

# Our Ecological and Human Footprint

Compiled by John McCarthy SJ <jmccarthy@jesuits.ca >

## Measuring Human Impact

We live on a human-dominated planet. As I write on October 3, 2007, the human population stands at an estimated 6.622 billion people.<sup>1</sup> When General Congregation 35 begins on January 5, 2008, the predicted global population, under exponential rates of increase, will be over 6.641 billion people.<sup>2</sup> Whether we like it or not, humans are stewards of the natural world. Scientific assessments consistently point to the increasing pressure exerted by humans on every ecosystem of the world, including the climate itself.<sup>3</sup>

How best to measure this human impact? Traditional scientific approaches considered human impact in conceptual terms such as "appropriation of net primary productivity" or "exponential population growth." Important as these concepts were, it was still difficult for people to grasp the gravity and extent of human domination of the planet. The usual scenario was to inform us of the extent of human appropriation of ecosystem goods and services. For example, we read that 50% of the globe's surface has been converted to grazed land or cultivated crops, that more than half of the world's forests have been lost in this land conversion or that we have built so many dams that nearly six times as much water is held in storage as occurs in free-flowing rivers.<sup>4</sup> Important as these ecological nuggets are, if heard enough times however, they can become dull and tepid. Some consistent measure of ecological sustainability or the impact of humans on the planet had to be devised.

Two measures have been developed to show the effect of human activity on the earth. These are called the "ecological footprint" and the "human footprint." Both metrics are similar in that they provide an assessment of human influence on natural ecosystems. A significant difference lies in the ability of each metric to consider the relationship between socio-economic justice and ecosystem functioning.

## Ecological Footprint

The ecological footprint was first described by William Rees and Mathis Wackernagel of the University of British Columbia, Vancouver, Canada.<sup>5</sup> The ecological footprint

compares human demand on nature with the biosphere's ability to regenerate resources and provide ecological goods and services such as arable land or potable water, for example. In other words, it considers the relationship between human consumption patterns and the capacity of the earth's ecosystems to provide those resources. It does this by assessing the biologically productive land and marine area required to produce the resources a population consumes and to absorb the corresponding waste. The consumption of resources is converted to a normalized measure of land area called global hectares and is expressed on a per capita basis. For example, ecological footprints of the high, middle and low income countries have been calculated as 6.4, 1.9 and 0.8 global hectares/person.<sup>6</sup> Figure 1 shows a map of relative consumption patterns by the nations of the world.<sup>7</sup> The relatively high consumption patterns of Western Europe and nations such as the United States and Japan are obvious.

## Human Footprint

The term "human footprint" was first developed by researchers at the Wildlife Conservation Society Institute and the Center for International Earth Science Information Network (Columbia University) in the United States. The human footprint is defined as a global map of human influence on the Earth's land surface predominantly in terms of the loss of the wild<sup>8</sup> or the human domestication of the planet.<sup>9</sup> Humans have so tamed the planet that, as of 1995, only 17% of the world's land area had no direct influence by humans as indicated by one of the following: human population density greater than one person/km<sup>2</sup>; agricultural land use; towns or cities; access within 15 km of a road, river or coastline; or nighttime light detectable by satellite (See Figure 2).<sup>10</sup>

Note that the human footprint is less obvious in the Polar Regions, the boreal forests of Canada and Russia, central Amazonia and the great deserts of the world.

Whether you consider the ecological footprint or the human footprint, one thing is certain. Humans dominate the planet and all its life. Never before in human history have we faced such responsibility – and such possibility. Death or life – for people and for nature. The choice is now ours.

<sup>1</sup> World population clock projection of the United States Census Bureau ([www.census.gov](http://www.census.gov)).

<sup>2</sup> Ibid.

<sup>3</sup> Vitousek, P.M., Mooney, H.A., Lubchenco, J., and Melillo, J.M. 1997. Human domination of Earth's ecosystems. *Science* 277: 494-499., Goudie, A. 2001. *The Human Impact on the Natural Environment*, Cambridge, MA: The MIT Press, 5th edition, 511 pp., IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contributions of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M., and Miller H.L. (eds.)] Cambridge: Cambridge University Press, 996 pp.

<sup>4</sup> Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: Current State and Trends*, Washington, DC: Island Press 2005.

<sup>5</sup> Wackernagel, M. and Rees, W. 1996. *Our Ecological Footprint: Reducing Human Impact on the Earth*, Gabriola Island, British Columbia: New Society Publishers.

<sup>6</sup> See the website of the Global Footprint Network at <http://www.footprintnetwork.org>. The mission of the network is to support a sustainable economy by advancing the Ecological Footprint, a measurement and management tool that makes the reality of planetary limits relevant to decision-makers throughout the world.

<sup>7</sup> <http://pnhbb.org/natural/footprint/img/cartogram.gif>.

<sup>8</sup> Sanderson, E.C., Jaiteh, M., Levy, M.A., Redford, K.H., Vannebo, A.V., and Woolmer, G. 2002. The human footprint and the last of the wild. *Bioscience* 52: 891-904.

<sup>9</sup> Kareiva, P., Watts, S., McDonald, R., and Boucher, T. 2007. Domesticated nature: Shaping landscapes and ecosystems for human welfare. *Science* 316: 1866-1869.

<sup>10</sup> Ibid. 1867.

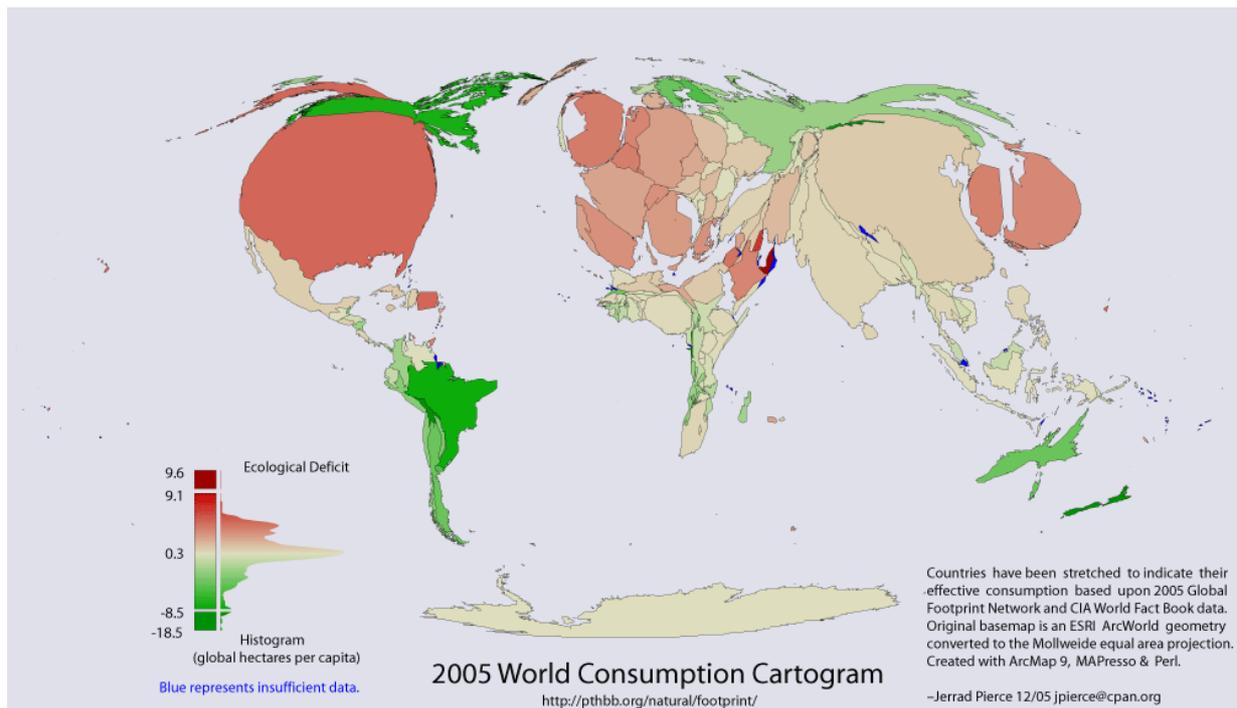


Figure 1. 2005 World consumption cartogram. The shapes of the countries have been stretched to indicate their relative consumption patterns<sup>11</sup>.

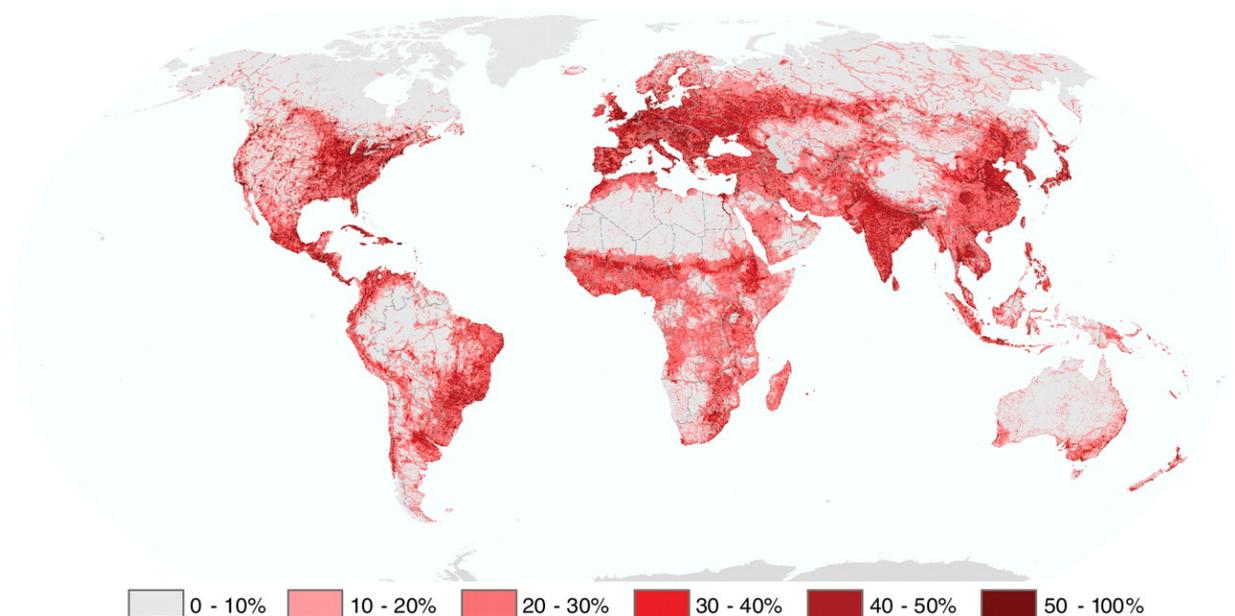


Figure 2. The human footprint on Earth. Human impact is expressed as the percentage of human influence relative to the maximum influence recorded for each biome. Data include human population density, land transformation (including global landcover, roads and cities), electrical power infrastructure (National Oceanic and Atmospheric Administration night-lights data) and access (via roads, navigable rivers and coastline) to the land.

<sup>11</sup> <http://pthbb.org/natural/footprint/img/cartogram.gif>