The Ecological Footprint: Frequently Asked Question

General

What is the Ecological Footprint?

The Ecological Footprint is a resource accounting tool that measures how much biologically productive land and sea is used by a given population or activity, and compares this to how much land and sea is available. 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. The Ecological Footprint measures the sum of these areas, wherever they physically occur on the planet. The Ecological Footprint is used widely as a management and communication tool by governments, businesses, educational institutions, and non-governmental organizations.

What does the Ecological Footprint measure?

Ecological Footprint accounts answer a specific research question: how much of the biological capacity of the planet is demanded by a given human activity or population? To answer this question, the Ecological Footprint 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 the waste it generates with today's technology and resource management practices. 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. Biologically productive land includes areas such as cropland, forest, and fishing grounds, and excludes deserts, glaciers, and the open ocean.

Global hectares are hectares with world-average productivity for all productive land and water areas in a given year. Studies that are compliant with current Ecological Footprint Standards (www.footprintstandards.org) use global hectares as a measurement unit. This makes Ecological Footprint results globally comparable, just as financial assessments use one currency, such as dollars or Euros, to compare transactions and financial flows throughout the world.

What is biocapacity?

Biocapacity represents the ability of ecosystems to produce useful biological materials and to absorb wastes generated by humans, using current

management and extraction technologies. Useful biological materials are defined as those materials that the human economy actually demanded in a given year. The Ecological Footprint measures demand on this productive capacity.

What is overshoot?
Ecological overshoot at any scale 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. The Ecological Footprint is often used to calculate global overshoot; which occurs when humanity's demand on the biosphere exceeds the available biological capacity of the planet. By definition, overshoot leads to a depletion of the planet's life supporting biological capital and/or to an accumulation of waste products.

What is the proper way to use the term Ecological Footprint?
The term Ecological Footprint, capitalized, is a proper name referring to a specific research question: how much of the biological capacity of the planet is demanded by a given human activity or population? Often, the word 'footprint' is used generically to refer to human impact on the planet, or to a different research question. As commonly used today, for example, the term 'carbon footprint' often refers to the number of tonnes of carbon emitted by a given person or business during a year, or to the tonnes of carbon emitted in the manufacture and transport of a product. In Ecological Footprint accounts, the 'carbon Footprint' measures the amount of biological capacity, in global hectares, demanded by human emissions of fossil carbon dioxide.

The term Ecological Footprint has been deliberately excluded from trademark to encourage its widespread use. Global Footprint Network strives to maintain the value of this term by encouraging our partners and others using the word footprint or Ecological Footprint to apply the term consistently, using the definition found in the Ecological Footprint Standards (www.footprintstandards.org). Global Footprint Network encourages research answering different questions to be referred to as something other than Ecological Footprint.

Is the Ecological Footprint a measure of carrying capacity?
Carrying capacity is a technical term that refers to the maximum population of a species that a given land or marine area *could* support. Many species have easily defined and consistent consumption needs, making carrying capacity relatively easy to define and calculate. For humans, however, carrying capacity estimates require assumptions about future per-person resource consumption, standards of living and "wants" (as distinct from "needs"), productivity of the biosphere, and advances in technology. An area's carrying capacity for humans is thus inherently speculative, and difficult to define.

Ecological Footprint accounts approach the carrying capacity question from a different angle. Ecological Footprints are not speculative estimates about a potential state, but rather are an accounting of the past. Instead of asking how

many people *could* be supported on the planet, the Ecological Footprint asks the question in reverse and considers only present and past years. The Footprint asks how many planets *were actually* necessary to support all of the people that lived on the planet in a given year, under that year's standard of living, biological production, and technology. This is a scientific research and accounting question that can be answered through the analysis of documented, historical data sets.

Methodology

How is an Ecological Footprint calculated?

Ecological Footprints can be calculated for individual people, groups of people (such as a nation), and activities (such as manufacturing a product).

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

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.

The Ecological Footprint 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.

The Ecological Footprint of an activity, such as producing a good (an airplane) or service (providing insurance) in the human economy, is calculated in a similar manner by summing the Ecological Footprint of all of the material consumed and waste generated during that activity. When calculating the Footprint of a business or organization, the activities to be included within the boundaries of that organization must be clearly defined.

What is a global hectare?

To allow different types of land to be compared using a common denominator, equivalence factors are used to convert physical hectares of different types of land, such as cropland and pasture, into the common unit of global hectares. The use of global hectares recognizes that different types of land have a different

ability to produce useful goods and services for humans. One hectare of cropland can produce a greater quantity of useful and valuable food products than a single hectare of grazing land, for example. By converting both cropland and pasture into global hectares, they can be compared on an equal basis.

A global hectare is defined as a hectare with world-average productivity for all biologically productive land and water in a given year. Biologically productive land includes areas such as cropland, forest, and fishing grounds, and excludes deserts, glaciers, and the open ocean. Global hectares are the common, standardized unit used for reporting Ecological Footprint and biocapacity across time and for areas throughout the world. Because total global production changes over time, the amount of physical material produced by a single global hectare also changes over time.

Global hectares can also be converted into global acres.

What is an equivalence factor?
The equivalence factor is the key factor that allows land of different types to be converted into the common unit of global hectares. The equivalence factor itself is a productivity-based scaling factor that converts one hectare of world-average land of a specific land type, such as cropland or forest, into an equivalent number of global hectares. These equivalence factors are based on assessments of the relative productivity of land under different land types in any given year. In the most current Ecological Footprint accounts, an index of suitability for agricultural production is used as a proxy measure of the productive capacity of different land types. Other updated and refined methods for this calculation are continually being explored.

What is a yield factor?
Within a given land type, such as cropland, the ability of an area to produce useful goods and services can vary dramatically based on factors such as climate, topography, or prevailing management. Yield factors allow different areas of the same land type to be compared based on the common denominator of yield. National yield factors for pasture, for example, compares the productivity of average pastures in a specific nation to world-average pastures. These yield factors convert one hectare of a specific land type, such as pasture, within a given nation into an equivalent number of world-average hectares of that same land type. The equivalence factors can then be used to convert world-average hectares of a specific land type into global hectares.

The national yield factor for a given land type is calculated as the ratio of national average yields of that land type, for example German forest, and world-average yields of that land type. Yield factors are calculated for each land type in each nation in each year.

When should I use the units global hectares, global hectare years, and global hectares per year?
A global hectare is a productivity normalized area that provides a defined continuous flow of goods and services for human use. Technically, a person with a 5 global hectare Ecological Footprint demands 5 global hectares of area over any time period. In one year, that person demands the amount of goods and services produced by 5 global hectares in that year. In two years, that person demands the amount of goods and services produced by 5 global hectares in two years. In one day, that person demands the amount of goods and services produced by 5 global hectares in one day, and so on. As the Ecological Footprint refers to a continuous demand, and biocapacity refers to a continuous supply, both are correctly reported in global hectares.

In the case of an activity with a discrete start and end, such as the creation of an individual product, a different unit is required. In calculating the Ecological Footprint of a product, the product does not require a continuous flow of goods and services but rather demanded the amount of goods and services produced by a given number of global hectares for a given, specific amount of time. Producing one book, one apple, or one table, which requires the use of a specific area for a finite amount of time, has a Footprint correctly reported in 'global hectare-years.

In the case of a product whose consumption is amortized over time, such as the structural materials in a building, the product begins with a total Ecological Footprint measured in global hectare-years. This total Ecological Footprint is then divided over the lifetime of the building, and the Ecological Footprint of that durable product in any single year is expressed in global hectare-years per year, or global hectares.

There is no instance in Ecological Footprint accounting where 'global hectares per year' is the correct unit to use.

How does the Ecological Footprint address waste flows?
From and Ecological Footprint perspective, the term 'waste' includes three different categories of materials, and each category is treated differently within Footprint accounts.

First, biological wastes such as residues of crop products, trimmings from harvested trees, and carbon dioxide emitted from fuel wood or fossil fuel combustion are all included within Ecological Footprint accounts. A cow grazing on one hectare of pasture has a Footprint of one hectare for both creating its biological food products and absorbing its biological waste products. This single hectare provides both services, thus counting the Footprint of the cow twice (once for material production and once for waste absorption) results in double counting the actual area necessary to support the cow. The Footprint associated

with the absorption of all biological materials that are harvested is thus already counted in the Footprint of those materials.

Second, waste also refers to the material specifically sent to landfills. If these landfills occupy formerly biologically productive area, then the Footprint of this landfill waste can be calculated as the area used for its long term storage.

Finally, waste can also refer to toxics and pollutants released from the human economy that cannot in any way be absorbed or broken down by biological processes, such as many types of plastics. As the Ecological Footprint measures the area required to produce a material or absorb a waste, materials such as plastics that are not created by biological processes nor absorbed by biological systems do not have a defined Ecological Footprint. These materials can cause damage to ecosystems when they are released into the environment, and this loss of biocapacity can be measured using an Ecological Footprint approach when it actually occurs. Such assessments are difficult, however, and not often completed. Assessments of the Footprint of toxics and pollutants, when completed, generally refer to the Footprint of extracting, processing, and handling these materials, but not to the Footprint of creating or absorbing these materials themselves.

How does the Ecological Footprint account for recycling?
As the Ecological Footprint reflects the demand for productive area to make resources and absorb wastes, recycling can lower the Ecological Footprint by offsetting the extraction of virgin products, and reducing the area necessary for absorbing wastes. Recycling paper, for example, can decrease the total amount of virgin timber that must be harvested to meet global demand for paper, thus reducing humanity's total Ecological Footprint.

The savings that result from the recycling process can be allocated to the person who recycles a material and/or the person who buys recycled material in a number of different ways:

- 100% to the person who buys the recycled paper (the wood fibre in a 100% recycled ream of paper could have no forest Footprint, since the footprint of that wood fibre was already allocated to the person who bought the virgin paper),
- 100% the person who recycles the paper (a person purchasing 100% virgin paper who recycled all of it would have no Footprint for the wood fibre in that paper, since all of it is reused later, assuming that no fiber is lost in the recycling process), or
- Split between the person who buys recycled paper and the person who recycles paper (the savings can be split 50%/50%, or in any other allocation).

Different researchers use different allocation principles for the savings from recycling, and standards compliant Footprint studies

(www.footprintstandards.org) will state their chosen allocation method explicitly. Regardless of allocation method, however, the largest reductions in Ecological Footprint can most commonly be achieved by reducing the total amount of materials consumed, rather than attempting to recycle them afterwards.

General Interpretation and Criticism

Is the Ecological Footprint too simplistic?
No single model or set of environmental accounts can capture every complexity of the world's many different ecological systems. The Ecological Footprint attempts to answer a single, specific research question that has far reaching implications: how much of the planet's capacity do we use compared to how much is available? By comparing the area we demand to how much area is available, Footprint accounts are easy to visualize and communicate, and provide the only available comprehensive answer to this research question. As with any data set, a fuller picture of the state of the planet can be gained by combining Footprint accounts with complementary indicators focussed on other important aspects of sustainability.

How can so many highly heterogeneous components be combined in any meaningful way in a single composite indicator?
Unlike most other aggregate indices, such as environmentally weighted material flow or various environmental performance indices, the Ecological Footprint does not assign arbitrary weights to individual components in order to add them together. Rather, all different types of land and sea that are demanded are normalized to a common unit, global hectares, based on empirical data on the relative productivity of these different area types. This normalization is not arbitrary and is based on observable, scientifically testable characteristics of the land and sea areas.

Aggregate indicators such as the Ecological Footprint provide value above and beyond their parts by conveying a large amount of information in a small space. The use of global hectares also shows the tradeoffs and substitutions that are often made between different ecosystems, and can compare aggregate demand on nature to aggregate supply of biological capacity.

Like any composite indicator, however, the aggregate Ecological Footprint data have their limitations. Aggregate results used in isolation can create an overly simplistic view of complex systems and give the impression that improvements in one area always compensate for deteriorations in others. True Ecological Footprint accounts can be disaggregated into individual components, such as seven major land types or several hundred different product categories.

Does the Ecological Footprint assume that different land types can be substituted for each other?

By expressing all different types of land in a common unit of global hectares, Ecological Footprint analysis is able to compare demands on one land type with demands on another based on their use of the biosphere's limited productive capacity. As an overarching rule of thumb, different land types can often substitute for one another based on their biocapacity. One average physical hectare of grazing land, for example, has about one-fourth the biocapacity of one average physical hectare of cropland. In other words, about four times as many hectares of average grazing land are needed to produce the same amount of beef as one average hectare of cropland growing grass.

Although productive capacity is arguably the most robust empirical method for comparing different land types to each other, this equivalency does break down for large changes, or when comparing two highly specialized ecosystems. In these cases, the Ecological Footprint of each land type can be viewed separately. Importantly, however, an aggregate Footprint in excess of aggregate biocapacity indicates that at least one type of ecosystem or productive land type is being demanded beyond its availability.

The Ecological Footprint does not appear to account for technology. If technology will continue to improve our lives and make our consumption more efficient, why should we be concerned about today's state of overshoot?

As an accounting tool, the Ecological Footprint in any given year reflects the prevailing technology of that year in calculating total demand for biological capacity. The accounts document only historical states as they occur. As more renewable electricity generation technology has been introduced, for example, the Ecological Footprint of the average kilowatt hour of electricity has fallen, since less fossil carbon is emitted per unit of energy. As paper manufacturing has become more efficient, generating less waste per unit of paper, the Ecological Footprint of paper has fallen accordingly. The Ecological Footprint thus makes no assumption about technological possibilities, but reflects their actual influence on our current demand on the planet.

A global Ecological Footprint analysis shows, however, that each year since the mid-1980's, humanity has demanded more productive capacity than the biosphere can supply, and that historically, gains in yield and efficiency have not been able to compensate for increasing demand. As a result global overshoot has increased over time. By definition, this overshoot leads to depletion of biological capital and the accumulation of wastes in the biosphere. This state represents a risk to global society today, increasing the potential for price shocks, disruption of global supply chains, economic recession, and political turmoil.

Why does the Ecological Footprint matter given that nations, for example, can import scarce resources from elsewhere?

When a nation's demand for ecological goods and services exceeds what its own ecosystems can supply, the nation can balance this ecological deficit in two

ways: by importing resources from elsewhere, or by drawing down its own stocks of ecological capital. Some nations use a combination of the two, both overdrawing their own biocapacity for export while simultaneously importing additional biocapacity from elsewhere. Comparing the Ecological Footprint of a nation to its own biocapacity can be used to determine whether, in the long run, a nation is capable of meeting its own demands from within its own borders. At the global scale, all nations cannot be net importers, and nations that rely on competition for increasingly scarce imports will be increasingly at risk.

What can Ecological Footprint Analysis tell us about the future of the planet? Are we all doomed?

The Ecological Footprint highlights the reality of ecological scarcity, which can be disconcerting and frightening information. The existence of global overshoot suggests that human society will need to make significant changes to 'business as usual' if it wants to create a sustainable future. Robust and accurate Ecological Footprint accounts can help us make decisions towards sustainability, and can quantitatively show the positive impacts of groups, businesses, and people making decisions that are helping to bring human demand within the means of the planet.

The Ecological Footprint seems to ignore factors such as human health and the well-being of society. Aren't these important to sustainability?

The Ecological Footprint does not attempt to capture every aspect of sustainability, as combining such disparate information could create a single indicator that could be very difficult to interpret and use, in the aggregate, for decision making. The Ecological Footprint answers only the question of how much of the planet's productive capacity is occupied for human uses, and how the demand for this productive capacity is distributed around the world. Sustainability means *living well, within the means of nature*, and the Ecological Footprint highlights a minimum condition that addresses only the second part of this equation.

The Ecological Footprint is often used in tandem with other indicators describing development or quality of life, such as the UN's Human Development Index. Additionally, comparative Footprint analysis can highlight disparities in consumption of biological resources between different populations, such as high and low income nations,

Does the Ecological Footprint determine what is a "fair" or "equitable" use of resources?

The Ecological Footprint is a science-based ecological accounting tool that reports the current state of demand for productive area, along with who demands it, and the amount of productive area available. Footprint accounts quantitatively describe the demand of any individual or a population, but they do not themselves draw conclusions or make assumptions about who *should* be using what. Rather, these are social and political choices that the Ecological Footprint

itself cannot make. While the Ecological Footprint can help to inform these choices, conclusions about what represents a “fair share” or an “equitable use” are moral and ethical choices, and the Ecological Footprint accounts are descriptive in nature.

Data Accuracy and Improvement

How accurate are Ecological Footprint measurements?
Current Ecological Footprint accounts provide a robust, aggregate estimate of human demand on the biosphere as compared to the biosphere’s productive capacity. As with any calculation system, Footprint accounts are subject to uncertainty in source data, calculation parameters, and methodological decisions. Exact error bars or standard errors for calculations have not been rigorously compiled, and no full, comprehensive, and quantitative estimate of uncertainty has yet been carried out. Several organizations, including Global Footprint Network, are seeking to allocate resources towards obtaining more accurate estimates of this nature.

How does Global Footprint Network address data quality?
Global Footprint Network’s Ecological Footprint accounts for nations rely on well-established international data sets, mostly provided by the United Nations and the United Nations Food and Agriculture Organization. These data sets are official, widely obtainable, and are available in a consistent format across nations, allowing comparisons to be made between countries. The data are taken at face value, except where a substantial error is apparent and recognized widely by the research community (for example, historical fisheries catch distortions or jumps of two orders of magnitude in trade flows for a single year). Global Footprint Network encourages national governments, statistical offices, and research organizations to participate in collaborative reviews of data quality and methodology.

Is the methodology behind Ecological Footprint calculations still changing?
The National Footprint Accounts, the basis for all standards-compliant Ecological Footprint assessments, undergoes constant updates and revisions as new data become available and methodological advances are made. All changes to the data and methods in the National Footprint Accounts are reviewed and approved by Global Footprint Network’s National Accounts Committee, consisting of representatives from the network’s partner organizations.

Although calculation parameters and source data are constantly being refined, importantly, the conceptual model behind Ecological Footprint analysis has not changed substantially since it was first introduced. Since then, the basic premises of Footprint accounting have been examined and applied by organizations, scientists, and governments throughout the world.

Are the Ecological Footprint calculations based on subjective judgment about the state of the world or the supposed need for environmental activism?
Like other accounting systems, such as the Systems of National Accounts and GDP, Ecological Footprint accounts build on a single, clearly defined research question, and attempt to provide the best possible objective, transparent, and scientific answer to this question. The process of initially defining a research question inherently involves normative judgments about which questions are important to pursue. Once a research question is identified, however, answering it is a scientific process.

Ecological Footprint accounts do not say anything about what should be, or what any person or group of people should do. Rather, they provide an objective and reproducible answer to the question of how much of the planet's regenerative capacity is occupied by human activities. No normative or opinion-based judgments or weighting factors enter into Ecological Footprint accounting methodology. For example, the equivalence factors that allow different land types to be aggregated in the common unit of global hectares are based on empirical measurements of productivity).

As an organization, Global Footprint Network does not engage in environmental advocacy other than to suggest that the maintenance of accurate ecological accounts has an important role to play in decision making.

Are there any standards set for Ecological Footprint assessments?
Global Footprint Network's Standards Committee has released an official standards document that addresses Footprint methodology and communication, including use of source data, derivation of conversion factors, establishment of study boundaries, and accurate communication of findings (www.footprintstandards.org). These standards are widely used by Global Footprint Network's partners and by other analysts who conduct Ecological Footprint research and assessments.

At the national level, Global Footprint Network maintains the National Footprint Accounts, which provide benchmark Ecological Footprint results for 150 nations from 1961-2003. The data and methods used in these accounts are overseen by Global Footprint Network's National Accounts Committee.

Carbon and Energy

Is the Ecological Footprint the same as the carbon footprint?
Recently, a number of organizations and governments have begun using the term 'carbon footprint' to refer to the quantities of carbon dioxide emissions associated with an activity, process, or product. This carbon footprint, typically measured in tonnes of carbon dioxide, is an initial step towards calculating a full carbon Footprint, which in turn is one piece of the total Ecological Footprint. A

carbon Footprint translates tonnes of carbon dioxide released into the demand this places for biological capacity, measured in terms of the total area, in global hectares, required to sequester these carbon emissions.

The carbon Footprint adds value to simple carbon emissions data in two ways:

- The carbon Footprint puts the magnitude of emissions into a meaningful context. Many people do not know how to interpret 1,000 tonnes of carbon emissions, but they can easily understand that if 1,000 global hectares would be required to absorb this carbon, but only 500 global hectares are available, this is a problem if we want to prevent this waste product from building up around us.
- The Ecological Footprint provides an overarching systems perspective that can reveal spill-over effects, when reducing demand in one area leads to an increase in demand elsewhere. For example, will shifting from fossil fuels to biomass fuels decrease or increase humanity's overall demand on the planet's biological capacity? Would increasing the use of biomass fuels be more or less effective than returning cropland to forest cover?

How is the nuclear Footprint calculated?

As currently shown in Ecological Footprint accounts, the nuclear Footprint is one of seven major Ecological Footprint land types. The size of the nuclear Footprint is calculated by assuming that one unit of nuclear electricity has the same Ecological Footprint as one unit of average fossil fuel electricity. This equivalency method was introduced in 1997 to reflect uncertainty about the appropriate method for capturing the true demand on the biosphere associated with the generation of nuclear electricity. This method does not suggest that nuclear electricity has the same carbon emissions as fossil fuel, but rather highlights that nuclear energy has a non-zero impact profile that has been difficult to calculate exactly.

Major concerns surrounding nuclear electricity are the risk of a future accident, long term waste storage, and proliferation risks. These issues, however, all fall outside the central research question of the Ecological Footprint, which does not address risk or model future scenarios. As a result, the Ecological Footprint may not be the most appropriate tool for assessing the tradeoffs between nuclear and fossil fuel electricity.

The nuclear equivalency method is currently undergoing scientific review, and changes are expected to be introduced in the upcoming Ecological Footprint accounts to be released in 2008.

Water

How does the Ecological Footprint treat water usage?
The Ecological Footprint of a biological resource represents the amount of biologically productive land and water area required to produce that material. Although freshwater is a natural resource cycled *through* the biosphere, and related to many of the biosphere's critical goods and services, it is not itself a material made by biologically productive area, or a waste absorbed by it. Ecosystems simply do not create water in the same manner as timber, fish, or fiber products.

As a result, the Footprint of a given quantity of water cannot be calculated with yield values in the same manner as a quantity of crop or wood product. When values for a 'water footprint' are reported, these are most commonly refer to either a measurement of total liters of water consumed, or to the Ecological Footprint required for a utility to provide a given supply of water. A water footprint can also be calculated based on the area of catchments or recharge zone needed to supply a given quantity of water. The area obtained from this calculation, however, cannot be added to other Ecological Footprint land areas, as this would create double counting (a forest, for example, can be used for both timber production and as a water catchment, but adding these two values together would count the amount of forest available twice).

Ecological Footprint accounts do directly reflect the influence of water availability on the biocapacity of ecosystems. Estimates of the amount of biocapacity that is dependent on freshwater supply, or of the lost capacity associated with water use for non-bioproductive purposes, could be calculated. As the relationship between freshwater and biological capacity is highly site specific, this analysis would need to be completed at a regional or local scale on a case-by-case basis.

Biodiversity

How does the Ecological Footprint relate to biodiversity?
The Ecological Footprint is not an indicator of the state of biodiversity, and the impact of a particular activity or process on biodiversity does not directly affect the Ecological Footprint calculation for that activity. Given the same yields, for example, the Ecological Footprint of Forest Stewardship Council (FSC) timber and uncertified timber is identical. These two practices will have very different consequences for the available future capacity of the forest to produce timber, which would be reflected in future biocapacity assessments but not in current Ecological Footprint accounts.

Although not a direct measure of biodiversity, the Ecological Footprint supports biodiversity assessment and conservation in two important ways. First, the Ecological Footprint can be used as a large scale indicator of the underlying drivers or pressures that cause biodiversity loss. For this reason, the Convention on Biodiversity (CBD) and the Streamlining European Biodiversity Indicators (SEBI) processes have both adopted the Ecological Footprint as an indicator of

pressure on biodiversity.

In addition, the Ecological Footprint can also be used to translate the consumption of a given quantity of material (such as one kilogram of paper) into the specific local land area from which it was harvested (such as one square meter of forest in Finland). After this initial translation, complementary indicators and assessment tools can be used to measure the impact on biodiversity associated with harvesting from that ecosystem. This approach has been used in Global Footprint Network's work in contribution to the Sustainable Consumption and Production program of the United Kingdom's Department for Environment, Food, and Rural Affairs (DEFRA).

Pollutants and Non-renewables

How does the Ecological Footprint account for pollution and toxic waste?
Toxics and pollutants released from the human economy that cannot in any way be absorbed or broken down by biological processes, such as many types of plastics, cannot be directly assigned an Ecological Footprint. As the Ecological Footprint measures the area required to produce a material or absorb a waste, materials such as mercury that are not created by biological processes nor absorbed by biological systems do not have a defined Ecological Footprint (although their extraction, processing, and transport may have an associated carbon Footprint, for example). Many of the most important concerns surrounding toxic materials, such as future storage risks and human health impacts, are best captured by indicators other than the Ecological Footprint.

Many of these materials can cause damage to ecosystems when they are released into the environment, however, and this resultant loss of biocapacity can be measured using Ecological Footprint accounting and allocated to the activity that caused the release of the pollutant. The relationships between pollution and ecosystem damage are very site specific, data intensive, and difficult to calculate in practice. Even if no specific calculation is undertaken, however, any loss of biocapacity associated with the release of pollutants will be reflected in future assessments of the affected area.

We are using up many of our non-renewable resources such as copper, tin, coal and oil. How does the Ecological Footprint measure this resource depletion?
As the Ecological Footprint measures demand on the biosphere's productive capacity, materials that are extracted from outside the biosphere (such as copper and other minerals that are mined beneath the ground) do not have a yield value that can be used to translate their creation into a productive area. One tonne of copper thus does not have an Ecological Footprint in the same way as one tonne of timber, which requires bioproductive area for its creation. There is, however, an Ecological Footprint associated with the energy and other materials used in extracting, refining, processing, and shipping these mineral resources, and

together these are often reported as the Footprint of the mineral. Additionally, when mined materials such as mercury or arsenic enter the environment, they may cause damage and a loss of productivity.

Non-renewable fossil fuel resources are treated differently from other minerals, however, since they actually represent an ancient material of biological origin, and their combustion releases a material, carbon dioxide, which is part of the biosphere's material cycles. The Footprint of carbon released from the combustion of fossil fuels is thus defined as the amount of productive area required to sequester this waste and prevent its accumulation. An alternative method would be to calculate the consumption of fossil fuels according to the productive area required to regenerate them, which would result in a carbon Footprint many hundreds of times higher than the current calculation.

For more information about Global Footprint Network and the Ecological Footprint, see www.footprintnetwork.org.