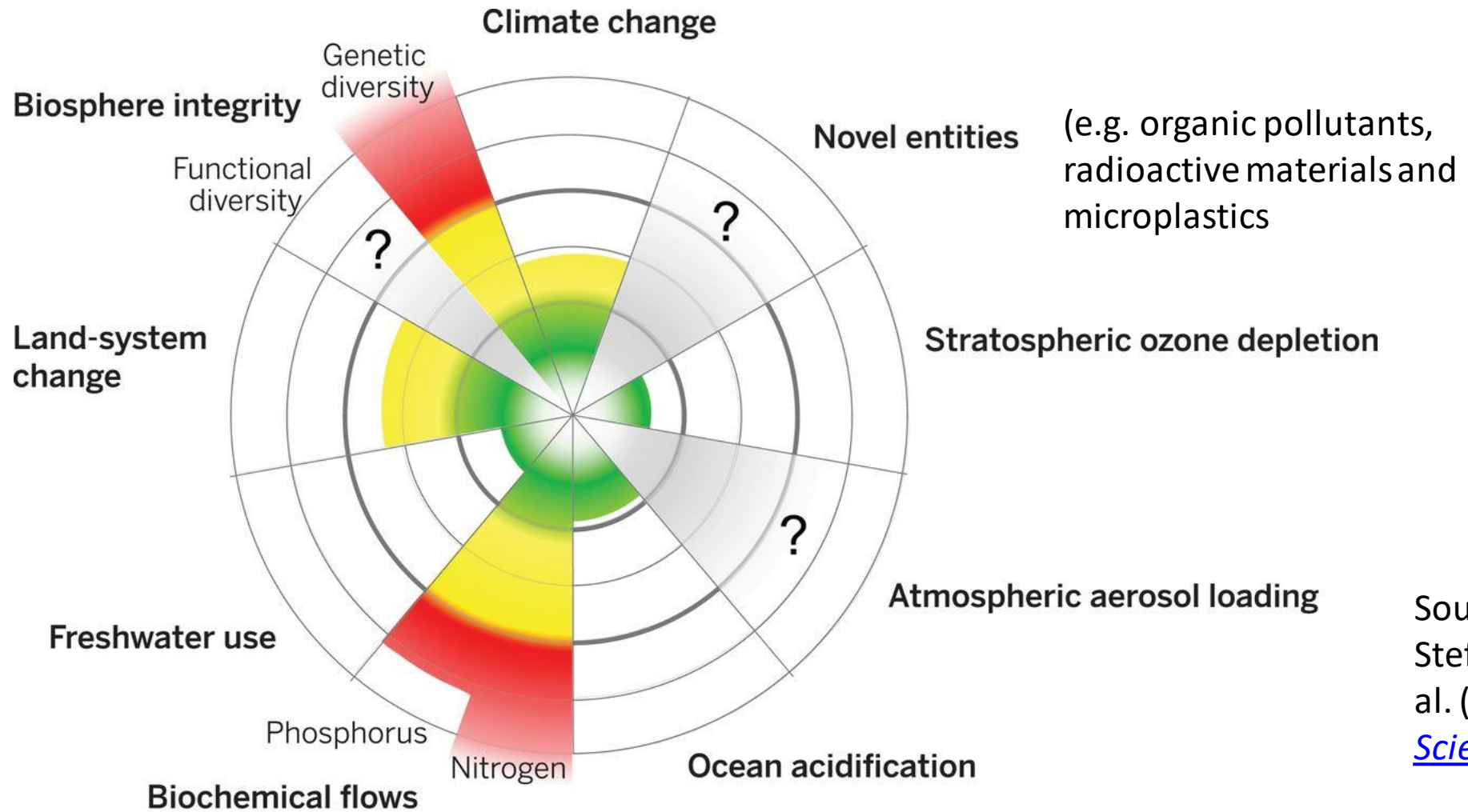
# Population Dynamics and Climate Change

**Raya Muttarak**

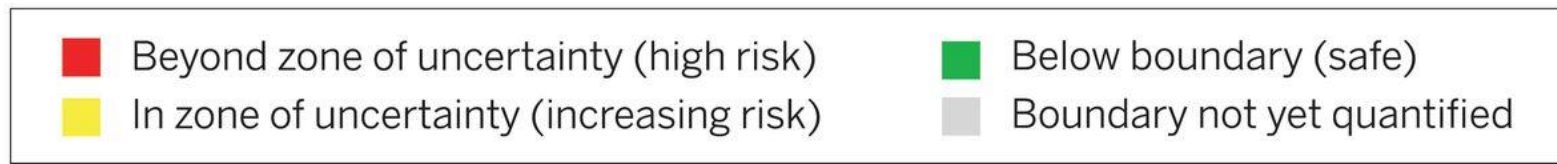
Department of Statistical Sciences, University of Bologna

United Nations Population Division Expert Group Meeting,  
19 July 2023

# Planetary boundaries and human development



Source:  
Steffen, W. et al. (2015).  
[Science](#).



# World Population Day: How will our planet cope with 10 billion people?



Daniel Bardsley

Jul 11, 2023

► Greater numbers of people could make efforts to combat climate change more difficult

## Would you give up having children to save the planet? Meet the couples who have

Wed 20 Jun 2018



theguardian

## To Breed or Not to Breed?

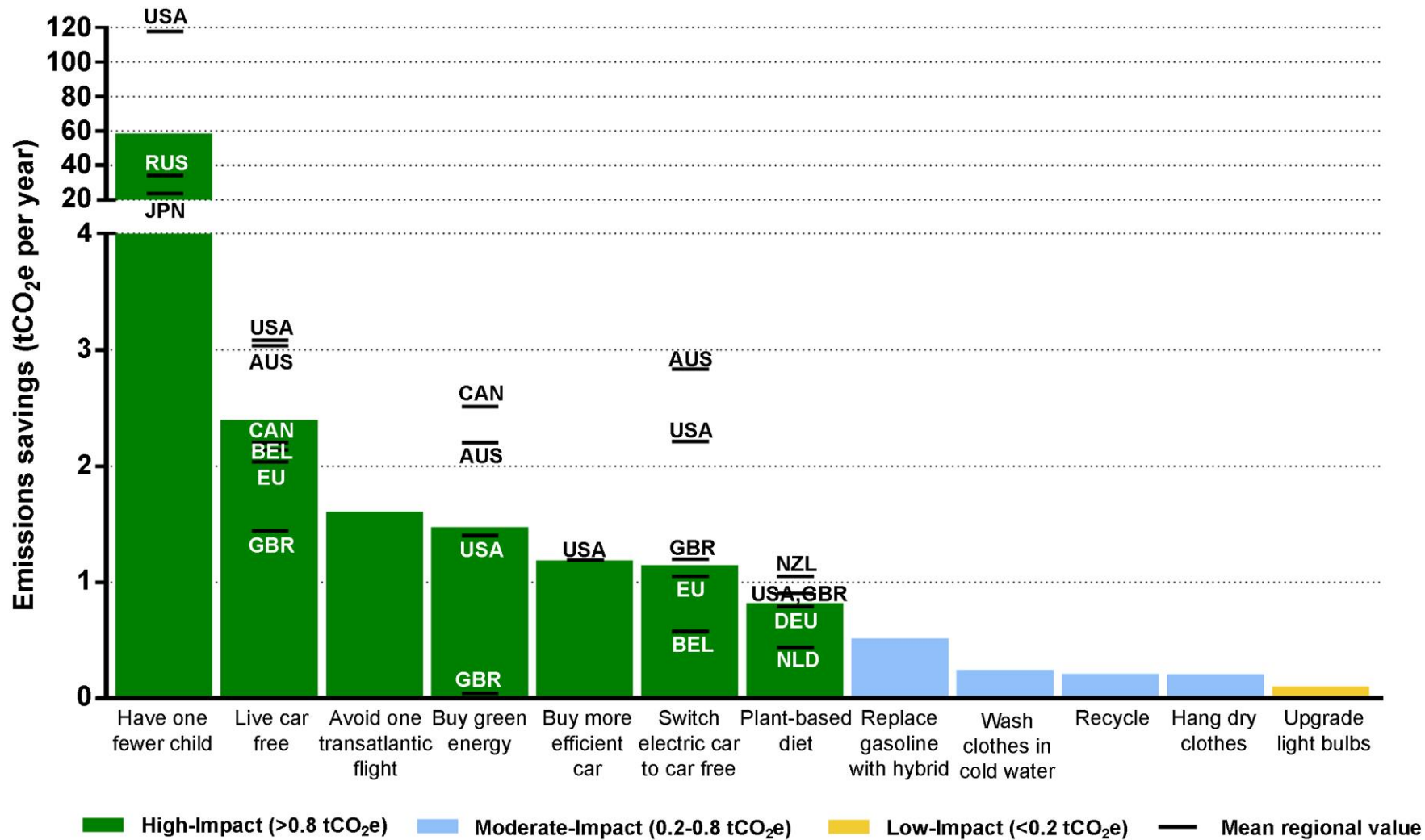
In a world of pandemic chaos, political strife and climate catastrophe, some would-be parents see the future as too dark to procreate.

VANITY FAIR

«Vasectomia climatica», scegliere di non avere figli per salvare l'ambiente

# One fewer child saves 58.6 tonnes CO<sub>2</sub>-equivalent (tCO<sub>2</sub>e) emission

Comparison of the emissions reductions from various individual actions



Source: Wynes and Nicholas (2017). *Environmental Research Letters*.



## Does having fewer children really a solution to fight climate change?



Source: [flickr.com](https://www.flickr.com/photos/15081162@N00/10000000000/).



Source: [health.clevelandclinic.org](https://www.health.clevelandclinic.org/)

## Population impact on the climate

Source: vietnamnet.vn

Source: [Dreastime.com](http://Dreastime.com)

$$I = P \times A \times T$$

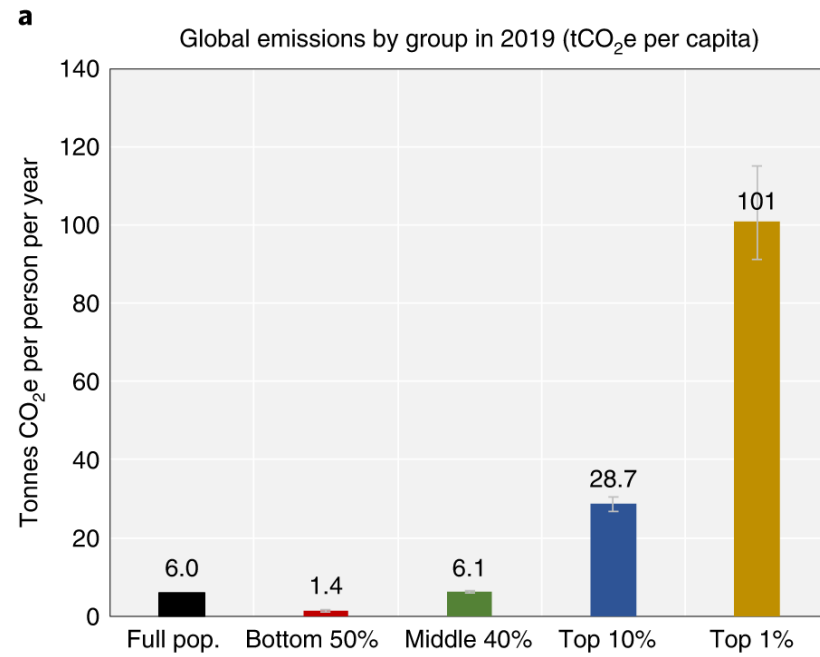
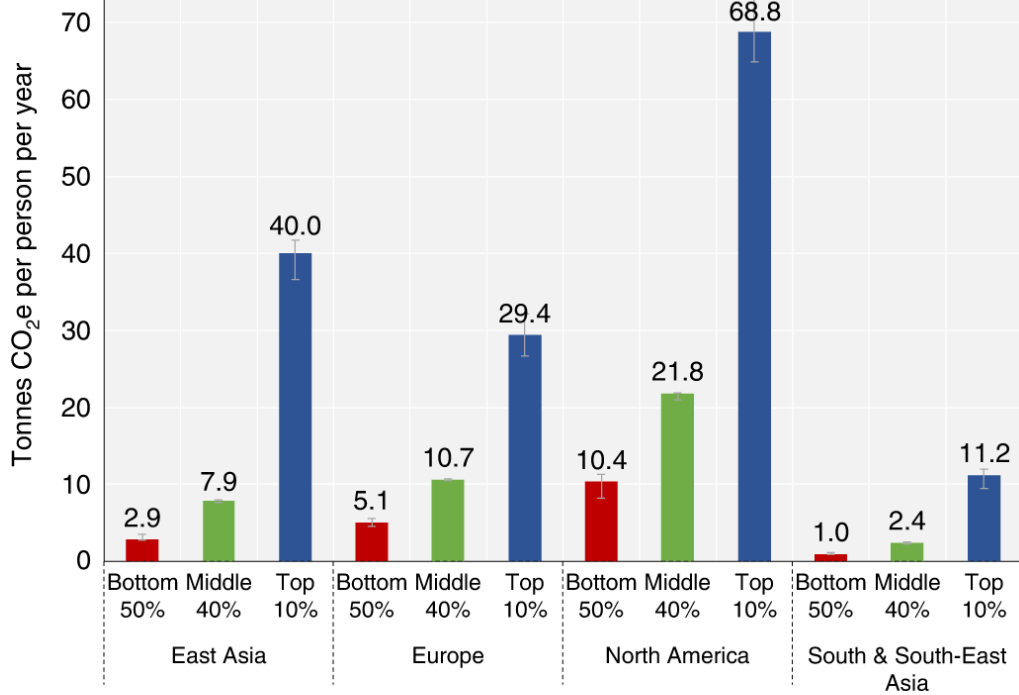
$I$  = Human impact on the environment

$P$  = Population

$A$  = Affluence (consumption per person)

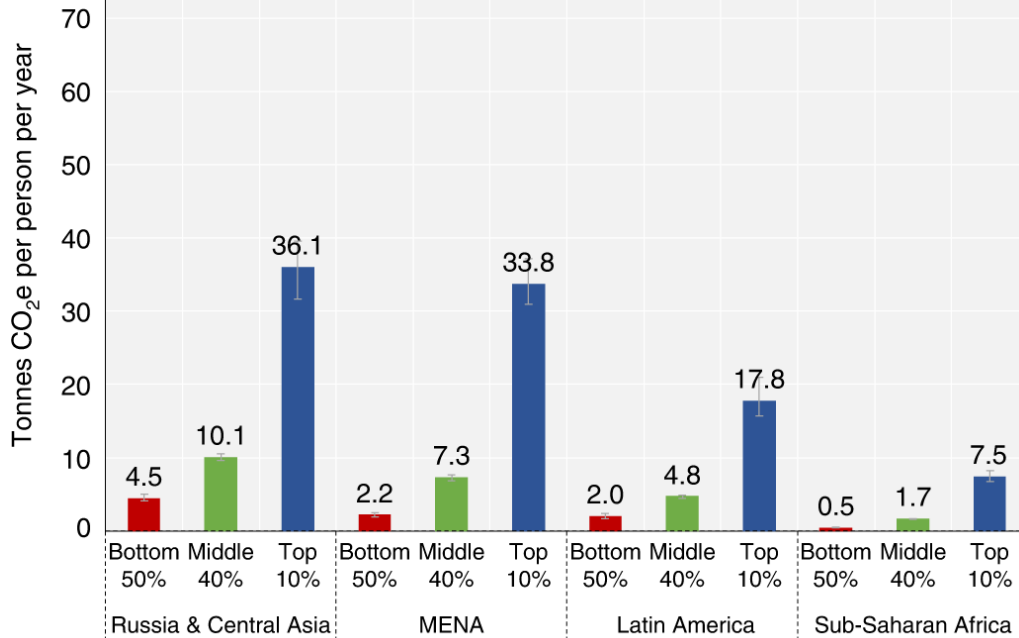
$T$  = Technology (impact per unit of consumption)





Source: Chancel, L. (2022). [Nature Sustainability](#).

## Per-capita emissions by group in 2019 (tCO<sub>2</sub>e per capita)

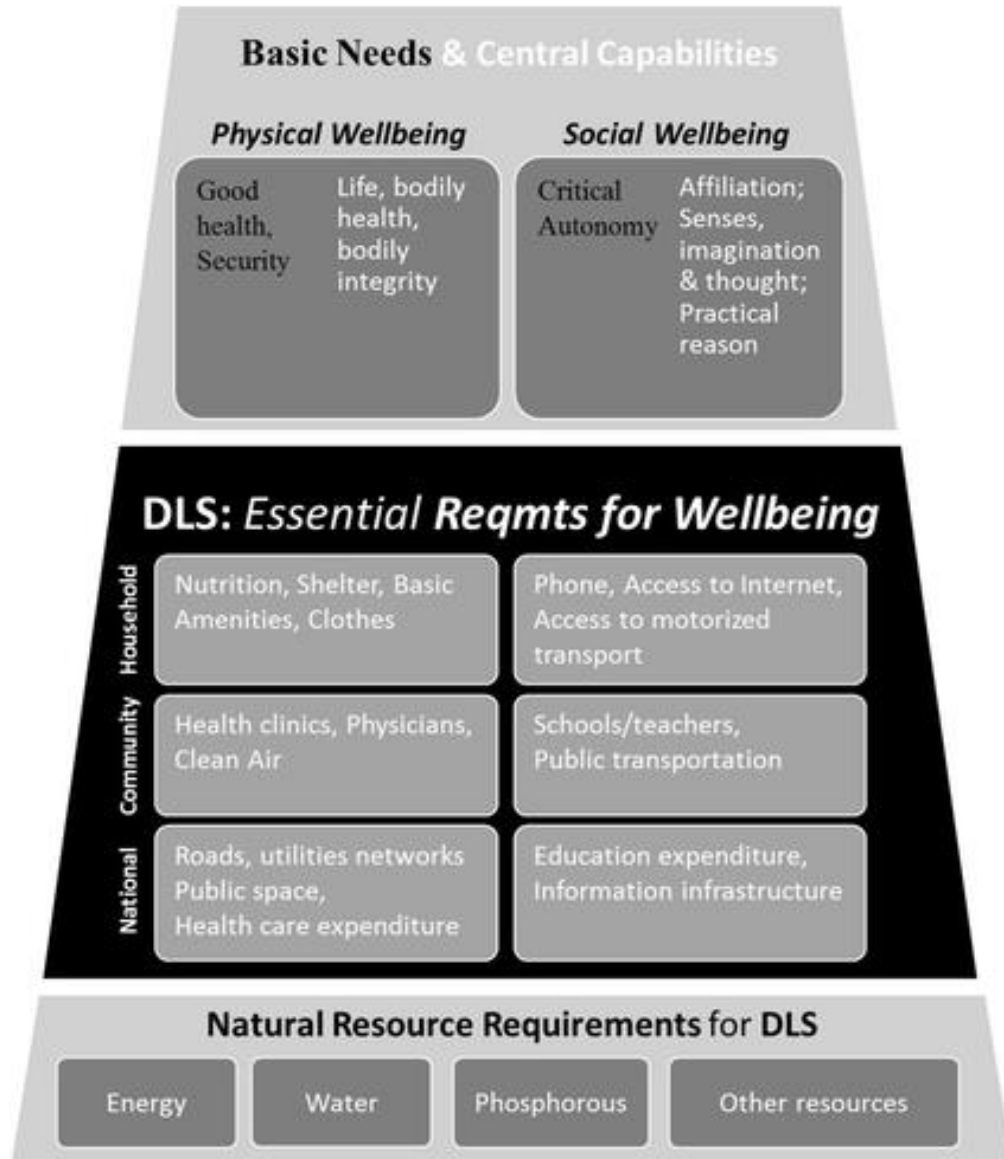


c Global emissions inequality in 2019: summary table

	Number of individuals (million)	Average (tonnes CO <sub>2</sub> per capita)	Threshold (tonnes CO <sub>2</sub> per capita)	Share (% total)
Full population	7,710	6	<0.1	100%
Bottom 50%	3,855	1.4	<0.1	11.5%
incl. bottom 20%	1,542	0.7	<0.1	2.3%
incl. next 30%	2,315	1.8	1.1	9.2%
Middle 40%	3,084	6	2.8	40.5%
Top 10%	771	29	13	48%
incl. top 1%	77.1	101	47	16.9%
incl. top 0.1%	7.71	425	125	7.1%
incl. top 0.01%	0.771	2,332	566	3.9%



# Decent Living Standards (DLS)



DLS specify a set of basic minimum **material requirements** that are essential for **human wellbeing**. That goes beyond subsistence and extreme poverty.

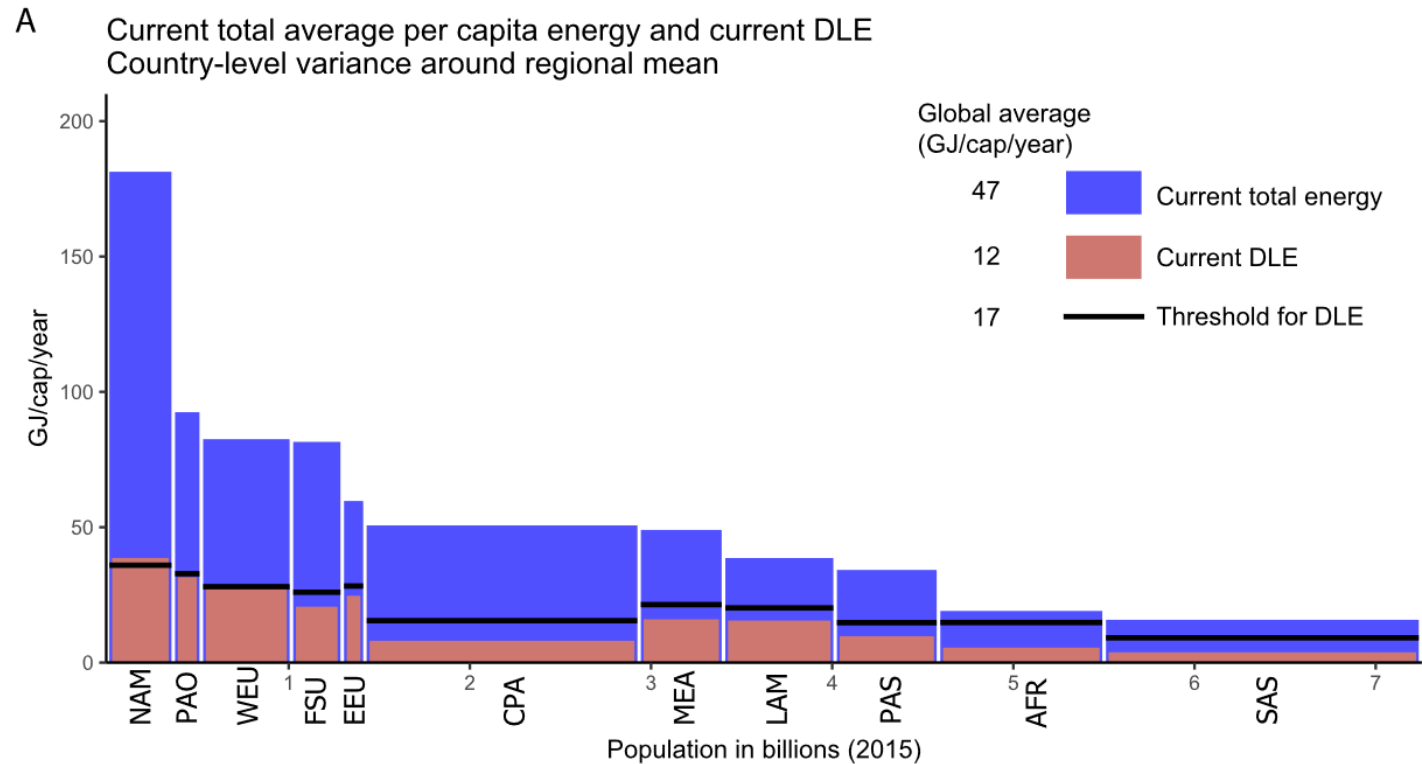
1. Nutrition
2. Shelter
3. Clothing
4. Health care
5. Air quality
6. Education
7. Information and communication
8. Mobility
9. Freedom to gather/dissent

Source: Rao, N. & Min, J. (2018). *Social Indicators Research*.

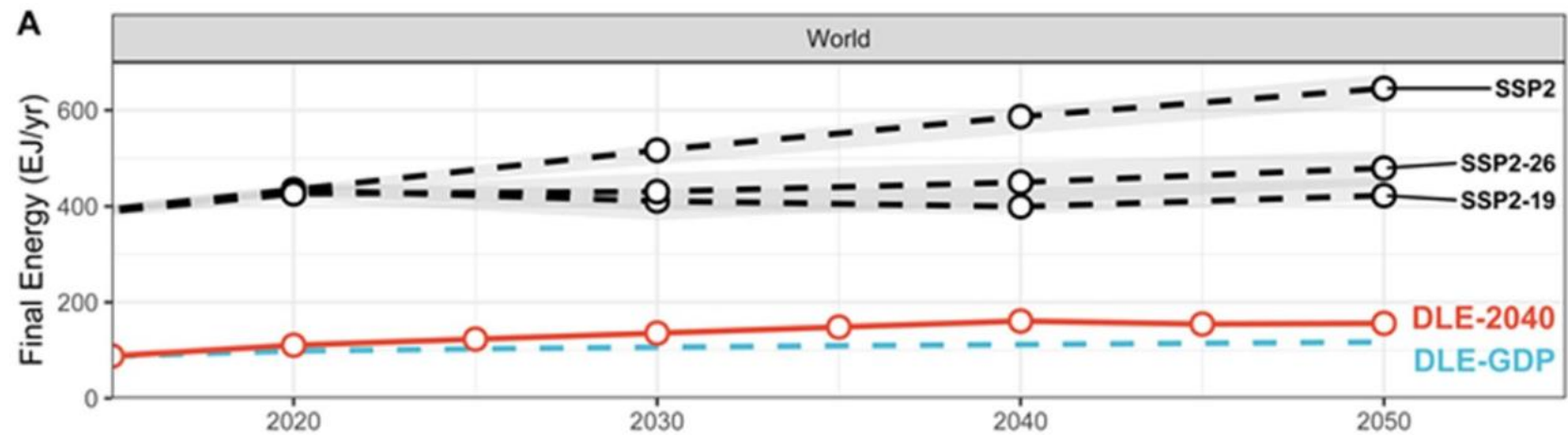




# Energy demand to meet Decent Living Standards for all by 2040



Timeseries of future pathways of decent living energy under a scenario in which decent living is provided to all by 2040 (DLE-2040), and a scenario in which decent living provision is related to economic growth (DLE-GDP), compared to SSP2 and its 2 °C (SSP2-26) and 1.5 °C (SSP2-19) compatible pathways.



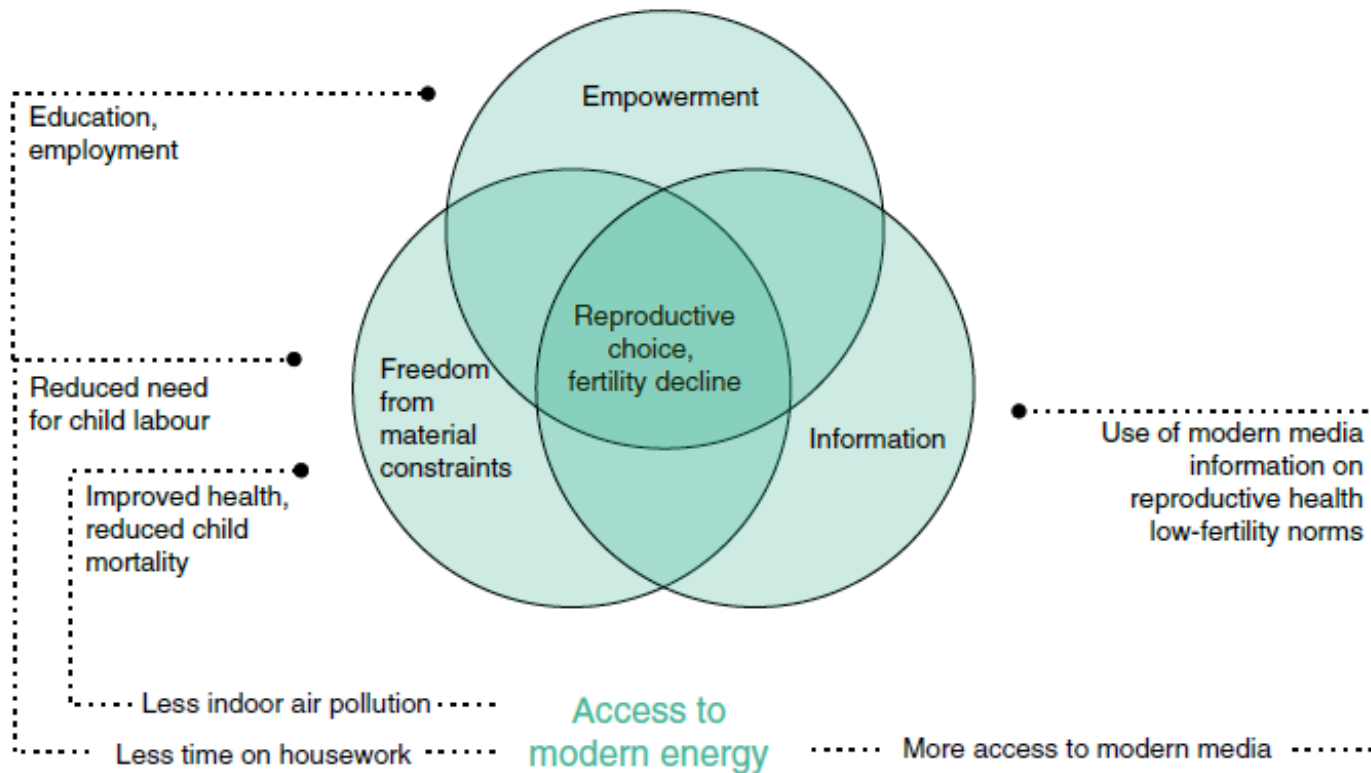
Source: Kirkstra, J. et al (2021). [Environmental Research Letters](#).



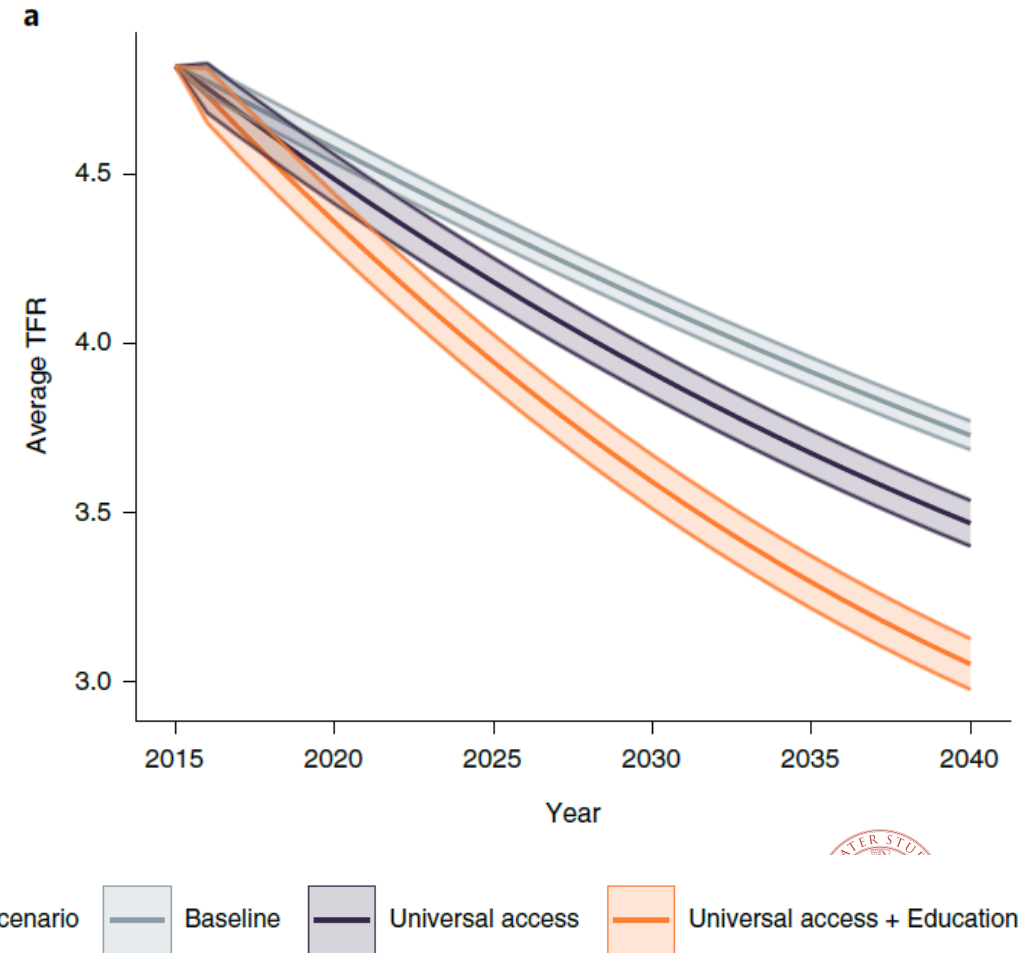
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# Women's access to electricity and modern cooking fuels powers the fertility transition

## Links between modern energy and fertility



## Predicted fertility decline from 2015 to 2040 in 25 sub-Saharan African countries



Source: Belmin, C., Hoffmann, R., Pichler, P., Weisz, H. (2021). [Nature Sustainability](#).



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**THANK YOU!**

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## Application of IPAT identity: Three main driving forces behind the increase of CO2 emissions in China

1963–1965	<i>P</i>	<i>A</i>	<i>T</i>	$\Delta I$ (in %)	$\Delta I$ (abs)
Shanghai	18%	14%	68%	20%	2,826
Guangdong	53%	40%	7%	16%	2,192
Heilongjiang	75%	9%	16%	17%	4,892
Henan	77%	12%	11%	7%	1,504
Gansu	29%	70%	1%	33%	1,758
China	51%	39%	10%	9%	37,082

1979–1990	<i>P</i>	<i>A</i>	<i>T</i>	$\Delta I$ (in %)	$\Delta I$ (abs)
Shanghai	55%	293%	−248%	33%	19,603
Guangdong	22%	117%	−39%	163%	62,623
Heilongjiang	26%	93%	−19%	60%	53,639
Henan	45%	170%	−115%	56%	48,006
Gansu	19%	68%	13%	155%	33,968
China	34%	180%	−114%	67%	1,017,958

1991–2002	<i>P</i>	<i>A</i>	<i>T</i>	$\Delta I$ (in %)	$\Delta I$ (abs)
Shanghai	6%	151%	−57%	97%	76,922
Guangdong	19%	92%	−11%	191%	193,604
Heilongjiang	44%	620%	−564%	18%	26,014
Henan	20%	185%	−105%	71%	94,452
Gansu	37%	162%	−99%	47%	26,018
China	30%	240%	−170%	49%	1,247,076

### Adjustive period of the economy (1963–1965)

- Mao's call of '*more people, more power*'

### Rural and urban reforms (1979–1990)

### Macroeconomic structural reforms since 1990

- Deng's 'socialist market economy'
- an open door policy for international trade and investment allowing foreign direct investments (FDI)

Source: Feng, K., Hubacek, K., Guan, D.(2009). [Ecological Economics](#).

