

Emprints of the Nations: The Change in Global Sustainability from 2000 to 2010

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The sustainability of the world's social and economic systems is a central issue confronting humanity in the 21st century. The finite fossil fuel and mineral resources of the planet are renewed very slowly compared to their rates of use, and thus their use to support human systems entails inevitable limits. In contrast, the renewable resources of the biosphere, e.g., solar radiation, winds, tide, etc. are supplied as constant flow sources that provide a certain quantity of available energy each year. Strong sustainability requires that the vast majority of humanity's material and energy needs be supported in the long run by the annual influx of renewable energy to the planet. Global conditions can be assessed in a uniform manner, because all energy, material, and information flows of the system can be normalized in terms of a single quantity, solar emergy, which quantifies them in terms of their relative ability to do work in the system of which they are a part. The emergy imprint or "emprint" of a system is an annual snapshot of system inflows and outflows that shows the relative sustainability and self-sufficiency of a territorial system, such as a nation, at any given time. The emprint is a 3X2 matrix with columns for renewable and nonrenewable emergy and rows for local, imported, and exported emergy. The emergy inflows to a system are represented by squares in the upper four cells that represent the percentage of the total imported emergy in each cell or category, i.e., local renewable, imported nonrenewable, etc. The third row of the matrix contains the percentage of the emergy exported in the renewable and nonrenewable categories. For example, if all circles are in the left-hand column, the system uses only emergy from renewable sources; and therefore it is completely sustainable. Furthermore, if the only circles are in the upper row's left and right cells, the system is completely self-sufficient. We applied this index to characterize 136 countries in the years 2000 and 2010 using existing data and then compared the change in the condition of these nations and of the world as a whole at the beginning and end of the first decade of the 21st century. The results are displayed on a world map where the countries have been classified into groups based on the similarity of their emprints.

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