Note

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Through the window of an airliner flying across the United States at night, the constellations of light around New York City, the Great Lakes, and then Seattle show the traveller constellations of activity. Down there, crowds of Americans are moving and manufacturing, trading and having a good time between the dark reaches of forests, Great Plains, and mountains. Satellite measurements transform the view from the airliner into global maps of upward light flux (Figure 1).[1]

How would the view from a plane circling the world at night brighten if everyone in the world lived like Americans? The light intensity in the US ranges from 160 DN (or a radiance value of 2E-04 watts/cm^2/sr) per grid cell in New York City with population about 7 million

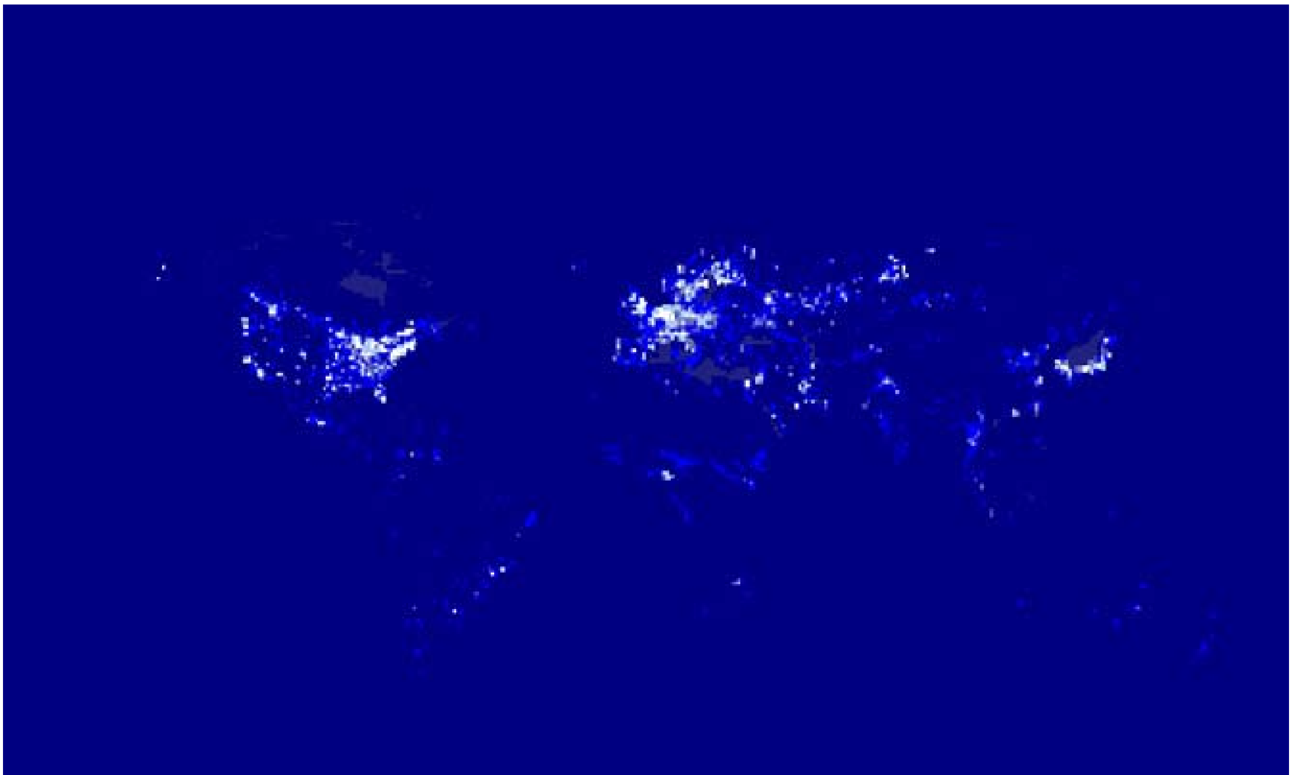

Figure 1. Night brightness, 1996. Upward light flux measured at the top of the atmosphere shows *where* human activity is as well as how *much*. We used the low-gain version of the Defense Meteorological Satellite Program Operational Linescan System (DMSP/OLS) data produced by Elvidge and colleagues at the US National Geophysical Data Center.[2]

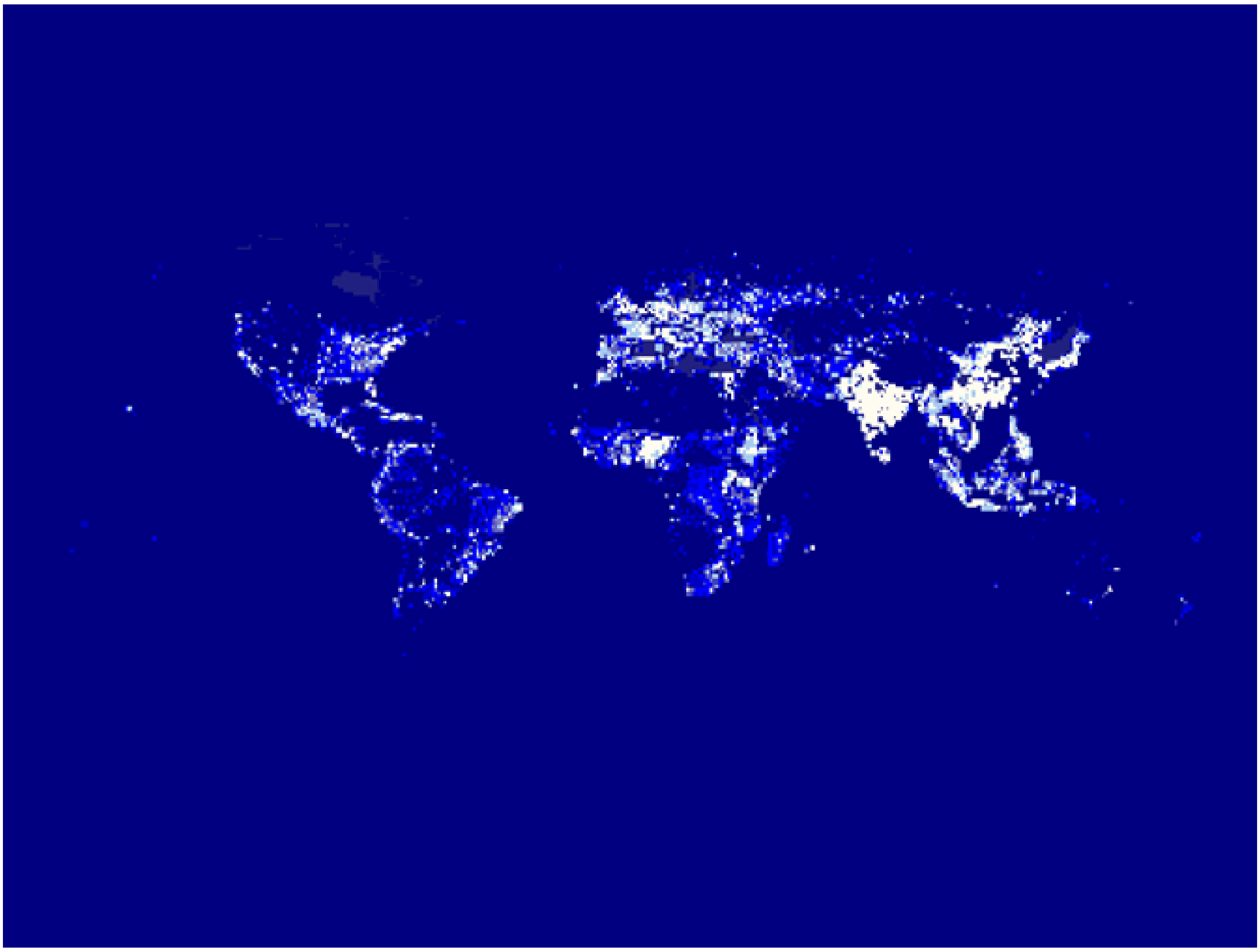

Figure 2. Upward light flux if all people lived like—that is, emitted light—like Americans. Although crowded places emit somewhat less per person than uncrowded places, flux increases fairly regularly with population despite differences in wealth.

to 0 in some areas of Alaska.[3] Using population with 1-degree resolution for the year 1990 (Li, 1997), Figure 2 shows how bright the night around the world would become if everyone in the world emitted 2.0E-24 watts/cm^2/sr, like the median American in 1996.[4] Subtracting the light in Figure 1 from the light in Figure 2 reveals a geography of potential development (Figure 3 – see following page). Because the light flux from a region is proportional to its electricity consumption, the geography of the *increased* light charted in Figure 3 suggests the geography of latent electricity demand. Entrepreneurs and environmentalists alike must take notice.

Fortunately, more efficient illumination will surely lower the wasteful emission of light and the energy to produce it long before everyone lives like present Americans (Ausubel 2004). Long before larks replace nightingales. Still, the images reinforce our appreciation that the choices of South and East Asia are especially fateful for sustainable development.

Notes

1. The map of light intensity was drawn on a global grid with a cell size of 30 × 30 arc seconds, or approximately 1 × 1 km. It was derived from nighttime images from March 1996 to January-February 1997 (Elvidge *et al*., 1999). Each cell contains a value between 0 and 255. The values between 0 and 254 represent non-saturated lights and can be converted to radiance values, and the value 255 indicates that there were no non-saturated light found at the location. For radiance calibrated lights, see http://dmsp.ngdc.noaa.gov/html/download_rad_cal_96–97.html
2. Cinzano *et al*. 2000 ; Elvidge *et al*. 1999 ; Elvidge 2000.
3. The radiance values were calculated according to the formula: Radiance = DN^(3/2) * 10^(-10) watts/cm^2/sr, where DN is a digital number (grid cell value). Sr abbreviates Steradian, the standard unit of a solid angle which determines the surface area on a sphere.
4. Because the resolution of DMSP/OLS is one square kilometer, data sets were re-sampled into the grid system of one degree by one degree (or 100 x 100 square km at the equator) to achieve consistency with the population data set.

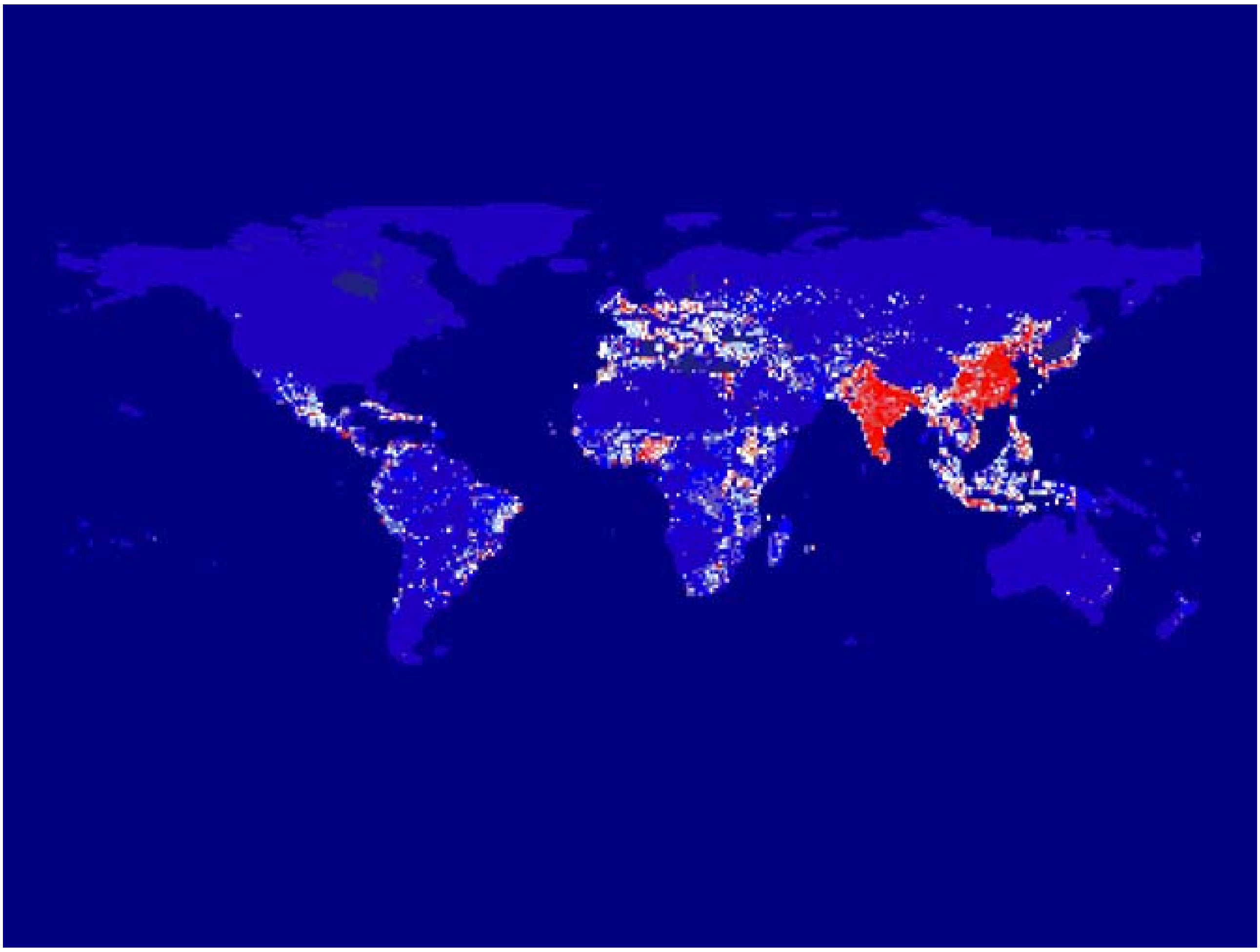

Figure 3. How much and where light flux would increase if everyone outside the US emitted 2.0E-24 watts/cm^2/sr units rather than the light they actually emitted in 1996–97. The brilliant increases outside the present industrialised regions dominate and would sharply alter the geography of electrical consumption, even without population growth. The increases follow a colour scale from white to red, where red shows the largest increases.

References

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