

## Aurora, Issue 2000

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Bill Rees is a nice fellow with a strong message - if the world cannot safely expand its way to sustainability we will have to discover other ways of relieving the material impoverishment of half of humanity.

A bioecologist by training and former Director of the University of British Columbia's School of Community and Regional Planning (1994-1999), Dr. Rees' combines teaching and research on public policy and the planning implications of global environmental trends, with public speaking on behalf of the ecosphere and the common good. He is best known for his work on the 'ecological footprint' - an analytical tool for measuring a community's energy and material consumption.

[Mike Gismondi](#) spoke with Bill Rees at the Parkland Institute Conference: "Building a Post-Corporate Society: A How to Guide for Citizens" in Edmonton, November 2000.

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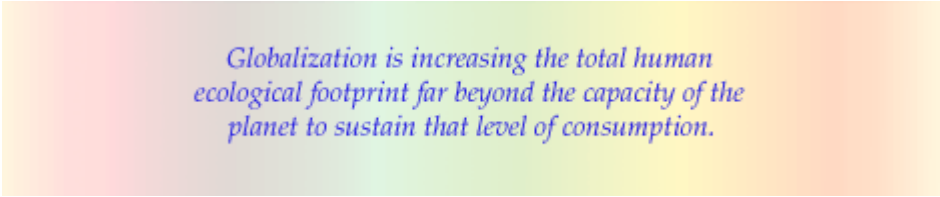
**Aurora:** Your concept of the ecological footprint is widely known today. I want to take you back a few years. I was wondering when you first became interested in ecological issues and planning?

**Rees:** I suppose you could say that the whole idea of the ecological footprints started when

I was eight years old, or nine years old. I was a farm boy in southern Ontario, at least on my mother's side we had a family farm. About eight of us cousins were used as, well, cheap labour. This was back in the pre-tractor days, we didn't even have electricity in the late forties and early fifties. One wonderful warm July summer in about 1952 or 53, I was nine or ten years old, we were in my grandmother's country porch, thirteen of us or so, having lunch after a hard morning's work in the field. I happened to glance down at my plate full of young new carrots, little potatoes, fresh lettuce, and so on, and to make a long story short, I realized that there wasn't a single thing on the plate that I hadn't had a hand in growing. That thought hit me like a rush of cold water being poured down my back. I was riveted. I suppose it was like an epiphany kind of experience. I was so excited by that notion, I don't think I was able to eat my lunch. At any rate, years later this thing just kept popping up over and over again, it was what made me want to go into zoology and biology at university. I went all the way through in population ecology to my Ph.D. So, it has very deep roots, being interested in that connection to the Earth, or the environment.

Throughout university I was constantly in search of what I thought should have been obvious, something called human ecology: the study of human beings as species of organism. I couldn't find it anywhere. It astonished me that academic ecologists and professional ecology had no focus at all on humans; it was all oriented to non-human species. I failed miserably to find any course that treated human beings as species. We were just beginning to think of environmental studies and that sort of thing, but that's not human ecology, that's really impact ecology.

I sought in vain for what I thought I really wanted to do. Ultimately, when it came time to apply for jobs, I tried desperately to create a niche for myself or at least to find a job where it would be possible to study humans as species of organisms as components of ecosystems. To my delight, a chance came up at UBC. The director of the planning program there Crawford Hawling, Buzz Hawling, one of Canada's premier ecologists, one of my mentors from way back created a joint position between the Institute of Resource Ecology and the School of Planning at UBC. I competed for that position and wound up going out there, ultimately moving most of my teaching into the planning school, where I, in a sense, created an environmental or resource oriented part of the planning program and developed a couple of courses in human ecology and ecological economics. That's where it all began, way back when I was a kid interested in human ecology.



*Globalization is increasing the total human ecological footprint far beyond the capacity of the planet to sustain that level of consumption.*

In the seventies I began to develop at the planning school this notion of ecological footprint analysis. It's grown since, and we've now got the book out for the last five years. It's in six languages and selling all over the world and it's having, I am gratified to say, quite an impact on the way people think about sustainability, human carrying capacity, and so on.

## Ecological Footprint

**Aurora:** I imagine that some of our readers don't know much about your work, can you describe the concept of ecological footprint and the principles that you are exploring?

**Rees:** The idea for the footprint, per se, came to me after a seminar I had given on the notion of carrying capacity. I was struggling in the mid-seventies to find ecological principles that had been developed with respect to other species that could be translated into human activity. Carrying capacity seemed to me to be one of these. Ecologists defined carrying capacity as the maximum number of organisms or individuals of a particular species that could be supported by a defined habitat without overgrazing or otherwise wrecking that habitat. It's a difficult concept, even in ecology, because climate and weather and so on change the instantaneous carrying capacity even of a habitat. It seemed to me the idea applied also to humans at some level. At that time we'd just seen the publication of the *Population Bomb* by Paul Ehrlich. There was a resurgence of interest in this concept of carrying capacity. Using agriculture, I took a quick and dirty shot at trying to calculate the carrying capacity, under a set of assumptions, of the lower mainland of British Columbia where I teach.

I presented this little paper to a group who had been assigned by the UBC President to create a new water resources research institute. We didn't know each other, so we decided to do a series of little seminars and by which we introduced each other to our own areas of interest. This little paper on carrying capacity of the region was received politely enough but a very senior Canadian resource economist, named Peter Pearce, took me aside afterwards and said, "Look, I want to have lunch with you." I thought, "Oh, this is interesting." He told me, "Look, economists have long ago resolved this issue. Carrying capacity has no meaning, whatsoever, because, after all, we can trade. Almost any area, like the lower mainland here has certain resources in surplus. And, if there is anything in short supply then we just sell off what we have in surplus in exchange for what we need, such as food, and thereby we can overcome any local limits to the carrying capacity of the area. And if trade doesn't work, then there is technology." In fact, it's almost a doctrinaire position in modern economics, that human ingenuity is capable of substituting for almost any good or service provided by nature. With these two ideas, which were completely unfamiliar to me, a more or less green Ph.D. in ecology, I went away with my tail between my legs. They completely undermined my concept that there might be limits to human carrying capacity.

There was always something that bothered me about this. The more economics I read, the more it bothered me. One day, a couple of years later, I woke up in the middle of the night with one of those "Ah-ha" experiences. I realized that I could capture the idea I was trying to get across while accommodating the economists' objections simply by turning the carrying capacity ratio over. Biologists would define carrying capacity as the number of organisms per unit area, what if you asked the question, how much area is needed per

organism per population, wherever it is? Even if we are surviving on trade goods, clearly some place, somewhere on the Earth, has to be creating or producing the goods that we are importing. Some area has to be assimilating the wastes that we generate through the consumption process.

I began to play with the idea of calculating the total area of productive ecosystem, whether terrestrial or aquatic, required to produce for any defined population, that is, the goods or services that the population consumes. Also, there are certain wastes that need to be assimilated by the environment for sustainability. Couldn't we come up with, for example, a carbon sink and determine how much land or ecosystem area is needed to assimilate the carbon dioxide outputs or the domestic waste outputs of a defined population? To make a long story short, then, that is the ecological footprint. Pick a population, examine its consumption patterns for a considerable period of time, and then calculate the total area of terrestrial and aquatic ecosystems needed to produce all the goods and services that the population consumes, and to assimilate the wastes that the population produces.

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The method is now sophisticated enough that there is no overlap. For example, we don't count leather goods because it is a by-product of the meat or dairy industry. We don't overlap in any major category so the numbers we come up with are a fairly good estimate of the actual amount of land and water needed to sustain a particular population. What we find is that [the footprint] varies very much with income, because income determines level of consumption. When we compare the ecological footprints of individuals among countries, they vary by a factor of twenty, from less than a hectare in a very poor country such as Bangladesh, to 10 or perhaps even 12 hectares in a country like the United States. This is almost a direct reflection of the vast difference in incomes between those two countries and therefore a much greater propensity and capacity to consume in the rich countries than in poor countries.

**Aurora:** These are averages, right?

**Rees:** Yes, these are averages. This is the per capita footprint. For a typical American or a typical Canadian, it might be 7 1/2 or 8 hectares.

## Redefining Progress

**Aurora:** I've noticed students in many countries are using your tool to develop footprints

of their own countries and analyse them.

**Rees:** Yes, I think it is probably one of the best known tools now that people are using in order to discover more than they'd like to know sometimes about themselves in relation to the environment.

I don't like the term "environment," I prefer "ecosphere." There are several Canadian junior school or high school textbooks now that have adapted the concept to be used by their students. One of my very best Ph.D. students - Mathis Wackernagel- who is also the co-author of the book, who has worked in California for an organization called [Redefining Progress](#). They have been continuing to push the concept in the U.S. He's posted a couple of simple footprint calculators that people can download and use just by answering a series of questions. You don't even need the data. It's a pretty crude tool, but if you can tell us what kind of car you've got, how many miles you drive, what kind of diet you have, and so on and so forth, through basically close correlation matrices, we can then do an inferential footprint. It doesn't do a bad job of estimating footprints. People are using this all over the world.

In 2004, Wackernagel started a new non-profit organization called [Global Footprint Network](#) which has been striving to broaden Footprint analysis and discourse.

#### [Footprint and Income Distribution Calculator](#)

The book's now translated into several languages: German, French, Italian, even Chinese. It's a very well known method and very controversial, I must say. It flies very much in the face of conventional wisdom, by that I mean the whole world basically. The formal sustainable development institutions from the World Bank to the International Monetary Fund, from the United Nations to most governments - they assume that we can grow our way to sustainability. Even the Brundtland Commission Report, *Our Common Future*, presumed that through relatively minor changes to more benign technologies that the world could have a five- to ten-fold expansion in industrial activity by the middle of the next century-when the population is expected to be about 9 billion people.

What we're showing is that current levels of consumption in the developed world are the target for everyone. But to bring 9 billion people up to at least the 1980s material standards enjoyed by western Europeans would require something like 6 or 7 hectares per capita, perhaps 4 or 5 depending on how many assumptions you want to make. The point is on planet Earth right now there are less than 2 hectares per capita of productive land and water. Many people will balk at that because obviously the sea is enormous, but only about 10 per cent of the sea is productive in the sense that we are talking about here. Most of the ocean is a biological desert.

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On land, anybody can look it up, there's only about 9 billion hectares of ecologically productive landscape: its forest, its grassland, crop land, and so on. If there were a fair and equitable allocation of land just among the existing population, and not taking into account the independent needs of any other species, then each human on the planet today would get a hectare and one half. If we were spread evenly over the surface of the productive part, you could wave to several neighbours. We are a very densely populated species given our very high material and energy demands, even on average.

If there is only a hectare and one half of land and about a half a hectare of productive ocean per capita, and the wealthy countries today enjoy somewhere between 4 and 12 hectares per capita, then it's clear that you can't bring 9 billion people to the same material standards that we enjoy with anything like the kinds of technologies that we are using or are likely to emerge or be made available particularly in the developing world in the next 40 years.

## Technology and Efficiency

**Aurora:** So there are no technological fixes in sight?

**Rees:** I've gone on from the basic footprint concept to demonstrate a couple of other interesting spin-offs. The assumption seems to be, in the mainstream, that improved technology, improved material and energy efficiency will help to solve this problem. In other words, we can continue to grow to the extent required to satisfy the needs of everyone if we simply get more efficient use of energy material.

You can buy a book today called *Factor 4*, (<http://www.ecouncil.ac.cr/rio/focus/report/english/wupprtal.htm>) which says that with off-the-shelf technology we could produce twice as much with half as much input. There's a four-fold increase in productivity right there. The problem is that technology alone and market alone won't solve the problem. And, we can show that, in fact, in the world's most technological economically efficient countries such as Japan, the United States, West Germany, the Netherlands, Austria, as their technologies have improved, as efficiencies have steadily increased over the last couple of decades, so has per capita consumption.

Incidentally, you can now get off the Internet, the latest study by the [World Resource](#)

Institute in Washington, it's called *The Weight of Nations*. They've compared just that list of countries I've given you. It shows that over the last fifteen years, despite increasing efficiencies, despite a slight de-coupling of GDP per capita from energy use per capita and material use per capita, per capita consumption of materials and per capita production of wastes are increasing. And therefore, of course, gross consumption and gross waste production are also increasing. I would even argue that this is a result of increased efficiencies.

**Aurora:** I found that an interesting twist in your papers, that we're more efficient, yet we're less sustainable.

**Rees:** In effect, if we want efficiency gains to work, we have to somehow prevent what we might call the rebound effect. We have to prevent the savings that we make from efficiencies from becoming somehow appropriated. We need to tax the savings away before they rebound within the economy by generating more consumption.

**Aurora:** We need a strong state and a tax system that understands sustainability.

**Rees:** Oh, absolutely. You know, one of the great ironies is that, clearly, first of all we should acknowledge that sustainability or sustainable development is a collective enterprise. We have to realize that we can't achieve this as individuals. I cannot use, for example, rapid transit if none is available. We have to recognize that many of the policies that need to be put in place are policies that respond to the public good, the common interest. Sustainability is clearly the largest of the common interest efficiencies that we have to deal with. Thinking that the market alone is going to function to achieve sustainability, I think is a bit naïve, particularly when you think that the market treats each individual, to use the economist's phrase, as self-interested utility maximizers with fixed preferences and unlimited material demands. Well, if everyone on the planet acts like that, then clearly we're on a path of total destruction.

*The market treats each individual, to use the economist's phrase, as self-interested utility maximizers with fixed preferences and unlimited material demands. Well, if everyone on the planet acts like that, then clearly we're on a path of total destruction. The economy will consume the planet and, indeed, that's what we are doing when we see the falling water tables, the collapsing fish stocks, depleted forests, and so on ...*

The economy will consume the planet and, indeed, that's what we are doing when we see the falling water tables, the collapsing fish stocks, depleted forests, and so on and so forth. It's already the case that the rates of consumption of many resources vastly exceed the rates of production in nature. When we see accumulated greenhouse gases, toxic contamination of food chains (even in the Arctic far from the sources of many wastes); when we see the increasing levels of hormone mimics so that, in the eastern United States now, as much as

1 per cent of human male births are beginning to show some signs of feminism; all of these are indicators that the capacity of our ecological systems to assimilate the waste by-products of industrial activity have also been exceeded. At both ends of the material through-put stream we are violating the basic principles of sustainability, namely that we can't consume more in the economy than is produced in nature, and we can't inject more waste into nature than can be assimilated by biophysical processes.

Coming back to the original notion of carrying capacity, I think evidence is quite clear that we've already overshot carrying capacity.

## **The Myth of an Ecologically Benign Knowledge-based Economy**

**Aurora:** In your writing you have said there were two false correctives: one is efficiency, what is the other one?

**Rees:** The other one is the myth that one sees emerging from time to time that as we shift to a more knowledge-based economy, this will be a more environmentally, or ecologically, benign economy. By knowledge-based we mean high-end service kinds of activities-financial services, computer services, computer technologies-all of the dot.com things that don't involve cutting trees or mining or digging for oil, and so on. Again, there is a kind of a superficial attractiveness, a seductiveness to this idea because obviously a tremendous amount of wealth, at least money wealth, is being created by these activities. I call these the benign activities of the mind because they're not literally imposing any direct impacts on the environment.

The problem is, if you look a little deeper, people in these kinds of high-end service and knowledge-based sectors are high-income earners. It's not as if the resource-based or manufacturing sectors have gone away. They've simply become relatively less important in terms of their contribution to GDP. Yes, we're creating more of our money wealth through the knowledge-based sectors, but in so doing, our incomes are rising more rapidly-so per capita consumption increases.

Moreover, many of our dirtiest industries have migrated offshore and are now happening in China, the Philippines, Malaysia, wherever. Even though our own environments seem to be-in the wealthy countries-improving, much of that is because the dirtiest activity is now taking place in the developing world.

You could even make the case that whatever we import from China may actually have a worse impact, globally, because, at the point of manufacture, the environmental regulations are not as strong as our own or not as well enforced. For example, the refrigerator that you import from Taiwan may well have a greater impact on the environment than it would have had if it had been manufactured, say, in Ontario, or right here in Alberta.

Just to wrap this up, the whole idea of the northern advanced or high-income economy shifting to knowledge-based economies is to maintain them at the top of the world's income heap. As our incomes increase, our per capita consumption increases-and the impact must occur somewhere. Eco-footprint analysis shows that as those economies shift to a higher and higher contribution in terms of wealth creation from knowledge-based activities, the eco-footprint continues to increase. Our impacts are moving offshore nevertheless they are impacts. The fact of the matter is, then, these economies are *not* more ecologically benign; that's an illusion and a myth.

## What Is To Be Done?

**Aurora:** You are not completely pessimistic, let's talk a bit about your optimism. For example, you mention the two faces of cities-cities can both have huge imprints but they also provide some potential for promoting sustainability. You also mention the two faces of globalization-a bit riskier thesis.

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**Rees:** Take cities first. If you understand the concept of ecological footprint analysis, then it is easy to understand the entity that we think of as the city is only a very tiny fraction of the whole human ecosystem. Although, on the one hand, many people-the geographers, economists-sometimes interpret urbanization as evidence of becoming less and less dependent on resources, nothing could be further from the truth. People are attracted to cities because of the higher income earning potential, and with that comes a higher per capita level of consumption. The ecological footprint so typical of cities is several hundred times larger than the built-up area or the political boundaries of those cities. In any ecological sense, a city is really the human equivalent of the cattle feedlot or intense industrial farming for chickens or hogs. This is not a particularly pleasant image. But the reality is that in this mode of consumption, the productive activity sustaining the economic and social and cultural activities that makes cities such wonderfully creative places-is occurring outside the cities. Other scientists have shown that for many European cities, for example, highly dense, rich, intense cities, the ecological space outside the cities needed to sustain them is as much as a thousand or eleven hundred times larger than the urban area itself. Now that might make people feel that cities are parasitic on the landscape. That's how one ecologist has described them.

On the other hand, we have to think that dense concentrations of people, and the juxtaposition of many industries, provide real opportunities to reduce energy and material through-put. Industrial ecology, the idea that the waste output of one kind of activity can be resource input for another, is only possible in cities. Cities are the only way we can really

reduce automobile use because cities have the densities necessary to provide for rapid transit. Cities make possible the treatment of industrial wastes because of the economies of scale and the agglomeration economies of having many similar industries together. We can make a lengthy list of the real ecological advantages of cities, but of course, we are not very adept yet of taking advantage of these to make our cities impact less on the environment, due to globalization.

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**Aurora:** As you say that, it helps identify where you are going to do politics. Being a town councillor in the Town of Athabasca, and thinking of the "politics" of small town planning, I can predict there is going to be a need for a lot of politics. Before we forget, tell me about your take on globalization?

**Rees:** Economists have argued there are tremendous potential advantages to globalization because almost every place has surpluses of some sorts of things, and these are resources, or commodities, or products that other places need or other places simply cannot produce. Globalization and trade are something that can bring great advantage to people. If we specialize in doing those things we do best, and trade for things other people specialize in doing best, then you can increase the total production in the economy. This is the efficiency advantage of trade-doing things most efficiently in a few places enables us to maximize total production.

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The way this is taking place at the present time encourages the market to respond in such a way as to greatly accelerate the rate at which we use resources. For example, it turns out there are many countries producing similar things. This can bid down the price of commodities in the world marketplaces. But as various producers of rice or grains find their prices falling, they have to take short cuts with resource husbandry to maintain market share to reduce prices to maintain the income flows that they require. So we see accelerated soil erosion, less attention to the maintenance of the resource base producing this kind of wealth. Globalization also exposes the remaining pockets of scarce resources to a global market, and price almost becomes no object when there is a very large number of very wealthy people in a very large market.

Even Canada seems to be suffering from Easterners' desire for turtle soup. A colleague of mine in Ontario says there is a trade going on with snapping turtles and other Ontario native turtles to satisfy the turtle soup market in far corners of the world. This kind of poaching is something that is threatening biodiversity. In British Columbia, bears are being killed in record numbers by poachers to satisfy a global market for bear gall bladders.

*In any ecological sense, a city is really the human equivalent of the cattle feedlot or intense industrial farming for chickens or hogs.*

We could create a list of potential good things about globalization if we managed trade properly and had appropriate regulatory regimes in place to make sure that the potential benefits of globalization are realized. Instead, we are deregulating and promoting a free-trade environment, and I can list a dozen ways in which this functions to accelerate the rate of resource throughput. It therefore increases the global ecological footprint substantially, and endangers many species that are being traded illegally across boundaries, because the facilities and capacity do otherwise do not exist. Right now I would say that, certainly in ecological terms, we could make a case that globalization is increasing the total human ecological footprint far beyond the capacity of the planet to sustain that level of consumption.

**Aurora:** How do we get peoples' attention?

**Rees:** One of the great ironies of the current global fascination with growth is that we can't show any objective or subjective benefits to growth beyond a certain income level. If we look at the standard indicators of human welfare that the United Nations uses-longevity, literacy, infant mortality rates-many of these peak out when the GDP per capita reaches 7 to 8 thousand dollars. Beyond that, it's absolutely flat. If we accept this selection of objective indicators as indicators of population health, for example, then going from 8 to 25 thousand or 35 thousand dollars U.S., or world dollars, per capita is really a questionable enterprise, because we are not gaining in those kinds of objective indicators.

Moreover, psychologists who study people's subjective sense of wellbeing find that wealth does not necessarily increase people's happiness. In fact, some of the happiest people on the planet live in places like Kerala, India, where per capita incomes are, say, one-sixtieth of those we find in the United States. Here we have, then, this great irony. We are able to show that beyond a certain level of income neither the objective nor subjective sense of wellbeing responds. So why are we engaged in this incredible rat race to maintain ourselves at the leading edge of the income pack?

In Canada, people are working longer hours rather than fewer hours. For the first time in the history of the industrial world, we have the capacity to give people more leisure time, to spend more time with their families, to create community. And yet, because we are

caught in this global struggle, this competitive struggle to obtain our share of markets, we are driving ourselves nuts. We are finding the work week is increasing rather than decreasing. There is very little sign of net benefit accruing to many people. I think it really is time to begin to question the morality, the ethics, and the assumptions underneath these models. Wouldn't it be better to start examining options of changing our behaviour patterns?

*We are sacrificing many of the indicators of safe cities, a secure sense of community, a healthy environment of the very things that would improve people's welfare in exchange for rising incomes. You could even make a case today that we are destroying more real wealth than we are gaining through growth.*

The whole thrust toward sustainability has been to treat it as an economic problem or a technological problem, hence, the emphasis on economic efficiency and technological efficiency gains. What's the point? What we really ought to be thinking about is what makes for people's welfare. We are sacrificing many of the indicators-safe cities, a secure sense of community, a healthy environment-the very things that would improve people's welfare in exchange for rising incomes.

You could even make a case today that we are destroying more real wealth than we are gaining through growth. If that's the case, then, as Herman Daly would say, growth is an uneconomic proposition where the quality of life for people is deteriorating even as their incomes increase. What's the point?

## Links

- *Our Ecological Footprint: Reducing Human Impact on the Earth*, by Mathis Wackernagel and William Rees  
New Society Publishers
- Transcript of the public talk by Bill Rees at the Parkland Institute Conference: "Building a Post-Corporate Society: A How to Guide for Citizens," Edmonton, November 2000.  
*Is There Intelligent Life on Earth?*
- The Living Planet Report 2000  
<http://www.panda.org/livingplanet/lpr00/>
- *Ecological Footprint Links and Resources*
- *Ecological Footprints of Nations: How Much Nature Do They Use? How Much Nature Do They Have?* by Mathis Wackernagel et al.
- Encyclopedia of World Problems and Human Potential: Applying Ecological Footprint Analysis by Union of International Associations.
- Evaluating the Use of Natural Capital with the Ecological Footprint Applications in

Sweden and Subregions, by M. Wackernagel, L. Lewan, and C. Borgstr?ansson  
<http://www.darwin.biol.lu.se/zoofysiolo/Lewan/Footprint.html>

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