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A new way to look at light pollution: Revealing the good, the bad and the ugly

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ABSTRACT
Which parts of the USA and Europe are the highest polluters of artificial light? A new analysis of this measure reveals great differences between the two sides of the Atlantic Ocean, detailed at the level of counties and provinces. Our studies show that overall, the USA produces polluting light three times more per capita than Europe.

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The dark night sky, dotted with the light of the stars, has been the source of inspiration for poets, artists, scientists and philosophers throughout human history. In our modern world, the natural beauty of the sky at night is drowned out by the huge number of artificial light sources. A current-day Van Gogh, living in a huge city would not be able to look up and visualise his version of 'The Starry Night' with the high levels of light pollution many of us experience as well.

Polluting light changes the levels of light naturally occurring at night and causes a host of negative effects. The natural alternation between light and darkness dictates our sleep-wake cycles. If you have ever tried to sleep in a room with bright street lights coming through the window, you might have realised how unsettling light pollution can be. Unsurprisingly, it is known to be associated with depression, insomnia and other health disorders. Much like other types of human pollution, light pollution affects wildlife species, potentially changing their behaviours associated with reproduction, foraging and navigation. To begin to tackle these growing phenomena of modern life, we wanted to identify the zones of Europe and the USA that are most affected by this problem. Which areas were the most virtuous? And which ones were contributing to high levels of pollution?

Our previous research had mapped the levels of light pollution of the World Atlas in unprecedented detail,

showing that this phenomenon is strictly correlated to the size of the population studied. For this reason, bigger, denser cities were always heavily polluted, hiding differences between them, while areas with a lower population density appeared to produce less light pollution. Therefore, we have further built upon our work with a different perspective: Looking at the polluting power per capita and per income within administrative units and cities.

From our new map, the contrast between the metropolises and provinces of Europe and the USA was immediately obvious.

In Europe, Germany and parts of the United Kingdom stand out clearly as the least polluting regions. In fact, in the top ranking, 25 European administrative units, 'the good': 21 are German-speaking followed by Denmark, Spain, Lithuania and Romania. On the other end of the score, in the worst 50 places, 'the bad and the ugly': 13 are in Portugal, 9 in Italy, 7 in Finland, 6 in the Netherlands, and 4 or fewer places in Spain, Belgium, the UK, Norway, Croatia, Iceland and France.

In the USA, the states with most counties in the top 25 'good' spots are Alaska (6), Colorado (5) and California (4), while at the bottom 50 ends of the ranking there are 21 'bad and ugly' counties in Texas, 11 in Louisiana and 6 in North Dakota.

Overall if we compared the differences between the most and least light-polluted provinces in Europe, there is a 120-fold difference in their light flux per capita. This means that there are communities that pollute the night environment a hundred times for each of their inhabitants! Between US counties this value is frighteningly higher, with a 16,000-fold in light flux per capita. When comparing the two continents, our most apparent finding is that the per capita pollution in the United States is three times higher than in Europe.

When assessing pollution concerning the gross domestic product (GDP), we were surprised to learn that having greater economic resources was not necessarily a factor for light pollution.
Both in the United States and Europe, it is often the countries or states with the greatest need to save economic resources that unfortunately produces the greatest waste.

Like with many of the environmental issues that countries across the globe are dealing with, a nuanced view is critical in finding solutions for them. This new 'catalogue' of more than four thousand administrative units will be useful to the scientific community and policy-makers to explore the realities of light pollution specific for each region and propose made-to-measure solutions to tackle this serious problem. Hopefully, we will be able in the future to once again enjoy the beauty of the night sky without unnecessary disruptions, knowing that we have restored balance to the ecosystems around us as well.