

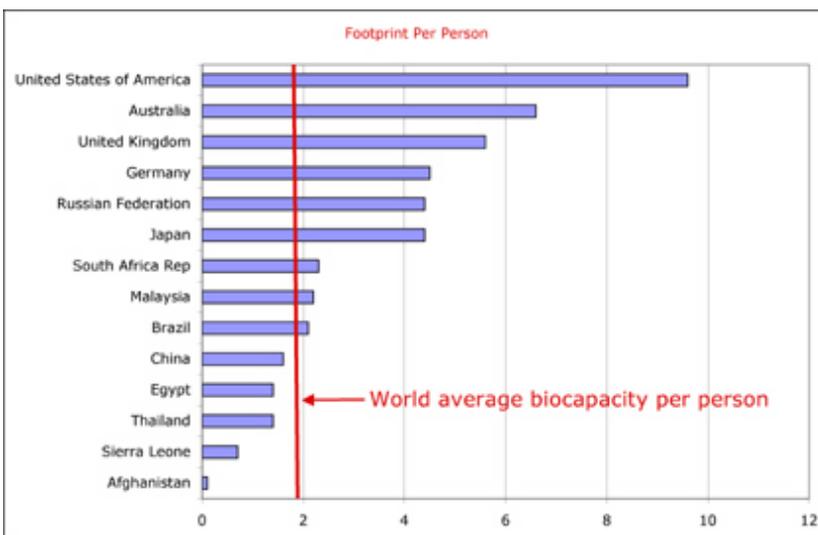
Ecological Footprints

The Worldwide Fund for Nature (WWF) has devised a measure of the impact that a given country has on the planet's environment. They call this the country's 'ecological footprint' and they report it in units of area. It is the area of the Earth that could notionally produce the resources in question (for example, forests could convert atmospheric carbon dioxide back into trees at a certain rate per unit area). The metaphor there is that the planet has only a fixed area. So if we use it up, some of us are going to have to be ejected through Spaceship Earth's metaphorical airlock. **At present,**

each person needs 2.2 global hectares to support the demands they place on the environment, but the planet is only able to meet consumption levels of 1.8 global hectares per person

So we are overdrawing our ecological account. Soon we shall need two planets, they say.

Using the WWF's **annual report** on these issues, the BBC report cited above includes a chart showing the ecological footprint *per capita* of a few selected countries, essentially as follows:



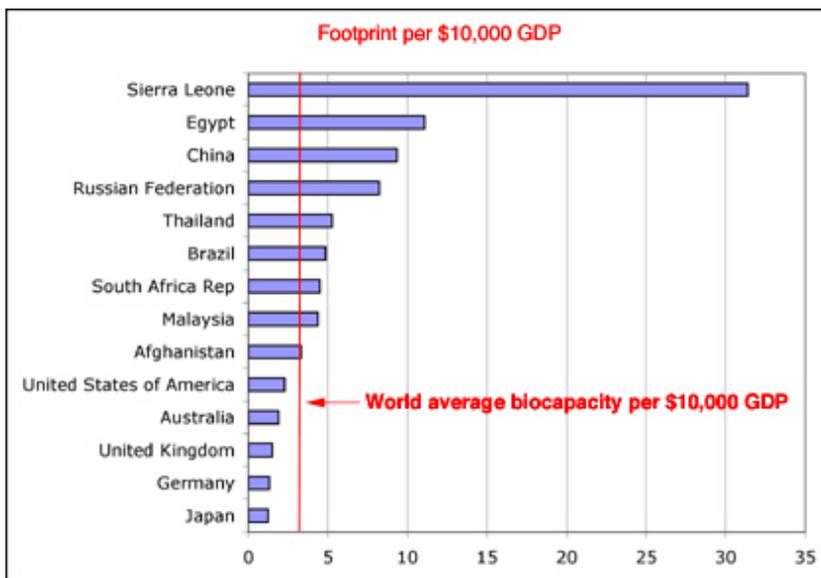
As you can see, the huge boots of Americans, Australians and Britons are trampling over the world's bio-space, while poor but virtuous Sierra Leoneans and Afghanis are trading lightly on the

Earth's sacred resources. It seems obvious who most deserves to be kicked off the planet.

But does this measure make sense?

First off, we're not at all sure that the measures of 'footprint' themselves are accurate. The data are hard to collect and harder to interpret, and many assumptions had to be made. For example, 48% of the footprint is currently due to carbon dioxide emissions. So if you think that the global warming problem might be solved, you will have to reduce most of the footprint estimates. And so on. But never mind all that. Even on the assumption that their footprint measure is accurate, dividing it by a country's population is of doubtful value. For example, if a country doubles its population without doubling its productivity, its real impact on the environment will increase, but its impact *per capita* will go down. The country will count as more environmentally virtuous – smaller ecological footprint per capita – by virtue of its runaway overpopulation! Conversely, a country that uses resources very efficiently may still count as becoming more environmentally unfriendly (larger footprint per capita) solely because it has also achieved low population growth.

This is the wrong way round. A better measure of environmental virtue would be the ecological footprint *per unit GDP*. This does not allow countries to 'cheat' by merely increasing their population without changing their physical effect on the environment, but it does take account of whether a country is wasting resources or using them efficiently. Out of curiosity, we used the WWF's numbers and the BBC's countries to construct the appropriate chart:



The countries are now in approximately the opposite order. Notice that the United States goes from worst on the chart, to using less than capacity, even though the worldwide average is 125% of capacity. This isn't a coincidence. Western countries create their 'footprint' as part of their productive process – creating the very things that let us lower the footprint while also increasing human welfare.

Footprint-per-GDP is, in our opinion, a better measure of countries'

environmental virtue. And it does not even take account of the other huge factor that is missing from the WWF's analysis: the 'area' (real or metaphorical) needed to sustain one person is not a constant of nature but depends on the available technology. For instance, how well the Earth can recover depends in part on how many carbon-dioxide-fixing machines we can build, and how efficiently, which in turn depends on how much wealth we can create and how fast. And hence the developed countries, the villains of the piece according to the environmentalists' narrative, are in reality even more environmentally virtuous *even by the WWF's standards of 'impact'* than our chart makes them seem.

(Data collected by [Elliot Temple](#).)

Fri, 10/27/2006 - 23:37 | [digg](#) | [del.icio.us](#) | [permalink](#)

Unscientific

The science in the WWF report is unbearably bad. They fudge numbers and basically say that:

- A) they do their honest best
- B) they fudge in what they believe to be the right direction

Doing your best isn't good enough. You need to actually have enough valid data, of the right types, not fudge your numbers to represent what you guess the data would say if you had it. Guessing is less accurate, and less scientific, than using real numbers.

You may think I'm joking, but they admit this in their report. For example they said their data about biodiversity over-represented whatever species people liked to study. So they just counted those less. How much less? Well, something about dividing the world into regions which they assume to be equally important, and then assuming that the convenient already-collected data for each region really is representative.

And people study vertebrates more than invertebrates. So how can they make conclusions about invertebrates, without nearly enough data? Easy. Just assume the trends for vertebrates apply.

-- Elliot Temple

curi@curi.us

Dialogs

by [Elliot Temple](#) on Sat, 10/28/2006 - 22:06 | [reply](#)

Country-centric Ideas

Sierra Leone in the best or worst of environmental scenarios is not going to make or break the globe. Neither will Great Britain or Germany. China and India might due to growth and carbon use factors. However, even here we are dealing only with county-centric ideas.

Land area and hemisphere measures of various factors per

population unit would make for a more interesting and pointed indicator of environmental footprint(s). Deep ocean areas might also be looked at to provide a number of baseline measures.

One time static measures of any sort are not usually very useful. Plot global trend charts. Take a series of snapshots using standard year intervals. Analyze the data through many different screens. Trends and their advantages and concerns will begin to emerge. Except in the extreme, this is not a competition between countries to be the bad-boy, hero of our environmental future. This is a scientific learning process that is ripe for useful discoveries.

by a reader on Sun, 10/29/2006 - 02:19 | [reply](#)

Environmental Virtue

The world's footprint measure seems better. But what exactly counts as environmental virtue? In which important ways will the environment degrade if the total human footprint exceeds the available area? Put another way, should we be making the environment better for humans to live in, or for animals and plants to live in?

Or do we try to minimise our impact and leave the other species to their fates? This amounts to partitioning the earth into two environments and reducing the net flux between them. Domed cities and space bubbles might be cool. But assuming animals aren't worthless, who manages the natural environment then? Does nature really know best, given that it has destroyed more than 99% of all historical species?

If we refuse to allow existing species to continue to die out, should we preserve them by gardening the earth and, as a side effect, allowing their fitness to deteriorate? Or should we merely collect their DNA, and the DNA of as many extinct species as we can find?

by [Tom Robinson](#) on Sun, 10/29/2006 - 20:37 | [reply](#)

Nature Knows Best

Why should nature know best? Why should what already exists be any good? Isn't that basically an obfuscated benevolent-creator-God theory?

-- Elliot Temple

curi@curi.us

Dialogs

by [Elliot Temple](#) on Mon, 10/30/2006 - 08:39 | [reply](#)

Are you serious?

Elliot, are you serious?

Nature is important because it sustains life on the planet. Plants

create oxygen, insects carry disease, forests control erosion and flooding, swamps filter water and help dampen the effects of hurricanes...

What will be the economic impact when Salmon go extinct? What was the economic impact when Chestnut trees were wiped out?

Nature has a very real impact on humanity.

by [Will](#) on Mon, 10/30/2006 - 14:26 | [reply](#)

the US consumes more per person than any other country in the wo

Ecological footprinting is not that hard. You simply look at the amount of resources humans use. If you want to do it country by country, just look at the resources each country uses: for example, how much paper does a country use each year? How many miles does the average citizen drive per day? How much electricity does the country use, and how is it produced? How much waste does the country produce? How do they farm? How much food do they consume?

The BBC method appears flawed, but it still can provide a general picture of which countries have the biggest footprint per person. Note that the WWF assesses nations' footprints in a variety of different ways. In many cases, the US does better than developing countries, in others it does worse.

There is no doubt that the US, in general, consumes more per person than any other country in the world.

Also, don't assume that technology will solve problems by default. Computers, for example, were supposed to reduce our dependence on paper and save the forests, but we now use more paper than ever before, resulting in a variety of increased ecological impacts.

by [Will](#) on Mon, 10/30/2006 - 15:18 | [reply](#)

Serious

Will,

I am serious. I certainly agree some changes to the Earth would not be good for us. But the natural state certainly isn't either. Adding cities and roads and sky scrapers has served us well. I'll be happy to see a lot more of those.

I don't think it's reasonable to evaluate whether a change is good based on a conception of whether that is the way nature wanted it. *That* is essentially theism. I think we should evaluate whether a change is good based on the expected effects for humans, and their desirability to humans.

-- Elliot Temple
curi@curi.us

Dialogs

by [Elliot Temple](#) on Mon, 10/30/2006 - 18:11 | [reply](#)

Re: the US consumes more per person than any other country

The WWF report (PDF version) does not say the US has the highest footprint per capita.

One of the problems with the WWF report is the lack of scientific care and precision. So even if the US is fairly close to the top, I think we should be more careful what we say about it.

-- Elliot Temple

curi@curi.us

Dialogs

by [Elliot Temple](#) on Mon, 10/30/2006 - 18:17 | [reply](#)

Nature knows best

If you act according to a belief that "nature wanted it" then yes, you are acting irrationally. But I'm not sure who's arguing that in this thread.

The thing is, nature does know best in many ways. If we anthropomorphize nature, we are being foolish.

But if we try to understand ecology and evolution, we begin to see that nature is made up of communities. Some plants fix nitrogen and other nutrients in the soil, animals and fungi help decomposition (thus nourishing the soil), predators and prey interact in complex ways, animals spread seed and pollinate plants.

When one species is stressed, that plays out in the whole community, in ways we are only just beginning to understand. The more stressed populations, the more humans begin to take notice: forest fires, blights in valuable crop species, erosion, flooding, nuisance species spreading, etc.

Human civilization started around 12,000 years ago. We have had a relatively stable ecosystem in that entire time, and this has supported our rise. There is every indication that the scale of changes we are seeing now will be catastrophic.

So yes, in a way, nature does 'know best.'

by [Will](#) on Mon, 10/30/2006 - 21:08 | [reply](#)

US consumes more per capita

You are right, the WWF report puts the US second in per capita footprint. The United Arab Emirates is first, mostly because of CO2 emissions. It's also, if I'm not mistaken, one of the richest countries in the world.

The US still far and away has the biggest footprint. For one thing, it

has 300 million people, whereas the UAE has only 3 million people.

Now, I still don't get your logic behind assessing footprint by GDP. One thing you will find in the report is that higher income nations have a bigger footprint across the board. The more money there is, the more goods will be bought and sold, and the more resources must be consumed to do so.

Even if you play with the numbers, the footprint (the amount of resources consumed) remains the same. By assessing GDP you are showing that some countries are more efficient at producing wealth from the resources they consume. You are not showing that they have a smaller footprint.

Am I wrong? Please explain that a little better.

You accuse the WWF of a lack of scientific rigor in their report. What alternative assessments can you provide?

by [Will](#) on Mon, 10/30/2006 - 21:29 | [reply](#)

"the more resources must be c

"the more resources must be consumed to do so."

Resources, in net, are not "consumed", they are created by our knowledge. Our ability to utilize energy, for example, is not limited by finite resources, but rather by our knowledge about how to access the virtually unlimited supply, throughout the universe.

"By assessing GDP you are showing that some countries are more efficient at producing wealth from the resources they consume."

Because resources are mostly not "consumed", the rate of growth of efficiency determines who will create the most resources over time(not "consume" the most resources). Footprint per GDP is a reasonable first approximation to who is creating resources the most efficiently.

by a reader on Tue, 10/31/2006 - 00:38 | [reply](#)

consuming resources

I think we are using different definitions of resources and consumption here. You say that resources are not consumed but produced. But the whole concept of ecological footprinting is based on quantifying the amount of land required to support a given person or nation. For example: how much electricity do you use, and how is that produced? How much paper do you use and how many acres of forest do you need to produce that paper? How much food do you eat and how many acres must be used to produce it?

The sorts of resources that GDP measures are different. They include things like services, ideas, entertainment. A totally different set of data.

by [Will](#) on Tue, 10/31/2006 - 00:50 | [reply](#)

Re: consuming resources

Will wrote:

How much food do you eat and how many acres must be used to produce it?

The sorts of resources that GDP measures are different. They include things like services, ideas, entertainment. A totally different set of data.

Do you agree that the first quantity depends heavily on the second? For example, the amount of food that a hectare of land can produce (a quantity of the first kind) depends on all sorts of factors of the second kind such as how much nitrogen can be fixed in factories at a given price, and how many people are needed to work the land to achieve a given rate of food production, which in turn depends on how cheaply tractors can be manufactured, and so on.

by [Editor](#) on Tue, 10/31/2006 - 14:24 | [reply](#)

food and acreage

Yes and no. In an industrialized society, yes, the efficiency of food production depends on technology which depends on the economy.

But there are other models. Hunter gatherers, for example, can provide for themselves with minimal technology required. They don't (at least very rarely) overuse the land, so they always have more next year.

Organic farming is another example.. still requires technology but a different kind, knowledge of soil biology, pests and predators, etcetera, and it has different effects on the surrounding environment than industrial farming - less pesticide and fertilizer runoff into local watersheds, for example.

Also there is the question: what kind of food do you eat? In the underdeveloped world, herders vs. agricultural societies use the land differently. In the developed world, meat eaters use more land per capita because livestock requires more land and water to feed than the equivalent amount of vegetable protein.

With more wealth, people generally choose to eat more meat, which is more resource intensive, rather than choosing to eat a vegetarian diet and thus becoming more efficient in land usage. So technology and wealth do not necessarily lead to more efficient agriculture.

by [Will](#) on Tue, 10/31/2006 - 14:42 | [reply](#)

Re: food and acreage

Will:

For hunter-gatherers, is it true or false that the number of people

who can be supported by a hectare of land depends on their technology?

Also, are you saying that hunter-gatherers use less land per person to produce food than the average American does? Or is it just agricultural societies in the 'underdeveloped world'? Or both, or neither?

by [Editor](#) on Tue, 10/31/2006 - 15:57 | [reply](#)

huntergatherers and GDP

My point about hunter gatherers was that there are ways of living that don't exactly fit into 'number of people supported per hectare.' Hunter gatherers live in a stasis with their environment. Their population generally remains constant, and there is always ample food. In addition, the land they live on is multipurpose. It is wildlife habitat, carbon sink, water filter, and food, clothing and shelter for humans all in one.

I don't have facts and figures about land usage per cultural/economic area. If you really want me to I will research it and get back to you. My point is that different ways of producing food have different impacts on the land. In some areas, herding causes desertification. In others it is well adapted to the local environment. Industrial meat production is very land intensive. Industrial farming is slightly less so, but with other side effects.

I am beginning to think you are sidestepping my question to you: Is it or isn't it true that when you assess ecological footprint per GDP you are only assessing how efficiently a nation produces wealth when they consume resources, and totally ignores the question of how much resources they consume, which is the focus of the WWF report?

by [Will](#) on Tue, 10/31/2006 - 17:25 | [reply](#)

Re: huntergatherers and GDP

I am beginning to think you are sidestepping my question to you: Is it or isn't it true that when you assess ecological footprint per GDP you are only assessing how efficiently a nation produces wealth when they consume resources,

We are not sidestepping it: we replied that the two are inextricably connected, and invited you to agree. Your answer was "yes and no", and that you'll get back to us.

and totally ignores the question of how much resources they consume, which is the focus of the WWF report?

Yes. Our post was primarily about the report's use of the footprint-per-capita measure, and to this end it largely conceded (for the sake of argument) their way of calculating the footprint itself.

by [Editor](#) on Tue, 10/31/2006 - 17:50 | [reply](#)

the basic message: the earth is being used up

This is an interesting conversation to have, because we are getting at one of the primary differences between people who think environmental issues are paramount and people who think economics are paramount. My point is not that footprint per GDP is a worthless way of looking at the state of the world. It is very important, as it can provide some hints about which way we might want to go as a society to reduce our own footprint.

But it seems to me that you were downplaying a real problem, which is that richer nations are using up the world's resources. If you examine the WWF report, you'll see many different things. For one thing, wealth seems to be a primary factor in resource consumption. The countries with the biggest footprint per person are primarily America and the Western European countries. So there is no reason to assume that producing wealth more efficiently makes a nation a better environmental citizen.

Another thing you'll see is that population also makes a big difference in footprint. If you look at the map on page 18 of the report, you'll see that China's footprint as a country is almost as big as the US - China has a much lower standard of living but four times the population as the US. So what happens when the Chinese achieve the same wealth as the US? They'd better learn quickly to be more sustainable or they could screw the whole planet. What about India, which currently uses even less land per person than China?

So let's not ignore the basic message of the WWF report: we are using up the earth faster than it can replenish.

Now, as for technology being inextricably linked to ecological consumption... well, technology can provide solutions. I think sustainable technologies hold a lot of promise and are being underutilized right now. The more technologically advanced nations are also the wealthy nations, and as I've already pointed out, more wealth leads to more consumption in general. It doesn't have to be that way in the future, but it is that way right now.

And please don't think that environmentalism is anti economic growth! There are ways to have a high standard of living and still cut our footprint. Likewise, technology and economic growth are necessary to find more environmentally efficient ways of living.

by [Will](#) on Tue, 10/31/2006 - 19:00 | [reply](#)

focus

and totally ignores the question of how much resources they consume, which is the focus of the WWF report

that was not the focus of the WWF report. there were two focusses. one was footprint *per capita* (and by country), not total footprint. the other focus was biodiversity.

the per capita assumption isn't about how much resources are being used, and for what. it's about how powerful individual people are, and how rich they are. it's opposed to effective, rich people, and gives better scores to nations stuffed to the brim with poor people. and it will do that even if the poor nation uses, in absolute terms, more footprint than its rich neighbors.

-- Elliot Temple

curi@curi.us

Dialogs

by [Elliot Temple](#) on Tue, 10/31/2006 - 19:33 | [reply](#)

Your ideology is showing

"it's opposed to effective, rich people, and gives better scores to nations stuffed to the brim with poor people."

Oh really? Look again. China has a similar footprint to the US. The point is not that China is a better environmental citizen. Any fool can look at the data and see that a country with a billion people that has the same footprint as a country with 300 million people is a serious problem now and will be an even more serious problem in the future. Where in the report does it state that China is somehow "better" than the US because their per capita score is lower? This is not an IQ test, it's a measure of the state of the environment.

"that was not the focus of the WWF report. there were two focusses. one was footprint *per capita* (and by country), not total footprint. the other focus was biodiversity."

Once again, we are using two different definitions of words here. Your use of the word "focus" is something that the report uses to analyze data. When I say focus, I'm talking about the general conclusion of the report. Perhaps my use of the word focus was in error. I apologize.

Also, note that the report analyzes consumption per capita, per region, per country, and by wealth.

Here's the conclusion, quoted from the foreward:

"The Living Planet Report 2006 confirms that we are using the planet's resources faster than they can be renewed – the latest data available (for 2003) indicate that humanity's Ecological Footprint, our impact upon the planet, has more than tripled since 1961. Our footprint now exceeds the world's ability to regenerate by about 25 per cent."

Pointing out that richer countries consume more is not the same as attacking the rich countries. The report is merely pointing out the basic facts.

Look, I don't want this to turn into a 'you're wrong no you're wrong' kind of debate. I think that the idea that economics are

fundamentally opposed to the environment is a bad idea for

economics and for the environment. I'd like this to be a discussion, not a political debate.

That said, if you can point out some kind of proof that the WWF has an ideological agenda, or that their science is seriously flawed, by all means, do so.

by [Will](#) on Tue, 10/31/2006 - 19:59 | [reply](#)

Science

I commented on their science above. It's the first comment.

-- Elliot Temple

curi@curi.us

[Dialogs](#)

by [Elliot Temple](#) on Tue, 10/31/2006 - 20:21 | [reply](#)

science

Do you have an alternative assessment? Because the WWF report also seems to be in line with accepted science on the state of the biosphere.

by [Will](#) on Tue, 10/31/2006 - 20:34 | [reply](#)

Re: Science

Whether the report reaches popular conclusions is irrelevant to whether they followed the scientific method.

I don't personally have an alternative, scientific conclusion. I haven't done any research.

The [Copenhagen Consensus Center](#) is investigating which environmental issues it is most effective to spend money fixing (what will benefit people the most, per dollar). Global warming is rated poorly. I haven't looked into their approach in depth, but I have read a lot of Lomborg's book (he's in charge of the Center) so I can speak for his thoughtful and careful approach.

-- Elliot Temple

curi@curi.us

[Dialogs](#)

by [Elliot Temple](#) on Tue, 10/31/2006 - 21:14 | [reply](#)

science?

I didn't say the conclusions were popular. I said they were in line with other scientific assessments of the biosphere.

There is ample evidence of species decline. If you want I will provide some links, but I'm confident you can find the information yourself.

As for Bjorn Lomborg, he's not a scientist, he's a statistician. I wrote a review on my own website of his book, read it [here](#). His book suggests that he has no clue about biology or ecology. He doesn't mention invasive species, for example, and his data on forest health starts from the 1950s, after most of the US had been logged.

I will say that I think his perspective is useful in looking at the interplay of environment and economics. But it is worthless for assessing the real state of the biosphere.

Anything else?

by [Will](#) on Tue, 10/31/2006 - 21:25 | [reply](#)

Re: Anything else?

Just to be clear: you still haven't defended the *methods* used by the WWF "scientists", only their conclusions.

If you'd like to concede they are no good, even as a thought experiment, we could discuss what that means for the report. If not, I'll wait.

-- Elliot Temple
curi@curi.us
Dialogs

by [Elliot Temple](#) on Tue, 10/31/2006 - 21:29 | [reply](#)

"You say that resources are n

"You say that resources are not consumed but produced. But the whole concept of ecological footprinting is based on quantifying the amount of land required to support a given person or nation."

Will,

The point is that nations with higher average GDP are far more able to utilize land efficiently (that is, need less land, for example to provide food for a given person). This occurs precisely because the technology is better. So technology both drives the relative size of the footprint of a country and the amount of food that can be produced from a given amount of land.

It makes no sense to "quantify the amount of land needed to support a given person..." and then quantify which people are taking more than their share.

The amount of land needed to support a person is not fixed. Essentially, the poorer nations are not utilizing their land efficiently, so this drives up the world-wide average amount of land needed to support a given person. If poor nations would develop economically, their efficiency in land use would increase, and therefore the world-wide average amount of land needed to support a person would decrease.

Therefore, if poor nations economically develop, each person

worldwide will need less than the cited "2.2" global hectares that is said to be required to support the demands he places on the environment (because more efficient land use usually places less demand on the environment, for a given amount of people). So helping poor countries to be economically vibrant, paradoxically decreases the relative "ecological footprint" of the United States.

"The Living Planet Report 2006 confirms that we are using the planet's resources faster than they can be renewed – the latest data available (for 2003) indicate that humanity's Ecological Footprint, our impact upon the planet, has more than tripled since 1961. Our footprint now exceeds the world's ability to regenerate by about 25 per cent."

This does not make sense. In free societies, we do not "consume" resources, rather in net we produce them. The elements needed to sustain life are virtually limitless throughout the universe. What is often scarce is our knowledge (and ethical behavior). As mentioned in a previous post, it is knowledge deficiencies alone that make energy scarce. If we grow virtually all of earth's food in space or on another planet, the 2.2 global hectares that is said to be needed to support the demands a person places on the (earth's) environment will shrink to close to nothing.

Our continued focus on economic growth via knowledge growth when coupled with ethical behavior will continue to make the world a more hospitable (and ecologically safe) place for humans.

by a reader on Tue, 10/31/2006 - 23:54 | [reply](#)

resources?

"The point is that nations with higher average GDP are far more able to utilize land efficiently (that is, need less land, for example to provide food for a given person)."

So if the richer nations are more efficient, then why do they also have a bigger footprint? Shouldn't China be considered more efficient since it supports a billion people with the same size footprint as the US?

We are comparing apples to oranges here. I've already said, GDP measures something totally different than ecological footprinting. There are resources and then there are resources. Ecological footprinting measures natural resources - air, land, water, lumber, food. Ecological footprinting does not measure the value of services, government spending, capital investments, ideas, entertainment, etcetera.

Now I'm not saying that technology can't aid in more efficient utilization of natural resources and thus give us a smaller footprint. I'm just saying that it hasn't.

by [Will](#) on Wed, 11/01/2006 - 04:50 | [reply](#)

Science?

Elliot,

I'll address the criticisms in your first comment below.

"You need to actually have enough valid data, of the right types, not fudge your numbers to represent what you guess the data would say if you had it. Guessing is less accurate, and less scientific, than using real numbers."

They do use real numbers. They have a pretty sophisticated and in depth analysis. What they do:

1. Identify the resources that require land area to produce. For example, charcoal, wood for construction, paper, firewood, etc. all are resources the use of which can be quantified. So are agricultural products. For CO₂, they calculate the amount of land that would be required to naturally absorb the emissions.
2. find out how much of those resources were consumed per country. Easy enough - look at various economic reports.
3. figure out how much land was required to produce the resources consumed.

Blammo! Instant ecological footprint. It's very straightforward actually.

Now for your next criticism:

"they said their data about biodiversity over-represented whatever species people liked to study. So they just counted those less. How much less? Well, something about dividing the world into regions which they assume to be equally important, and then assuming that the convenient already-collected data for each region really is representative."

Um, are they going to go into the field and collect data on every single species in each bioregion? Not with the funding they've got currently they won't. They use data that has already been collected and verified, and they track it over time. If they can they use multiple datasets. I've already pointed out that their conclusions jive with the accepted science.

"And people study vertebrates more than invertebrates. So how can they make conclusions about invertebrates, without nearly enough data? Easy. Just assume the trends for vertebrates apply."

Vertebrates have a much bigger impact on the environment than your typical invertebrate. They eat more, move faster, etc. If invertebrates are declining we have every reason to assume that biodiversity in general is in decline. The index uses data about nearly 1000 species (including invertebrates, by the way) and determined that their populations are in decline. That's bad news,

even if, say, Jellyfish and mosquito populations are on the rise.

For a closer look at the methodology: A download can be found [here](#) about the methodology of the 2005 report. Another is [here](#) about the methodology used in the 2000 report.

More information about the methodology behind the living planet index can be found [here](#), [pdf](#).

by [Will](#) on Wed, 11/01/2006 - 06:07 | [reply](#)

Science

" If invertebrates are declining we have every reason to assume that biodiversity in general is in decline. "

that is philosophy/argument, not scientific measure

you say they don't have the funding to study every species. ok. that's not my problem. they should only claim things they have the funding to research properly.

the already existing data is fine as data about individual species. but there way of combining it by regions to represent the whole world can't be said to be based on scientific measurement.

worse, they say things like they don't combine figures from different studies to get enough data points for a species, because it would not be valid. *but* if the two studies *intended* to be compatible, then they do combine them. intent is not science.

-- Elliot Temple
curi@curi.us

Dialogs

by [Elliot Temple](#) on Wed, 11/01/2006 - 07:50 | [reply](#)

Apples and Oranges are Both Fruit

"So if the richer nations are more efficient, why do they also have a bigger footprint? Shouldn't China be considered more efficient since it supports a billion people with the same size footprint as the United States?"

No, China is *creating* fewer resources per person than the United States. Or, said another way, China is "less efficiently" utilizing a virtually unlimited supply of natural resources.

"Ecological footprinting measures natural resources -- air, land, water, lumber, food."

You are assuming that natural resources, like the ones listed above, are somehow "used up" by nations like the United States. I have explained how, for example, energy and usable land can be created, indeed will be created, virtually without limit. It is precisely those countries creating a bigger "ecological footprint" per person which are making these resources more and more available. Since the

potential to access these "natural resources" exist without practical limit in the universe, the issue is who is able to create access to more and more of these available resources.

Those countries with higher average per capita income have higher incomes precisely because they are creating greater access to ultimately unlimited resource supplies.

What natural resource, essential for human happiness and survival (with the possible exception of ethical behavior) is not expected to be created in sufficient quantities to enable ultimately unlimited growth in human potential?

Resources are not lacking. Knowledge is. And knowledge is being created, for the most part, in advanced Western Industrialized countries.

What critical resource is really being "used up" or consumed, with no possible substitutes that will not be even better?

by a reader on Wed, 11/01/2006 - 12:59 | [reply](#)

science?

Elliot:

"that is philosophy/argument, not scientific measure"

Actually, it is science. The scientific method: formulate a hypothesis, gather data to support, perform experiments to verify. If the experiment/observation does not match the hypothesis, then formulate a new hypothesis. If it does, look for more data/experimental evidence to support.

I'll ask you again: can you provide an alternative assessment of the state of the biosphere that is scientifically credible? I don't consider Bjorn Lomborg to be credible for reasons I've already explained. Anyone else?

by [Will](#) on Wed, 11/01/2006 - 17:00 | [reply](#)

apples and oranges

"You are assuming that natural resources, like the ones listed above, are somehow "used up" by nations like the United States."

I'm not assuming it. It's been demonstrated and it's very simple. We are using up land to produce our food, houses, roads, fuel, etc.

You haven't really explained how land and resources can be created without limit (btw I detect a little Bucky Fuller in your language - have you been reading his stuff?). But even if it can, the question is not: 'can we create unlimited resources?' but rather 'are we using up our resources too quickly?'

If the earth was a business, we would have a budget. Since money

is not really a good way to measure the state of the environment, ecological footprinting is a new way to look at the planet's budget.

Now, if we were a business, and the land we have available to produce food, fuel, housing, paper, roads, bury garbage, etc. was our budget, then we are using up our budget 25% faster than we are replenishing it.

If we were a business in that situation, we would have to enact spending cuts or we would go out of business. It's that simple. If your position at work was costing a company 25% more than it was earning the company, then the company is going to look hard at eliminating your position, or cutting costs. It wouldn't matter if you said: 'But I can produce infinite wealth for you!' What matters is that you do or do not produce the wealth.

Again, I'm not denying that technology can lower a nation's footprint. I'm saying that it hasn't so far, in fact, it's done the opposite.

"What natural resource, essential for human happiness and survival (with the possible exception of ethical behavior) is not expected to be created in sufficient quantities to enable ultimately unlimited growth in human potential?"

The future won't necessarily be the end of all humans. But the environmental trends we can see all around us if we look indicate that the world is going to be harder to live in, and there will be massive human suffering. Do you want to eat jellyfish instead of fish? That's likely in the next 50 years. Would you like to see more poison ivy, kudzu, bush honeysuckle, and other invasive species instead of trees and flowers? We are almost certainly headed in that direction.

What about more insects and fewer birds? More crows and starlings and fewer warblers and woodpeckers? No maple syrup? More possums and raccoons and squirrels, fewer otters, wildcats, muskrats, and beavers?

What about watching whole nations die for lack of fresh water? That's coming. More sickness and death from air pollution? That's coming. More floods and mudslides because of logging and mining? Just wait.

What about no more wild rivers? No more pristine natural places? Think it's unlikely? Would you drink from any river within 20 miles of your home?

It really all depends on how you define happiness.

by [Will](#) on Wed, 11/01/2006 - 17:18 | [reply](#)

Something to think about

Bacteria and insects will adapt quickly to changing conditions because they have short life spans and reproduce in quantity.

What a wonderful future we face!

by **Will** on Wed, 11/01/2006 - 17:20 | [reply](#)

Re: Science

If [vertebrates] are declining we have every reason to assume that biodiversity in general is in decline.

that is philosophy/argument, not scientific measure

Actually, it is science. The scientific method: formulate a hypothesis, gather data to support, perform experiments to verify.

Which data gathered in the WWF report supports or verifies the statement that declining vertebrates implies general biodiversity decline?

-- Elliot Temple
curi@curi.us

Dialogs

by **Elliot Temple** on Wed, 11/01/2006 - 18:07 | [reply](#)

science?

There's no need to support it in the report. It is generally accepted as a measure of biodiversity.

by **Will** on Wed, 11/01/2006 - 18:09 | [reply](#)

science

Look at it this way: we can base our physics on theories of what electrons and atoms do despite having never actually seen an atom. We can state that light behaves as both a particle and a wave, and make predictions, without ever seeing the particles that make up light.

Inference happens all the time in science. We infer the size of stars by their magnitude and color, and from that we can also infer their lifespan and what elements they contain. We don't have to physically travel to a star to do that.

by **Will** on Wed, 11/01/2006 - 18:15 | [reply](#)

Re: Science

There's no need to support it in the report. It is generally accepted as a measure of biodiversity.

If that is so, shouldn't the WWF report say it is generally accepted, and cite a solid scientific study on the matter?

-- Elliot Temple

by **Elliot Temple** on Wed, 11/01/2006 - 19:26 | [reply](#)

science

If it truly is accepted, why bother?

by **Will** on Wed, 11/01/2006 - 20:46 | [reply](#)

Science

What the WWF report says is:

Plants and invertebrates were excluded, as few population time series data were available. It is assumed that trends in vertebrate populations are indicative of overall trends in global biodiversity.

If it is an accepted conclusion so solid that it doesn't need a citation, why did they call it an "assumption"? And why did they say the reason for this assumption was a lack of data (implying they would not have assumed it if more data was available)?

-- Elliot Temple
curi@curi.us
Dialogs

by **Elliot Temple** on Wed, 11/01/2006 - 21:07 | [reply](#)

assumptions and science

I don't know why they used the word assumption. At its heart, it is an assumption.

But it's not the same as assuming your iron is turned off without checking it. It's more like assuming that a star has certain elements in it because when you look at it through a spectroscope you see certain colors, and then from that assuming the lifespan of the star. Of course no one has ever monitored the entire lifespan of a star, but there is enough supporting evidence that you can make a reasonable guess and make predictions based on that guess.

With vertebrates, there are a lot of things that measure ecosystem health. Many large vertebrates require large areas of contiguous, undisturbed habitat. They require certain plants for food and habitat, certain types of soil that support their favored food, etc.

Put another way, it's like measuring the health of an economy by monitoring the number of rich people in the economy. Maybe not the best measure, but if it's all you've got there are still ways to get good information from it.

by **Will** on Wed, 11/01/2006 - 21:55 | [reply](#)

A Reader

Dear A Reader who wrote:

"What natural resource, essential for human happiness and survival (with the possible exception of ethical behavior) is not expected to be created in sufficient quantities to enable ultimately unlimited growth in human potential?"

I'm curious who you are :) If you're interested in talking, email me.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Wed, 11/01/2006 - 23:31 | [reply](#)

Science

Will,

What seems to be obvious is often false. That's why scientists very carefully document all their assumptions which seem obvious. And they consider each carefully. If someone else has already examined an assumption, that is fine, but they will reference the previous work they believe is sufficient. So even if the WWF was perfectly right to study the way they did, their report is lacking in scientific rigor.

But the exact proportions and relations between vertebrate and invertebrate biodiversity are not obvious, and not easy to quantify. So when the WWF assumes they are exactly proportional, that is making up numbers, and the results are therefore extremely restricted in applicability.

To make this more concrete, here are some factors they apparently did not consider:

- Animals eat plants. More vertebrates could mean less plants
- Why should there be proportional amounts of big animals and microscopic ones, which have very different habitat needs?
- The effect of humans on animal populations is very complex. For example, when animal populations get low, humans ruin trends by trying to save endangered species. And how hard they try depends on how much they like that animal.

-- Elliot Temple

Cur@curi.us

Dialogs

by **Elliot Temple** on Wed, 11/01/2006 - 23:46 | [reply](#)

More Apples and Oranges

"You are assuming that natural resources, like the ones listed

above, are somehow "used up" by nations like the United States."
Reader

"I'm not assuming it. It's been demonstrated and it's very simple.
We are using up land to produce our food, houses, roads, fuel, etc."
Will

If something essential was being depleted "to produce our food, our houses, our roads, fuel, etc." then the prices of these items (in aggregate) would be rising due to scarcity of resources. We can measure whether or not prices for essential items have in net increased by determining the amount of work that an average human being has to do in order to purchase items essential to life (food, housing, clothing, etc.)

Another way of measuring the availability of essential resources is to determine whether life-expectancy has increased or decreased. If life expectancy is decreasing, then indeed, some essential resource is being depleted.

As it turns out, human beings are having to work fewer and fewer hours to afford the essentials of living. Therefore these items are far more available to each person, even than 100 years ago. (The price of essential resources needed to live has fallen in terms of the amount of work needed to obtain them).

Even if a life-sustaining resource is plentiful now but will be gone rapidly because of an expected environmental catastrophe, say 25 years from now, futures markets would dramatically increase the price of this resource, at the present time. But this hasn't happened, either. The price of essential resources, as measured by the amount of work that a citizen of the planet has to do in order to survive, has fallen dramatically in human history, and continues to fall.

Life-expectancy is also increasing. Therefore the environment is (in net) more health-promoting and life-sustaining than it ever has been. If an "essential" resource were missing or scarce, human beings could not obtain it as readily, and so on average would be dying at an earlier age. But they are not.

The simple fact of increasing human well-being shows that life promoting resources are being created in greater and greater amounts, despite the odd suggestion that somehow we have less of them, or will soon have less of them.

"Now, if we were a business, and the land we have available to produce food, fuel, housing, paper, roads, bury garbage, etc. was our budget, then we are using up our budget 25% faster than we are replenishing it."

If a person spends more money than he takes in, then he goes in debt to someone. Precisely who are the citizens of the world in debt to, from an ecological perspective? If you say "our children", then why on average (worldwide) are our children progressively having to work fewer hours to meet their needs. That is, why are there more "essential resources" available to them for each hour that

they do work, or will work.

"But the environmental trends we can see all around us if we look indicate that the world is going to be harder to live in, and there will be massive human suffering...Do you want to eat jellyfish instead of fish? That's likely in the next 50 years."

How can you possibly know that humans will have to eat jellyfish? If the price of fish goes up, people will grow them on farms, as they already do. And why should I eat jellyfish? or fish? For ethical reasons, I am a vegetarian. I don't want animals to suffer.

"What about watching whole nations die for lack of fresh water? That's coming."

Only in a world full of virtually infinite quantities of water, can someone see scarcity. I have no doubt that nations can dehydrate themselves to death. But the major factor that prevents people from drinking adequate amounts of water is repressive political organization, not inadequate amounts of water. People **want** to drink. Free market organization and the absence of war has provided and will continue to provide virtually unlimited quantities of clean water to those who value freedom enough to allow people to work for what they want. Water purification and desalinization efforts allow millions of people the world over to drink abundant quantities of fresh water.

"Would you drink from any river within 20 miles of your home?"

Yes, utilizing my water purifier. A more interesting question is whether I would have been as healthy drinking river water 200 years ago. Unfortunately, because of parasitic infection (e.g. Giardia), I think not.

by a reader on Thu, 11/02/2006 - 01:07 | [reply](#)

Astrophysics

Will wrote:

We infer the size of stars by their magnitude and color, and from that we can also infer their lifespan and what elements they contain. We don't have to physically travel to a star to do that. [...]

It's more like assuming that a star has certain elements in it because when you look at it through a spectroscope you see certain colors, and then from that assuming the lifespan of the star. Of course no one has ever monitored the entire lifespan of a star, but there is enough supporting evidence that you can make a reasonable guess and make predictions based on that guess.

But there's a vital difference.

It's impossible to infer things from observation alone. All the

'inferences' you mention in astrophysics are made from the observations *plus a universal theory*, which contains a substantive explanation, unrivalled and independently corroborated, of why the inferences should be true. When we aren't able to apply such a theory to interpret an astronomical observation, for whatever reason, we cannot make inferences of that kind; indeed, whenever there's even the slightest wiggle-room, working out what's happening, even approximately, becomes very hit-and-miss.

by [David Deutsch](#) on Thu, 11/02/2006 - 01:11 | [reply](#)

Astrophysics vs. ecology

I wasn't so much trying to say that the examples I gave about stars were guesses or assumptions. I was trying to point out that there are other supporting strands of evidence in the study of ecology, enough so that we can draw inferences from basic trends.

by [Will](#) on Thu, 11/02/2006 - 04:25 | [reply](#)

scientific rigor

Elliot:

"their report is lacking in scientific rigor."

"the exact proportions and relations between vertebrate and invertebrate biodiversity are not obvious, and not easy to quantify. So when the WWF assumes they are exactly proportional, that is making up numbers, and the results are therefore extremely restricted in applicability."

The WWF doesn't assume them to be exactly proportional. They don't have to be exactly proportional, either, to be a problem. Some animals will prosper, some will perish. Of course, which will prosper? Microorganisms that cause disease? Insects that carry disease? Scavenger animals that will further damage ecosystems?

Here is a direct quote from the paper "The Living Planet Index: using species population time series to track trends in biodiversity" by Loh et al. Google scholar it if you want to read more about the methodology used in the 2006 report.

The index is currently based on nearly 3000 population time series for over 1100 species. All species in the index are vertebrates. (p. 1)

The LPI indicates that populations of wild species of vertebrates have declined overall from 1970 to 2000. The extent to which this is a reflection of trends in global biodiversity as a whole has not been determined. In situations where habitat loss is the primary cause of population declines, it is reasonable to assume that there is a positive correlation between declines in vertebrate and non-vertebrate populations. Where hunting, fishing or indirect exploitation is the cause of

a decline in a particular vertebrate species, the decline will not necessarily be indicative of population trends in other species in the same ecosystem. At large scales of entire realms, oceans, regions or biomes, overall declines in vertebrate populations are significant in their own right and may also be seen as indicative of changes in underlying ecosystem processes(p. 5-6).

The WWF report is not intended to be a comprehensive report of the state of the biosphere. It examines the ecological footprint of humanity and a general index of the state of the planet. There are many other sources that support the conclusion of the Living Planet Index that world ecosystems are in trouble.

by [Will](#) on Thu, 11/02/2006 - 04:57 | [reply](#)

apples and oranges?

"in order to *purchase* items essential to life"

"human being are having to *work* fewer and fewer hours to afford the essentials of living."

Are they? All over the world? In sweatshops in the third world? Are hunter gatherers who have been 'globalized' working less than the four hours a day their old lifestyle required? Are you really looking at the whole picture of humanity or only at the wealthy nations?

"If something essential was being depleted "to produce our food, our houses, our roads, fuel, etc." then the prices of these items (in aggregate) would be rising due to scarcity of resources."

Not so. We in the rich nations don't see the scarcity because we import much of our resources. It's not evident here because our wealth insulates us. It is becoming more evident around the globe. This is what the report is talking about when it calls the US an ecological debtor nation. We just haven't run out of credit yet.

"Even if a life-sustaining resource is plentiful now but will be gone rapidly because of an expected environmental catastrophe, say 25 years from now, futures markets would dramatically increase the price of this resource, at the present time."

That's an assumption, not a fact. Just one example: What about a blight that spreads rapidly because of monocultural agriculture and wipes out a crop?

"Precisely who are the citizens of the world in debt to, from an ecological perspective?"

The wealthy nations are currently in debt to the poor nations with still abundant ecological wealth - but the poor nations lack the power to collect, so in the long run we will be in debt to our children.

"If you say "our children", then why on average (worldwide) are our

children progressively *having to work* fewer hours to meet their needs?"

See above, and also note that you can't predict the future. Our children may or may not be working fewer hours to meet their needs 5 or 10 or 30 years down the road.

"Free market organization and the absence of war has provided and will continue to provide virtually unlimited quantities of clean water to those who value freedom enough to *allow people to work* for what they want."

Actually nature provided the abundant clean water. Wealth, not free markets, determines who will get the clean water in the future. I bet you pay for your water right now, actually.

"A more interesting question is whether I would have been as healthy drinking river water 200 years ago. Unfortunately, because of parasitic infection (e.g. Giardia), I think not."

200 years ago, you would have been adapted to the local parasites.

Notice that I highlighted a few things in your statements. I think it is very interesting that you make your assumptions based on work and economics.

Here's something for you to consider.

400 years ago, when Europeans first came to America, wildlife was stunningly abundant. It was said that a man couldn't dip an oar in a river without hitting a fish. Trees, some of them 20 feet in diameter, covered the eastern half of the country. A squirrel could go from Georgia to New York, hopping from Chestnut tree to Chestnut tree and never touch the ground. The chestnut trees produced 6000 nuts each per year. A man could point a blunderbuss into a flock of birds at random and be almost guaranteed to bring one down. Flocks of passenger pigeons darkened the sky for *days* as they passed overhead. In the Pacific Northwest, you could dunk a basket into a river and pull up enough Salmon for your family to eat.

Nowadays, we consider ourselves lucky to be "allowed to work".

by [Will](#) on Thu, 11/02/2006 - 05:31 | [reply](#)

"200 years ago, you would hav

"200 years ago, you would have been adapted to the local parasites"

Surely health was much worse in 1806 than now?

by a reader on Thu, 11/02/2006 - 09:23 | [reply](#)

200 years ago

Depends on where you lived. Indigenous people in Australia

currently live an average of 57 years, shorter than the average Australian. But there are other measures of health besides lifespan, and the lifeways and environment of the Aborigines have changed considerably because of the white folks.

So how healthy were people back then to relative to today? For a European or American, almost definitely worse. For others? Who knows?

Life existed on this planet for millions of years without water treatment technology.

by [Will](#) on Thu, 11/02/2006 - 13:38 | [reply](#)

Something interesting

This study came out as we were having this discussion.

Global Map Shows New Patterns of Extinction Risk

It is interesting because it shows that a high density of endangered species from one group (birds or mammals or fish, for example) doesn't necessarily mean that species from other groups in the area are endangered. In other words, if birds are endangered in one area, land mammals might be doing just fine.

It is only tangentially related to our current discussion, but it can provide some context for looking at biodiversity. Note that this study examines the concentrations of endangered species per area, while the Living Planet Index examines overall population trends in vertebrates worldwide.

It is relevant because it illustrates how one assumption about ecology have been turned on its ear: the idea that one species can be an indicator for all is demonstrated to be a bit more complex by this study.

Of course, a decline in, for example, bird populations, even if mammals seem to be doing fine in the same area, is still a problem. Birds prey on caterpillars and insects which can destroy trees. They spread seeds and nutrients as they travel. Some of them provide prey for other species, etc. which is why a study that shows a general decline in vertebrate species worldwide is cause for alarm.

by [Will](#) on Thu, 11/02/2006 - 14:59 | [reply](#)

ocean biodiversity, jellyfish, rich nations, and weeds.

A **new study published in Science** (subscription only, but you can read the abstract. Try a university library for a copy) suggests fish species will be gone in 50 years if trends don't change, and outlines the problems for the ocean and man if biodiversity continues to collapse.

Also, richer nations are depleting the fisheries of poorer nations:

Brashares, Justin S., Peter Arcese, Moses K. Sam, Peter B.

Coppolillo, A. R. E. Sinclair, and Andrew Balmford. "Bushmeat Hunting, Wildlife Declines, and Fish Supply in West Africa." *Science*. Vol 306, Issue 5699, 1180-1183 , 12 November 2004

Kaczynski, Vlad and David Fluharty. "European policies in West Africa: who benefits from fisheries agreements?" *Marine Policy*. 26. 2003.

Alder, Jacqueline and Ussif Sumaila. "Western Africa: A Fish Basket of Europe Past and Present." *Journal of Environment & Development*. 2 June 2004.

A glimpse at our future:

About eating jellyfish in the future.

Planet of Weeds

by **Will** on Fri, 11/03/2006 - 02:36 | [reply](#)

Plentiful Food in the Past?

http://en.wikipedia.org/wiki/Jamestown%2C_Virginia

the winter of 1609-1610 at Jamestown became known as the "starving time" as the settlers faced starvation, and scheduled supply ships were delayed by weather. ... The colonists had not planned to grow their own food. Instead, they expected that trade with the locals would supply them with enough food between supply ships. But new evidence suggests that the Native Americans had very little food to start with.

Apparently getting food was not as easy as dipping a bucket in a river, or picking nuts. It was hard enough that a lot of people died.

And it wasn't just the white people who had trouble. The Native Americans, who had had many generations to figure out how to get food, themselves had very little.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Fri, 11/03/2006 - 04:33 | [reply](#)

food at jamestown

Good point.

1. The colonists were from one England, hated and feared the American wilderness, and had very little idea how to survive in it. And they had no plans to grow their own food.

2. I'd like to see the 'new evidence.' Perhaps there were some local changes that led to scarcity in the area? Diseases brought by the colonists?

Of course, food was not always plentiful everywhere all over the world before evil white folks came and destroyed everything. But there was a general abundance, naturally. That abundance is what let us survive and evolve as a species. Now, in many places, that abundance is gone, or disappearing.

There are theories that scarcity led to the adoption of agriculture. If that is the case, then humans had to have encountered areas of scarcity, or they never would have adopted that more labor intensive lifestyle.

by **Will** on Fri, 11/03/2006 - 15:06 | [reply](#)

Consuming vs. Creating Resources

Will wrote:

I'm not assuming it. It's been demonstrated and it's very simple. We are using up land to produce our food, houses, roads, fuel, etc.

And what happens to our food, houses, roads and fuel when they are produced using land? They do not vanish into thin air. They are also used for some purpose. For instance a road, fuel, etc. may be used to bring fertilizer to a farm where an already "used" land is used a second time to produce more food. The complex web of all such activities makes up our economy, and when that economy is free, the net result is that the increasingly efficient use of land due the growth of knowledge makes the "consumption model" of resources irrelevant. I agree with "a reader" that the essential resource necessary for sustaining a free economy is effectively *created* by the same economy. The name of that resource is *knowledge*.

-- Cyrus Ferdowsi, <http://libiran.blogspot.com>

by **Liberal Iranian** on Mon, 11/06/2006 - 07:57 | [reply](#)

producing resources?

Can you quantify this? Can you demonstrate that knowledge actually makes us more efficient in using land? If so, why is it that the richer and more technologically advanced countries use more land than the poor countries?

This study is a snapshot. One way to test your idea would be to examine trends over time, perhaps comparing economy trends with footprint trends. In that case, you might see some kind of trend that technology is making life more sustainable. But the evidence seems to show otherwise.

With a little thought maybe we can turn that trend around.

by **Will** on Mon, 11/06/2006 - 15:00 | [reply](#)

Re: producing resources?

Will wrote:

why is it that the richer and more technologically advanced countries use more land than the poor countries?

Could you be specific about what you mean by this? Taken literally, it says that the technologically advanced countries have a greater combined area than the other countries, but if you look at an atlas you will see that that is not true. The argument here seems to be about efficiency, so perhaps you mean that. Efficiency is always defined as a ratio: some measure of benefit per unit usage of a resource. So if you are referring to efficiency, you must mean that some benefit per unit area of land is less in technologically advanced countries than in others (and less now in the US than it was at the time when the inhabitants were hunter gatherers?). What measure of benefit are you referring to? Presumably not GDP? Or population? What is it?

by [Editor](#) on Mon, 11/06/2006 - 15:24 | [reply](#)

producing resources

why is it that the richer and more technologically advanced countries use more land than the poor countries?

I'm talking about the footprint of the richer countries. The footprint is the amount of land used to produce the resources that a country consumes.

I was responding to Cyrus' comment that:

when... economy is free, the net result is that the increasingly efficient use of land due the growth of knowledge makes the "consumption model" of resources irrelevant.

My challenge to him is: how do you prove that land is being used more efficiently? If it is being used more efficiently, why is it that richer nations have a bigger footprint than other nations?

by [Will](#) on Mon, 11/06/2006 - 16:35 | [reply](#)

a difference in perspective

We keep coming back to the same point, so I'm going to try to restate the problem as each side sees it.

I take the WWF's view that the earth's renewable resources are being used faster than they are being replenished. I believe that this will be disastrous down the road.

You (I'm speaking to everyone else here) seem to believe that

wealth is beneficial in its own right and with market freedom it will fix our environmental problems on its own. For that reason, countries that use more of the world's resources should be forgiven, because they also tend to produce more wealth and everything will even itself up down the road.

Is this a correct restatement of your arguments?

by **Will** on Mon, 11/06/2006 - 16:42 | [reply](#)

GDP/land

Will,

Your last comment is not a correct statement of *my* argument. I do not take the view that *wealth* will solve the problems, but *knowledge*. There is a causal link between the growth of knowledge and the generation of wealth, but it is important to emphasize the actual source of solutions.

About your challenge: land is being used more efficiently in the free industrialized countries because it generates more (a lot more) wealth. That is, the ratio of GDP/land is much bigger there. This is the measure of efficiency of land use and the essence of **The World's** post. This is also my answer to the Editor's question to you in their last comment.

-- Cyrus Ferdowsi, <http://libiran.blogspot.com>

by **Liberal Iranian** on Mon, 11/06/2006 - 18:27 | [reply](#)

GDP vs. land use

Cyrus,

Can you demonstrate a clear connection between increasing knowledge and increased efficiency of land use? Because when I look at the data provided by the WWF I see that the richer countries use more land (have a bigger footprint) than poor countries.

If wealth indicated efficient land use, then why is this so? Why aren't the poorer countries using more land and the richer countries less?

I've said it before but I'll say it again: GDP has a lot of irrelevant information included if you want to compare it to footprint. For example: how does buying a ticket to a concert increase sustainability? What about getting in a car wreck and going to the hospital, which increases GDP? What about all the money that is spent on television programs and advertising, purely for the sake of entertainment and marketing? How do these things increase the efficiency with which we use natural resources on the planet? These things all contribute to the GDP.

by **Will** on Mon, 11/06/2006 - 19:19 | [reply](#)

Footprints

The footprints are not amount of land, they are supposed to be, roughly, amount of pollution. Half the footprints are CO2; the amount of CO2 created doesn't necessarily have much to do with amount of land used.

Additionally they are footprints *per person*. So even if they could be counted as land *per person* you'd still have to multiply by population sizes to see who used the most land.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Mon, 11/06/2006 - 19:33 | [reply](#)

Footprint Per GDP

If wealth indicated efficient land use, then why is this so? Why aren't the poorer countries using more land and the richer countries less?

It is so. That's what the original post showed. It calculated footprint per GDP. The rich countries produce more stuff per unit footprint.

You're free to deny that rich countries produce *useful* stuff, but that is not the same issue as efficiency of production.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Mon, 11/06/2006 - 19:36 | [reply](#)

GDP

What about getting in a car wreck and going to the hospital, which increases GDP?

That *decreases* GDP. It is known as the broken-window fallacy.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Mon, 11/06/2006 - 19:42 | [reply](#)

broken windows

What about getting in a car wreck and going to the hospital, which increases GDP?

That *decreases* GDP. It is known as the broken-window fallacy.

Alright, I won't debate you about that. What about my other

examples? What about money spent on video games and pornography? What about the millions of tons of paper used to print magazines and newspapers? Etc.

by [Will](#) on Mon, 11/06/2006 - 20:07 | [reply](#)

footprints

"The footprints are not amount of land, they are supposed to be, roughly, amount of pollution."

Actually, it *is* the amount of land required to sustain the level of consumption. Reread the papers I linked to. They totaled the amount of resources (lumber, paper, food, fuel, etc.) consumed per country, calculated the amount of land used to produce those resources, and that's the footprint.

Amount of CO2 is also turned into land use, although there is some wiggle room here. They calculated the amount of land that would be required to absorb the CO2 produced and got an acreage which is added to the footprint.

by [Will](#) on Mon, 11/06/2006 - 20:15 | [reply](#)

gdp vs. footprint

If wealth indicated efficient land use, then why is this so? Why aren't the poorer countries using more land and the richer countries less?

It is so. That's what the original post showed. It calculated footprint per GDP. The rich countries produce more stuff per unit footprint.

You're free to deny that rich countries produce **useful** stuff, but that is not the same issue as efficiency of production.

I'm not denying that wealth, knowledge, etc. are useful. And I'm not arguing about efficiency of production.

I'm arguing about efficiency of land use.

It doesn't really matter how much 'wealth' or 'knowledge' you can produce from an acre of land if you use that land up faster than it can replenish itself.

by [Will](#) on Mon, 11/06/2006 - 20:22 | [reply](#)

Video games and other measures

Will,

The money and time spent on video games is generated by and is part of the same economy as a whole. The teenager in the US who spends his parents' money on a video game gains from that in many different ways. His imaginative power and mental ability as

an adult is affected by the video games he played as a teenager. He usually grows up to be a productive member of the US economy, contributing to the staggering GDP of the US compared to developing countries. The teenager in a developing country is more than happy to be able to spend the same money on a video game. Not having enough cash, he has to spend other types of money (time, education, etc.) to buy similar products. He has limited choice and ends up spending more than the cash equivalent that his American peer spends. This reflects and contributes to the fact that the economy he is part of is less efficient, mostly due to restrictive practices, at providing his needs.

If you insist that GDP is not a good measure of the knowledge that generates it, you should suggest some other measures of knowledge to normalize the footprint/land use. For example, one may choose to count the number of research papers in some or all fields of sciences. This number is not as comprehensive as GDP because it does not contain the plethora of non-research knowledge on which the efficiency of the economy depends. It is affected by some extraneous factors, such as the size of the society and the focus of its economy. But I am guessing the results would be, within limitations, more or less the same as GDP.

-- Cyrus Ferdowsi, <http://libiran.blogspot.com>

by **Liberal Iranian** on Mon, 11/06/2006 - 22:02 | [reply](#)

Knowledge from land

Will wrote

It doesn't really matter how much 'wealth' or 'knowledge' you can produce from an acre of land if you use that land up faster than it can replenish itself.

What if you produce the knowledge that allows you to replenish the land faster than it currently does itself?

-- Cyrus Ferdowsi, <http://libiran.blogspot.com>

by **Liberal Iranian** on Mon, 11/06/2006 - 22:05 | [reply](#)

Will's Argument

Will, maybe I can help you with your argument, although I disagree with it.

You must be saying that although wealthier countries are currently producing more goods and products per unit land area than they ever have before, there are long term side-effects associated with enjoying all this wealth, now. In producing all these goods and services that Westerners want at the present time, Western nations are producing toxins, for example greenhouse gasses.

The "footprint" of the United States is "too big", meaning we are

creating more toxic byproducts than we are recycling in our national land area. So we are using up more than our fair share of the overall ecological recycling capacity of the world. Worse, the world as a whole is creating more toxic byproducts than the world's natural ecological processes can recycle. Therefore, toxic compounds are building up. Right now, efficiency in economic production is not being compromised, because levels of toxic compounds (like CO₂) are not so high as to adversely affect productivity very much. For example, temperatures have not risen high enough from greenhouse gasses to degrade farming capacity. Furthermore, gains in knowledge have increased economic productivity per land area probably faster than coincident toxic waist increases have degraded that efficiency. That's why "a reader" can argue that efficiency gains continue to rise. But a worldwide ecological footprint larger than the current land area of the entire world must be a harbinger of our eventual inability to sustain the efficiencies we are currently enjoying in the Western world.

Why? A hectare of land can only be made to produce more of a product, for example food, up to a certain point. We must eventually work harder to get more output from the same input (land). There must eventually be diminishing returns. Isn't that a law of economics? But toxic products can build up virtually indefinitely. Therefore, although economic efficiency is high and currently growing, it will eventually plateau, and then fall, as it eventually succumbs to the ultimately finite productive capacity of the earth – made increasingly less by the relentless build-up of toxic waste, greenhouse gasses, and general ecological destruction.

Therefore, although we are relatively comfortable now in the Western world, we must conserve our natural resources immediately, to prevent catastrophe in the long-term.

Will,
Is that a reasonable summary of your position?

by a reader on Tue, 11/07/2006 - 00:44 | [reply](#)

resources and knowledge

What if you produce the knowledge that allows you to replenish the land faster than it currently does itself?

I understand the drift of your argument: wealth creates knowledge, resources, and technology.

That would be great but based on the evidence I have I don't see that happening. Can you provide me with solid evidence that a. wealthier countries use land more efficiently than poor countries, and explain to me why, if a is true, b. rich countries all have a bigger footprint than poor countries?

by Will on Tue, 11/07/2006 - 15:30 | [reply](#)

Will's argument

You have restated the basic drift of my argument. But you put a

little too much emphasis on 'toxics'.

The issue goes far beyond toxic pollution. The ecological footprint, for example, shows that we are using too much land. Wild habitat is destroyed daily, on land and in the seas. Where original habitats have been destroyed, invasive species move in, making it difficult or impossible for the local ecosystem to recover.

Then you have the issue of global warming compounding the problem. We have already seen that spring is coming earlier - this throws off prey/predator relationships when predators use different markers (length of days) than the prey (seasonal warmth) to start mating. So you get predators looking for prey whose population has already peaked (google 'pied flycatcher global warming'). The change in seasonal timing also throws off birds and insects that pollinate as plants bloom earlier - this can affect commercial agriculture and thus humans directly.

So it's not just about pollution, although pollution is a problem.

by **Will** on Tue, 11/07/2006 - 15:59 | [reply](#)

going in circles?

It seems to me that we are going in circles with Will. So I repeat my take on the issue: it is knowledge (of many sorts and in huge amounts) that solves problems, not wealth or technology per se. These are themselves the results of the growth of knowledge. If by using a land you create the knowledge of how to replenish it, you have no such thing as the problem of "using up" the land.

Can you provide me with solid evidence that a. wealthier countries use land more efficiently than poor countries, and explain to me why, if a is true, b. rich countries all have a bigger footprint than poor countries?

Answers to both questions have been given in the post and previous comments. But, for the sake of clarity: how do you define the efficiency of land use, Will?

-- Cyrus Ferdowsi, <http://libiran.blogspot.com>

by **Liberal Iranian** on Tue, 11/07/2006 - 18:45 | [reply](#)

arguing in circles

I define ecological efficiency (efficiency of land use) as the amount of land required to support a person. This is the same measure as that used by the WWF.

AT the core, it seems to me that I am talking about ecology and you all are talking about economy.

Here is the problem with your position. The ecological footprint measure used by the WWF states quite clearly that a. on average, a person in the so called developed world requires more land to support their lifestyle than a person in the 'developing' world.

Furthermore, the report states that b. the earth's resources are being used up too fast.

You have consistently argued that because the developed world produces stuff, we shouldn't worry about b. the fact that the earth's resources are being used up faster than they can be replenished.

You are in effect waving your hand to make the problem go away. Just because we produce some vague 'knowledge' doesn't mean that we aren't using the planet up. The knowledge that we need to produce to slow down the consumption and reduce our footprints is not being produced by the wealthy countries - or if it is, it is not reflected in the WWF report and you have not provided hard data to prove that it is so. (If you can present hard data, rather than just a general argument, please do so).

Calculating footprint per GDP, then, is only marginally useful, and effectively avoids the real, serious, glaring issues pointed out in the report: a. Rich people use more and b. we are using the world up faster than it can replenish.

That is the substance of my argument, and despite your (everyone I have engaged with so far) presenting various vague generalities (wealth produces knowledge and stuff), you have not convincingly demonstrated to me how footprint per GDP is anything more than marginally useful for assessing and dealing with issues a and b.

Perhaps a better way to use GDP to assess ecological efficiency would be to compare the footprints of nations with comparable GDPs - perhaps the top twenty or thirty richest nations. Then you would have an idea of which nations are better at producing wealth per dollar from a particular amount of land, and you would have an idea of which developed societies should be emulated. I have a feeling that Britain and the US would fare poorly on such a comparison.

I would like for us to be able understand each other at least. I have had a feeling throughout this thread that my opponents aren't fully grasping what I am saying. I'm sure you feel the same about me. My apologies.

by [Will](#) on Tue, 11/07/2006 - 22:22 | [reply](#)

Trying to reach some understanding

Will:

I think we agree on this:

The footprint of an entity (nation, person, amount of wealth, etc) is defined as the amount of land needed, at the present state of technology, to sustainably produce the resources being used by that country or person, or to create that wealth.

What I think we may disagree on is this: The footprint, thus defined, is not a constant area, but changes with time.

Let's not get hung up on why it changes; but I guess you'll want

evidence that it does change. OK. For example, in 1800, the population of the world was below 1 billion, and the economist Thomas Malthus calculated that even considering agriculture alone, and ignoring other uses of resources, it could support only about twice that at the average standard of living for 1800. In other words, the total world footprint then was 0.5 (Earth areas). Since then, the population has increased about sevenfold and the resource usage -- well, I don't know what figures you'd want me to take, but at the most conservative estimate it has to have increased at least 20-fold. So by Malthus' measure of footprint, the current footprint has now increased to at least 20 -- or correcting that for carbon dioxide, to at least 40. Yet in reality it has increased to only 1.3.

Similarly, in 1970, the environmentalist Paul Ehrlich calculated that the Earth could sustainably support, at the average standard of living at the time, slightly fewer people than were alive at the time - - in other words, the footprint then was slightly above 1. And Ehrlich, too, wasn't counting carbon dioxide. Had he known of its harmful effects, he would have calculated the footprint at closer to 2.

Since then, world resource usage has again increased greatly. Hence by Ehrlich's measure of footprint, the Earth's total footprint has now increased to -- what? -- at least 4, say. Yet it has actually fallen to 1.3.

Hence, isn't it misleading for you to use the terms "footprint" and "land use" or "resource use" interchangeably? For the conversion factor between footprint and land area is not constant.

by [David Deutsch](#) on Wed, 11/08/2006 - 01:46 | [reply](#)

Numbers

Will asks how economic efficiency can increase (more product per land area) while ecological "efficiency" decreases (presumably amount of natural resources for the next generation to use divided by the amount of natural resources for this generation to use).

Imagine that a company in the United States manufactures a computer. A certain amount of labor and effort went into making that computer. We trade that computer for a certain amount of oil from Saudi Arabia.

A few years later, knowledge increases, so we are now able to build a more powerful computer, without having to work any harder. Because the computer is more powerful, the Saudi's are willing to give us more oil per computer, because they like the more powerful computer better. So we can now say that the United States is more economically efficient. We have worked no more hours, but are now able to import more oil, because we can trade a more powerful computer to the Saudis.

But the land area of the United States has not increased. Therefore

from an economic perspective, we are using our land more efficiently. We are working the same amount of hours on our land, and importing more oil. And with more oil, we can produce even more goods because of the extra energy we have. Economic efficiency of land use has thus increased in the United States.

Now let's look at it from Will's ecological perspective. There is a finite amount of oil in the ground the world over. By making a better computer, we are taking *more* of a finite supply of oil out of the ground. So now our descendants have fewer natural resources (less oil). And the more efficient we become (better and better production of computers) the more the Saudis take oil out of the ground for us to use, but not for our descendants to use. So the ratio of resources available to our descendants divided by resources available to us has decreased. Ecological efficiency has decreased.

According to Will, the earth is only able to generate ("replenish") energy for us at a certain mostly fixed rate per land area. It will take, for example, millions of years for enough animals to die and geological conditions to be right to transform dead animals into oil and replenish the oil supply for our future. If we exceed a certain rate of use of energy, it would take much more available land (a bigger planet) for the earth to replenish the energy supply that we are currently taking from the earth per unit time.

So we require a bigger planet to satisfy our hunger, for example, for energy. But we don't have a bigger planet, so we are using up more land resources (energy recycling capacity) per time than we are putting back into the earth. Our ecological "footprint" is too big. Indeed, the more economically efficient the United States becomes (getting more oil per unit work because of making better computers) the larger the ecological footprint of the United States, because we can use up more of the earth's natural resources per time.

This is why Western nations have the largest ecological footprints and also the highest economic efficiency per land area (for now, anyway). Increasing knowledge increases the efficiency by which Western nations can produce goods that other people want. These other nations (or their dictators) trade their natural resources to the United States in exchange for the trinkets (like computers) that we give them. The more efficient we are at making trinkets (because of our increasing knowledge), the more efficiently we rape the land of developing nations, enjoying short-term benefit, but causing long-term catastrophe.

Knowledge allows people to make things which other people want. Others then are willing to use up natural resources to get those goods created because of knowledge. This is why hunter-gatherer societies did better than we do. Will says hunter-gatherers did not have to work so hard to support themselves. Fifty-thousand years ago, hunter gatherers *knew less*. This ignorance prevented them from harvesting natural resources at too rapid a pace. They could not deplete their environment. So these noble savages, and their children (as long as they also kept them in ignorance) could continually pass to the next generation, a world continually and

renewably rich in natural resources, for everyone to enjoy.

Knowledge, far from helping humanity, actually has been the means by which humanity was and is destroying itself.

But it is possible for us to learn from this, before it is too late.

If instead of selling the Saudis a computer, we had sold them many solar panels in exchange for oil, the ecological balance sheet would be different. Those solar panels would utilize land, for example, because they would have to be physically placed somewhere on earth. But in doing that, we would be increasing the rate that the earth produces energy for us. We would be using knowledge to help, rather than hurt, us. If we traded the Saudis enough solar panels, the energy that we would be creating from the sun could more than match the energy depleted by taking oil from the ground. If we also planted numerous trees, these could ingest the carbon dioxide produced from burning the oil, so we would not be overtaxing the earth's natural ability to absorb carbon dioxide. Alternatively, we could simply use less oil and more solar energy to begin with. Then we would not be using up more energy per time than the natural energy-creating capacity of the land. If we are not using up resources faster than the world wide land area is naturally (and via technology) recreating resources, our worldwide "footprint" would not be larger than the area of the earth, itself.

So as illustrated above, economies can utilize land more efficiently (at least in the short-term) from an economic perspective, while the ecological balance sheet tells a different story. But according to Will, we should follow the ecological (not the economic) balance sheet, because eventually there will be a reckoning. If we continue to use up energy resources, for example, faster than the geographical area of the earth can naturally replenish those resources, eventually energy will run short, prices will rise, and economic efficiency will fall -- just as ecological efficiency has already fallen.

My counter argument to Will was that if his theory were really correct, we should see, now, price increases for energy resources, for example in future's markets. If efficiency will eventually fall because of a world-wide shortage of resources relative to demand, prices will rise. People will try to stockpile resources.

But we don't see that. Why? Because "natural" resources have *substitues*. The issue is not whether oil resources will be used up, but rather whether *energy resources* will be used up. Citizens of the world are "voting with their feet". That's why prices for most resources are not rising. People are betting that increasing knowledge will continue to incrementally create more new resources per unit land area, than that same knowledge destroys resources per unit land area. Resources created by "learning something" divided by resources consumed by learning the same "something" is a measure of whether one is an optimist or a pessimist. A ratio greater than one means you are an optimist. Most of the readers of the World, as you can tell, are optimists!

"each person needs 2.2 global hectares to support the demands

they place on the environment, but the planet is only able to meet consumption levels of 1.8 global hectares per person"

Consider the ratio 2.2/1.8. Will, if you are right about the future of our world, eventually we will use up our natural resources and economic efficiency will fall dramatically. For example, the oil will be used up so we won't be able to take (and burn) as much oil per unit time. Therefore our ability to place "demands" on the environment will fall. Therefore the top number (2.2) will fall.

But the bottom number (1.8) will fall, as well, given your doomsday scenario. If knowledge decreases (not likely) or if the environment becomes polluted or more hostile, the environment will be less able to meet (recycle) consumption levels of 1.8 hectares per person.

The future you are predicting (lower levels of the top number and lower levels of the bottom number) is, by the way, exactly the condition of the numbers that hunter-gatherers experienced, if their "scientists" had calculated such a number. Hunter gatherers took fewer resources from the environment (top number) per time. But the ability of their environment to recycle the resources *THEY NEEDED* (bottom number) was less as well. For example, if there were too many people per unit area, the number of animals was not sufficient to hunt and eat. That's why the population density of hunter gatherers had to be so low.

By the way, it is very likely that for hunter-gatherers, their top number was also higher than their bottom number. The migration of hunter-gatherers from the probable evolutionary origin of humans in Africa, North through Europe and Russia and then across the Bering Strait into the New World probably occurred because of a shortage of animals. Vast remains of dead animals over the edges of cliffs suggests that hunter gatherers did not "conserve" animals, but indeed drove entire herds off of cliffs. They therefore created a scarcity of animals. For the hunter gatherers to survive, they had to continually migrate north to follow the dwindling animal herds that they were destroying. Finally, hunter-gatherers arrived in the new world.

The original "conservers" of resources important to humans, were the agricultural societies that evolved in the wake of the migration of the hunter gatherers. They protected private property, to prevent the over-hunting of the land by hunter-gatherers. Thus the city-state came into being in the fertile crescent, as a response to the over-exploitation of nature by hunter-gatherers.

The above is the theory of the economic historian Douglas North (Structure and Change in Economic History). He won the Nobel Prize partially because of this work.

I don't expect to be able to convince you that both numbers (resource use, resource creation) will continue to increase because knowledge will continue to increase. But please do note: When you are predicting doomsday scenarios, the problem is not so much that the top number (the footprint) is too big, but rather that you believe that it will eventually get too small. Please also note that historically, the top number would seem to be (at least in dynamic

societies) always larger than the bottom number.
And it has not predicted doom.

I think that knowledge and ethical behavior, alone, are the only ways to deal with our uncertain future. The very thing that increases use of and creation of resources, is therefore the very thing (I think the only thing) that will protect us from uncertain catastrophies. Since niether you nor I really know what will happen in the future, I think we have to bank on increasing our knowledge. And yes, that implies increasing our productive and destructive capacities.

by a reader on Wed, 11/08/2006 - 03:19 | [reply](#)

Re: understanding

The footprint of an entity (nation, person, amount of wealth, etc) is defined as the amount of land needed, at the present state of technology, to sustainably produce the resources being used by that country or person, or to create that wealth.

I would take out the word 'sustainable', but yes.

What I think we may disagree on is this: The footprint, thus defined, is not a constant area, but changes with time.

I don't disagree. I am aware of Ehrlich and Malthus.

There are several important differences between now and back in 1970 or 1800. Notably, global warming, overfishing of the oceans, global trade which brings invasive species around the world, etc.

I've never denied that knowledge and technology can offer more efficient land use.

What I am arguing is that, as things stand right now, there must be a radical change or we *will* see Ehrlich and Malthus' predictions borne out, just a little late. Wealth does not automatically produce better technology. We have overcome obstacles in the past, but that does not mean that we will again this time - at least not without concerted effort.

Hence, isn't it misleading for you to use the terms "footprint" and "land use" or "resource use" interchangeably? For the conversion factor between footprint and land area is not constant.

Misleading? Perhaps. Did I intend it that way? No. I assumed everyone was on the same page, since we are, after all, talking about the WWF's report on ecological footprints.

by [Will](#) on Wed, 11/08/2006 - 03:30 | [reply](#)

Re: Understanding

Will wrote:

Ehrlich and Malthus' predictions...

Wait! I realise that most critics of environmentalism cite Malthus and Ehrlich in order to make fun of how wrong their predictions were. But that's the opposite of what I'm doing. I'm not citing them for what they were wrong about but for what they were right about: not for their predictions of their future, but for their calculations of the footprint at the time.

So, given that the human race's footprint (adjusted for carbon dioxide) has fallen from perhaps 1.7 or so in 1970 to only 1.3 now, the next question I want to ask is -- again, not **what** made it fall, but **who**? Was it not the people of the developed countries, and in particular, the change in the way those people used resources?

by [David Deutsch](#) on Wed, 11/08/2006 - 03:59 | [reply](#)

Re: Numbers

You just about stated my argument. However, I don't consider our usage of oil to be part of our footprint. Neither does the WWF, who calculate footprint as the amount of 'bioproductive' land required to support a certain level of consumption. Oil is only part of the footprint to the extent that it produces pollutants like CO2 that take up bioproductive land.

I think a more illustrative example, instead of oil, might be fishing. Fishing is a booming industry in the developing world, the biggest agricultural commodity that is traded internationally. Rich nations buy fish from poor countries, propping up the economy. The wealth that the poor countries get from fishing increases their standard of living and allows them to fish more.

Now, fish catches are beginning to level off and decline, even though more and more people are getting into the business. What happens? The prices go up, so there is more incentive to keep fishing. The fishermen also increasingly turn to other, more destructive practices like bottom trawling or shark finning.

Eventually, unless something changes, the ocean's ecosystems will collapse. Free markets will not solve the problem. Aquaculture might, but not by itself.

When the ocean fisheries are finally depleted, one billion people who currently depend on fish for their daily protein will face starvation.

Knowledge, far from helping humanity, actually has been the means by which humanity was and is destroying itself.

I never said this, and I don't believe it, although I can see how you might get that from my using hunter gatherers as an example.

I agree more with this:

I think that knowledge and ethical behavior, alone, are

the only ways to deal with our uncertain future.... Since neither you nor I really know what will happen in the future, I think we have to bank on increasing our knowledge.

Increase our knowledge, yes, and rather than dismiss the problem, focus our knowledge on fixing it.

by [Will](#) on Wed, 11/08/2006 - 04:09 | [reply](#)

1.3?

Where do you get the figure of 1.3? The WWF report says 2.2 per person.

by [Will](#) on Wed, 11/08/2006 - 04:13 | [reply](#)

nevermind

Nevermind, you are taking out carbon dioxide, correct?

by [Will](#) on Wed, 11/08/2006 - 04:14 | [reply](#)

Re: 1.3

No no, I'm leaving carbon dioxide in. 2.2 is the WWF-calculated footprint in hectares per human, and in those units the Earth's capacity is currently 1.8.

1.3, or perhaps $2.2/1.8=1.22$, is, as I said, the current WWF-calculated total footprint of the human race measured in units of the Earth's total surface area. In effect, it is how many Earths we are currently using.

by [David Deutsch](#) on Wed, 11/08/2006 - 04:22 | [reply](#)

Re: 1.3?

It seems we haven't agreed on our definitions of footprint . First you said:

Similarly, in 1970, the environmentalist Paul Ehrlich calculated that the Earth could sustainably support, at the average standard of living at the time, slightly fewer people than were alive at the time -- in other words, the footprint then was slightly above 1.

Then you said:

So, given that the human race's footprint (adjusted for carbon dioxide) has fallen from perhaps 1.7 or so in 1970 to only 1.3 now,

Which figure are you saying Ehrlich came up with? 1 or 1.7?

I am also confused by your usage of the number 1.3. That's a ratio,

not the total footprint per person as the WWF defines it.

When I (and the WWF) say footprint, I mean the amount of land a person, nation, whatever, uses.

You seem to be saying with your figure of 1.3 that the world is exceeding the earth's capacity by 30 percent (the WWF says 25%). Is that correct? Is there another word for that figure that we could use besides footprint to avoid confusion?

by [Will](#) on Wed, 11/08/2006 - 04:56 | [reply](#)

Re:1.3

Prof. Deutsch,

Let us look at the ration 2.2/1.8.

Would it not be correct to say that historically, both numbers (2.2 and 1.8), should have increased over time, likely because knowledge has increased over time?

Isn't it less important what the ratio is, and more important for human success that the top number continues to increase indefinitely? Presumably, the top number will not be able to increase indefinitely unless the bottom number also increases. And increasing knowledge should make them both continue to go up over time?

Have I missed something?

by a reader on Wed, 11/08/2006 - 05:41 | [reply](#)

Clarification?

I think Prof. Deutsch is saying that the figure for Ehrlich was about 1, but Ehrlich did not take into account carbon dioxide damage, so Ehrlich's figure if he had known about carbon dioxide damage, would have been closer to 2, say 1.7.

According to the WWF the correct figure is 2.2/1.8 which is approximately 1.22 (conservatively round up to 1.3).

I think Prof Deutsch is asking who caused this ratio to fall?

by a reader on Wed, 11/08/2006 - 05:58 | [reply](#)

Ratio

I am also confused by your usage of the number 1.3. That's a ratio, not the total footprint per person as the WWF defines it.

The WWF report says we are using up 125% of capacity. We are using up 1.25 earths worth of resources. Soon we will be using 2 earths.

1.3 is just 1.25 rounded up. It's how many earths the WWF says we

are using. This can be compared to how many earths worth of resources other people calculated we were using.

We need to use these units, after the division, b/c if the WWF says we are using 2.2 out of 1.8, and someone else says we are using 22 out of 18 (in different units), that is actually the same, and comparing 2.2 to 22 would be totally wrong.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Wed, 11/08/2006 - 06:07 | [reply](#)

did footprint fall?

David:

...not *what* made it fall, but *who*? Was it not the people of the developed countries, and in particular, the change in the way those people used resources?

You assume that the footprint actually fell.

Since the 1970's, fish stocks have plummeted. Across the board, just dropped off a cliff. Vertebrate populations are dropping all over the planet. Habitat destruction has continued.

There have also been positive developments. In the US, environmental regulations and the EPA reversed a lot of the decline here. New agricultural technology made cropland more productive - probably the main thing that has prevented Ehrlich's prediction from coming true.

What actually seems to have fallen is the -calculated- footprint. How do we know that Ehrlich's figures were correct? Certainly we have much better information today than we did then.

Also, maybe the footprint didn't fall. Maybe the technological measures we have come up with in the years since Ehrlich made his predictions are only stopgaps, and will only slow the impending collapse rather than stop it?

I kind of like the model proposed by a reader, that the number on top (the amount we use up) gets bigger, but so does the number on the bottom (the amount the planet can support). That seems pretty accurate to me.

The thing is, it is a constant balancing act to keep the top number from outpacing the smaller number.

by **Will** on Wed, 11/08/2006 - 06:52 | [reply](#)

footprint

he said the percent of capacity being used fell from 170% (or more)

to 130%. that doesn't mean the total footprint (as an absolute number) fell, b/c capacity may have gone up.

-- Elliot Temple
curi@curi.us
Dialogs

by **Elliot Temple** on Wed, 11/08/2006 - 07:28 | [reply](#)

footprint

Well, if the carrying capacity of the earth went up, that is slightly different from footprint going down.

If that's what happened (and I think that *is* what happened with Ehrlich's predictions) then it was the richer nations that caused it to happen because of advancements in agricultural technology.

That doesn't automatically mean that richer nations get a free pass now. Either they must reduce consumption or figure out a way to increase carrying capacity.

by **Will** on Wed, 11/08/2006 - 15:01 | [reply](#)

Re: footprint

Will wrote:

Well, if the carrying capacity of the earth went up, that is slightly different from footprint going down.

No it isn't. Not according to the definition we have agreed, which was:

The footprint of an entity (nation, person, amount of wealth, etc) is defined as the amount of land needed, at the present state of technology, to produce the resources being used by that country or person, or to create that wealth

So if the carrying capacity of the Earth goes up, the amount of land needed to produce the resources currently being used goes down, and the footprint goes down proportionately. Right?

by **David Deutsch** on Wed, 11/08/2006 - 15:19 | [reply](#)

footprint

if the carrying capacity of the Earth goes up, the amount of land needed to produce the resources currently being used goes down, and the footprint goes down proportionately. Right?

Allow me to think out loud here:

One number (2.2 according to the wwf) is the amount of land

required to support every human.

The other number (1.8) is the amount of acres per person the earth could support. So when the top number (2.2) gets bigger than the bottom (1.8), we are in a period of ecological deficit. When it is smaller than the bottom, we are building up our natural capital, so to speak.

New technologies that increase the agricultural productivity of land will decrease the top number. I honestly don't know how much impact these technologies would have on the bottom number. That seems like it would be something like x/p , where x = the amount of available bioproductive land and p = population. X should be a constant unless we can create technologies which allow previously unusable land to become productive, which is rather different from making the existing land more productive.

So population increase because of better technologies could cause that bottom number to shrink, even as the top number shrinks. In that case, your percentage figure, 1.3, could go up even as footprint per person shrinks. Your percentage figure could go down if technology increases enough to make the top number smaller than the bottom, or if we can make the bottom number bigger by decreasing population or increasing the available land.

Then there is the possibility that agricultural land required per person decreases, but because of increasing wealth, other resources consumed goes up: more land required for timber, paper, etc. In this case, population will increase, the bottom number will shrink, the top number will increase or stay the same, and the percentage figure will increase.

There is also a possibility that we have underestimated the bottom number, and our technologies are allowing us to exploit and destroy the available resources more 'efficiently.' I'm thinking of fishing here, where fish stocks have collapsed, but we keep finding ever more destructive ways to keep producing high catches. In other words, we have found short term solutions, stretching the earth's carrying capacity but not actually increasing it.

Am I being clear here?

In any case, is all this actually relevant to your rhetorical point?

by [Will](#) on Wed, 11/08/2006 - 16:53 | [reply](#)

Agricultural Efficiency

Consider the ratio we have been talking about.

You are correct that increases in agricultural productivity will decrease the ratio, but it does so not by decreasing the amount of resources that individuals consume per time (the top number), but rather by allowing the land to "replenish" more food per time (if there is no extra toxic waste from growing the food more efficiently).

So increases in agricultural productivity, everything else equal,

increase the bottom number, but do not decrease the top number. The reason the top number does not decrease is that if food is produced more efficiently, the price falls and if anything people consume *more of it* (or the population increases to take more advantage of the lower price of food). Either way net food consumption increases. Economists say that in most situations, food is not an "inferior" good.

So, increases in agricultural productivity raise the bottom number, and do not decrease the top. A higher bottom number means one can "replenish" more food from the earth per unit time when agricultural productivity increases (providing that there are no toxic byproducts from these increased efficiencies).

So these are my questions (similar to Prof. Deutsch).

You (Will) have agreed that the bottom number has historically increased over time.

A. Who has cause the bottom number to increase over time?

And equally importantly

B. Why have these people acted to increase the bottom number ? Put another way, what incentive have these people had to increase the bottom number?

by a reader on Wed, 11/08/2006 - 20:55 | [reply](#)

agriculture

You are right, new agricultural technology would increase the bottom number. But it would also decrease the top number, which is the amount of land required to produce the resources consumed by an average human.

Keep in mind the other variables: population, amount of other resources consumed, etc that could affect this number.

Anyway, the answer to your question:

a. what has caused the bottom number to increase over time? Well, we haven't actually proven that it has increased. We have seen that Malthus and Ehrlich's calculations were wrong. Perhaps they underestimated the carrying capacity of the earth, or overestimated the footprint at the time.

Also, perhaps we are stretching the earth's resources, rather than extending them.

B. Why have these people acted to increase the bottom number? Put another way, what incentive have these people had to increase the bottom number?

I know the answer you want to hear, so for the sake of argument, I'll give it: the technologically advanced, richer nations have given

us technology that has made agricultural land more productive.

What was their motivation? Profit.

So I've said it. But this doesn't prove a thing. In addition to the possibilities stated above, note the fact that past trends do not prove future trends. There could be a number of things that affect our ability and desire to develop new technologies.

Also consider the possibility that our development of new technologies must occur at a rate fast enough to repay our ecological debt.

by **Will** on Wed, 11/08/2006 - 21:59 | [reply](#)

Past and Future

Will,

So I've said it. But this doesn't prove a thing. In addition to the possibilities stated above, note the fact that past trends do not prove future trends. There could be a number of things that affect our ability and desire to develop new technologies.

You don't need to prove it: you need to explain it, which you have. Also, you are right that the future does not follow from the past inductively. But if we can *explain* past trends according to a rule that is not falsified yet (in our case, the rule that the incentives of people in free, industrialized countries result in increases in the carrying capacity of the Earth) it is irrational to throw that rule away on the vague statement that it is not proven. No law of Nature is ever proven. As to problems: they arise constantly and they must be solved (not erased) by allowing the free growth of knowledge.

-- Cyrus Ferdowsi, <http://libiran.blogspot.com>

by **Liberal Iranian** on Thu, 11/09/2006 - 03:47 | [reply](#)

What Should Be Done?

There seems to be a reasonable amount of understanding and agreement now. And we don't need total agreement about the current state of the Earth. What to do next only partially depends on that.

The WWF wants to appeal to governments to force people to live with a lower footprint -- to use less stuff per person. And it designed its measure, footprint *per person*, to finger rich, lower-population nations as the ones using more than their fair share, who should be forcibly made to stop.

And the WWF wants to scare people into taking action -- changing their personal lives to consume less. People should spend more of their time recycling, and buy more environmentally friendly products, and so on.

Whether the current state of the Earth is a problem or not, I oppose

all that. I want to see a focus on science, and optimism that we can fix problems, rather than pessimism and trying to avoid them. We don't have perfect foresight, so problem avoidance cannot work reliably. (Note: of course sometimes if you do know about a problem in advance, avoiding it may be easiest/best)

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Thu, 11/09/2006 - 05:29 | [reply](#)

Technological Breakthrough Lowers Footprint

Want to use less water?

<http://www.physorg.com/news82299918.html>

Now showers can use 30% less water without feeling less pleasant.

-- Elliot Temple

curi@curi.us

Dialogs

by **Elliot Temple** on Fri, 11/10/2006 - 01:31 | [reply](#)

Yay. Let's all be happy-cl

Yay.

Let's all be happy-clappy optimistic libertarians and hold hands and sing hymns to knowledge and about the rich and the smart are soon going to build us a better boat - who needs to throw all that heavy stuff overboard or plug the leaks?! Increase, increase, we say!

by Neil on Sat, 11/11/2006 - 13:12 | [reply](#)

One Billion Humans

Thanks Will and the Libertarian legions.

Seriously, thanks.

I like nice round numbers and elegant math. My conclusions on the above for now are that these factors:

Smarter, fewer humans

More edible cellulose, etc.

Better use of plentiful electrons

in combination make for an elegant formula for a good life on a carbon based planet.

Doesn't seem too hard to figure out.

Cheap, technologically efficient birth control (and the knowledge to

use this technology wisely) while eating/wearing tasty paper products and driving around in our electron fueled vehicles, now that's the ticket!

You scientists can do the math. What the heck, I'll triple the fudge factor, three billion humans works too. That's my WWF theory and it works.

by a reader on Mon, 11/13/2006 - 17:07 | [reply](#)

Carbon Dioxide,

...man-made carbon dioxide emissions that is, make up just 0.017% of the green house gases in the atmosphere, and carbon dioxide is the least effective green house gas anyway. The past 170 years have been the coldest in the past 1000 years. The coldest period in the past 170 years was during one of the biggest booms in man-made carbon dioxide emissions in history. The ice caps are growing and sea levels are stable or even falling. What's the big deal with this climate change malarky?

Besides, sooner or later the Earth is going to become uninhabitable and it doesn't matter how many of us take up cycling. There is no 'solution' to climate change except to move to another planet, or to build massive Space 1999-style enviro-domes or something like that. In the meantime I'm going to keep eating my beef, using my incandescent lightbulbs (which don't poison the planet, unlike the other kind) and driving my 4x4. I might even smoke a few cigars while I'm at it.

by [The Cynical Libertarian](#) on Sun, 03/18/2007 - 11:49 | [reply](#)

I recommend some schooling...

I don't know if you took basic maths? But I'll have a go.

In a democratic system (doubtful you believe in this philosophy) the weighting is relative to the individual. Ergo each person carries the same burden.

Weighting by GDP just doesn't make sense.. That's the equivalent of giving votes in a political system based on how much money you earn (again this may be the interpretation in America).

I know you see yourself as some kind of agent-provocateur but please don't waste my time publishing such tosh...

by a reader on Fri, 03/23/2007 - 14:02 | [reply](#)