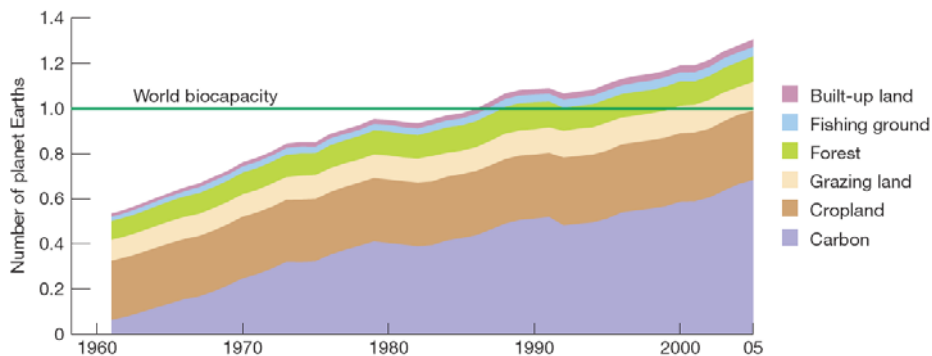


## Ecological Footprint Accounting and Methodology

The Ecological Footprint is a resource accounting tool that measures the amount of biologically productive land and water area an individual, a city, a country, a region, or all of humanity uses to produce the resources it consumes and to absorb its waste using prevailing technology. The Ecological Footprint is used widely as a resource management and communication tool by governments, businesses, educational institutions, and non-governmental organizations.

Productive land and sea areas support human demands for food, fibre, timber, energy, and space for infrastructure. These areas also absorb the waste products from the human economy, such as CO<sub>2</sub> emissions. This demand on the biosphere can be compared to biocapacity, a measure of the amount of biologically productive land and water available for human use. Ecological overshoot occurs when a population's demand on an ecosystem exceeds the capacity of that ecosystem to regenerate the resources it consumes and absorb its wastes; a practice that leads to a depletion of the planet's life supporting biological capital and/or to an accumulation of waste products.



**Figure 1:** World ecological overshoot according to the 2008 edition of the National Footprint Accounts. Humanity's Ecological Footprint, expressed in number of planets demanded, has increased significantly over the past 45 years.<sup>1</sup>

The National Footprint Accounts measure the ecological resource use and resource capacity of nations over time. Based on approximately 5,400 data points per country per year, the Accounts calculate the Footprints of 150 nations from 1961 to the present. These accounts provide the core data that is needed for all Ecological Footprint analysis worldwide.

### Data Sources and Methodology

The calculations in the National Footprint Accounts are primarily based on international data sets published by the Food and Agriculture Organization of the United Nations, the International Energy Agency, the UN Statistics Division, and the Intergovernmental Panel on Climate Change. Other data sources include studies in peer-reviewed science journals and thematic collections.

Global Footprint Network is the steward of two committees: the **National Accounts Review Committee** and the **Standards Committee**. These committees are composed of members of more than 100 Partner organizations and were created to oversee the scientific basis of the National Footprints Accounts and provide standards to govern Footprint applications. Together, these ensure accurate, consistent and comparable Footprint analyses. In addition, Global Footprint Network encourages national governments to conduct reviews of their country's own accounts through a third party process.

### Ecological Footprint Calculations

The Ecological Footprint is calculated by considering all of the biological materials consumed, and all of the biological wastes generated, by a person in a given year. These materials and wastes each demand

<sup>1</sup> Global Footprint Network 2008. National Footprint Accounts, 2008 Edition. Available at [www.footprintnetwork.org](http://www.footprintnetwork.org).

ecologically productive areas, such as cropland to grow potatoes, or forest to sequester fossil carbon dioxide emissions. All of these materials and wastes are then individually translated into an equivalent number of global hectares, hectares with world-average productivity.

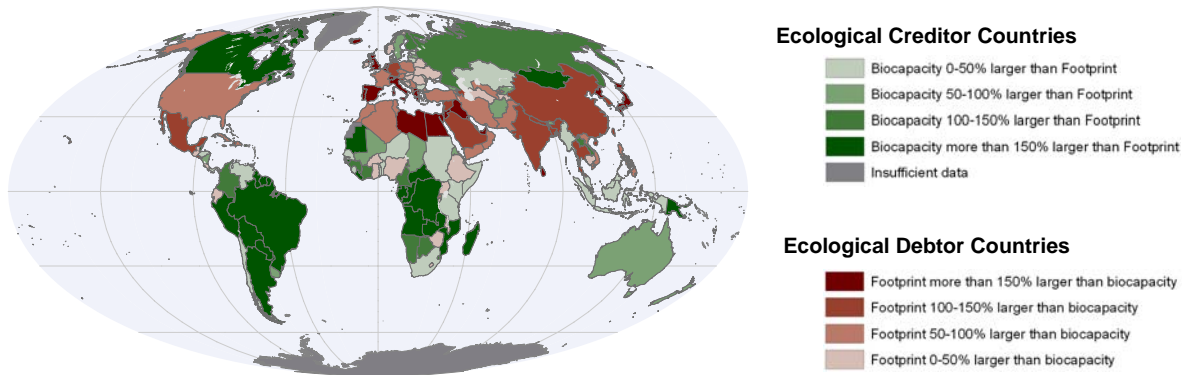
To accomplish this, an amount of material consumed by that person (tonnes per year) is divided by the yield of the specific land or sea area (annual tonnes per hectare) from which it was harvested, or where its waste material was absorbed. The number of hectares that result from this calculation are then converted to global hectares using yield and equivalence factors. The sum of the global hectares needed to support the resource consumption and waste generation of the person gives that person's total Ecological Footprint of consumption. The Ecological Footprint of consumption of a group of people, such as a city or nation, is simply the sum of the Ecological Footprint of all the residents of that city or nation. It is also possible to construct an Ecological Footprint of production for a city or nation, which instead sums the Ecological Footprint of all resources extracted and wastes generated within the borders of the city or nation and does not account for the imports or exports for that city or nation. The Ecological Footprint represents appropriated biocapacity, and biocapacity represents the availability of bioproductive land. For any land use type, the Ecological Footprint  $EF$  of a country, in global hectares, is given by

$$(Eq. 1a) \text{ Ecological Footprint} = \frac{P}{Y_N} \cdot YF \cdot EQF$$

where  $P$  is the amount of a product harvested or waste emitted,  $Y_N$  is the national average yield for  $P$ , and  $YF$  and  $EQF$  are the yield factor and equivalence factor, respectively, for the land use type in question. A country's biocapacity  $BC$  for any land use type is calculated as follows, where  $A$  is the area available for a given land use type<sup>2</sup>

$$(Eq. 1b) \text{ Biocapacity} = A \cdot YF \cdot EQF$$

### What is an Ecological Creditor Country?



**Figure 2:** Ecological Creditor and Debtor Countries (data 2005)<sup>3</sup>

Residents of ecological creditor countries use less ecological resources than are available within their national borders, and therefore are endowed with a reserve of natural assets. This reserve, in an increasingly resource-constrained world, empowers these countries and strengthens their strategic position in trade or for biodiversity preservation. In contrast, countries with ecological deficits depend on net imports of such resources or on liquidating their ecological assets to maintain their economies. As ecological creditor countries, currently home for merely 20 percent of the world's population, become increasingly rare, it will become crucial for debtor nations to forge relationships with these creditor countries (see Figure 2). This Summit will help explore and define these possibilities.

<sup>2</sup> Ewing B., A. Reed, S.M. Rizk, A. Galli, M. Wackernagel, and J. Kitzes. 2008. *Calculation Methodology for the National Footprint Accounts, 2008 Edition*. Oakland: Global Footprint Network. 3.

<sup>3</sup> Ewing B., S. Goldfinger, M. Wackernagel, M. Stechbart, S. M. Rizk, A. Reed and J. Kitzes. 2008. *The Ecological Footprint Atlas 2008*. Oakland: Global Footprint Network. 21.

## GLOSSARY OF TERMS<sup>4</sup>

**Biological capacity, or biocapacity:** The capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. “Useful biological materials” are defined as those used by the human economy. The biocapacity of an area is calculated by multiplying the actual physical area by the yield factor and the appropriate equivalence factor.

**Ecological Footprint:** A measure of how much biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices. The Ecological Footprint is usually measured in global hectares. Because trade is global, an individual or country's Footprint includes land or sea from all over in the world.

**Ecological Creditor:** A country with a biocapacity that exceeds their Ecological Footprint of consumption, calculated by the ratio of biocapacity to Ecological Footprint of consumption for that country. In 2005 Ecological Creditors included: *Brazil, Russia, Canada, Argentina, Congo Dem Rep, Australia, Bolivia, Indonesia, Colombia, Peru, Congo, Madagascar, Mozambique, Sweden, Paraguay, Angola, Finland, Gabon, Central African Rep, Mongolia, Cameroon, New Zealand, Zambia, Cote d'Ivoire, Myanmar, Chile, Uruguay, Guinea, Papua New Guinea, Mauritania, Kazakhstan.*

**Ecological Debtor:** A country with an Ecological Footprint of consumption that exceeds their biocapacity, calculated by the ratio of Ecological Footprint of consumption to biocapacity for that country. In 2005 Ecological Debtors included: *Lesotho, Malawi, Trinidad and Tobago, Cambodia, Ecuador, Turkmenistan, Tajikistan, Burundi, Jamaica, Costa Rica, Armenia, Mauritius, Haiti, Slovakia, Guatemala, Rwanda, Albania, Bosnia Herzegovina, Norway, Belarus, Slovenia, Croatia, Zimbabwe, Burkina Faso, Oman, Dominican Republic, El Salvador, Tunisia, Macedonia, Yemen, Ghana, Hungary, Cuba, Jordan, Ireland, Lebanon, Azerbaijan, Serbia and Montenegro, Nepal, Uganda, Denmark, Romania, Sri Lanka, Ukraine, Morocco, Austria, Singapore, Libya, Korea DPRP, Uzbekistan, Kuwait, Syria, Algeria, Czech Rep, Ethiopia, Philippines, Switzerland, Israel, Hong Kong, Iraq, Saudi Arabia, Portugal, UAE, Vietnam, Belgium, Bangladesh, Greece, Nigeria, Netherlands, Pakistan, Poland, Thailand, Turkey, Iran, Egypt, France, Korea Rep, Mexico, Germany, Spain, Italy, United Kingdom, India, Japan, USA, China.*

**Equivalence factor:** A productivity-based scaling factor that converts a specific land type (such as cropland or forest) into a universal unit of biologically productive area, a global hectare. For land types (e.g. cropland) with productivity higher than the average productivity of all biologically productive land and water area on Earth, the equivalence factor is greater than one. Thus, to convert an average hectare of cropland to global hectares, it is multiplied by the cropland equivalence factor of 2.64. In a given year, equivalence factors are the same for all countries.

**Global hectare (gha):** A productivity-weighted area used to report both the biocapacity of the Earth, and the demand on biocapacity (the Ecological Footprint). The global hectare is normalized to the area-weighted average productivity of biologically productive land and water in a given year. Because different land types have different productivity, a global hectare of, for example, cropland, would occupy a smaller physical area than the much less biologically productive pasture land, as more pasture would be needed to provide the same biocapacity as one hectare of cropland.

**Overshoot:** Global overshoot occurs when humanity's demand on nature exceeds the biosphere's supply, or regenerative capacity. Such overshoot leads to a depletion of Earth's life supporting natural capital and a build-up of waste. At the global level, ecological deficit and overshoot are the same, since there is no net-import of resources to the planet. Local overshoot occurs when a local ecosystem is exploited more rapidly than it can renew itself.

**Yield factor:** A factor that accounts for differences between countries in productivity of a given land type. Each country and each year has yield factors for cropland, grazing land, forest, and fisheries. For example, in 2005, German cropland was 2.3 times more productive than world average cropland. The German cropland yield factor of 2.3, multiplied by the cropland equivalence factor of 2.6, converts German cropland hectares into global hectares: One hectare of cropland is equal to 6.0 gha.

**For further information, and referenced materials please see:**

<http://www.footprintnetwork.org/en/index.php/GFN/page/publications/>  
<http://www.footprintnetwork.org/en/index.php/GFN/page/methodology/>

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<sup>4</sup> Ewing B., S. Goldfinger, M. Wackernagel, M. Stechbart, S. M. Rizk, A. Reed and J. Kitzes. 2008. *The Ecological Footprint Atlas 2008*. Oakland: Global Footprint Network. 75-78.