Nate Hagens (00:00:02):

You are listening to the Great Simplification with Nate Hagens. That's me. On this show, we try to explore and simplify what's happening with energy, the economy, the environment, and our society together with scientists, experts, and leaders. This show is about understanding the bird's eye view of how everything fits together, where we go from here, and what we can do about it as a society and as individuals.

(00:00:33):

Oh, how do I introduce my next guest? Let me count the ways. Bill Rees is a professor emeritus at the University of British Columbia. He was the former director of the School of Community and Regional Planning at UBC. He is the originator of the Ecological Footprint concept and the co-developer of the method. He is a systems ecologist, long known in circles of scientists talking about global ecological overshoot of the human endeavor. He is very involved in conversations about sustainable socioeconomic development of our culture and the challenges that we face as a global human species in the 21st century. This is a rapid fire conversation. Bill is older than me, but has much more energy, and I did all I could do to keep up with him. I think many of you will take away some core insights of our planetary situation from this conversation with Professor Bill Rees.

(00:01:59):

Greetings, Bill.

William Rees (00:02:01):

How do you do, Nate? Good to see you again.

Nate Hagens (00:02:03):

Good to see you again. I was thinking about when preparing for this when I first met you in person. Do you remember?

William Rees (00:02:11):

I haven't a clue.

Nate Hagens (00:02:13):

It was in 2005-6-7-ish at a Ecological Economics conference in Burlington, Vermont. And I followed you around. You had a line of ecologist groupies that were trying to get your attention, and I patiently waited my turn to shake your hand.

William Rees (00:02:33):

You got a much better memory than an old guy like me.

Nate Hagens (00:02:38):

Let's just start at the very basics. You were an ecologist. What is an ecologist and how did you start thinking when you were a young man that hey, I want to be an ecologist?

William Rees (00:02:52):

Well, an ecologist is someone who studies the relationships between living organisms and their natural environment, which includes other living organisms. It's really the study of the ecological niche, the way in which organisms fit into the biophysical and biological systems of which they are a part. Now, the interesting thing is that humans don't consider themselves as part of ecosystems. So we have this odd situation where ecologists scarcely ever study human beings. The whole idea of humans in relation to environment has been given over to economists who know absolutely nothing about ecology. In fact, I once wrote a paper, which I argued that economists really ought to be ecologists and vice versa, but it's never gone anywhere. We still have that separation of silos so that ecologists don't study humans, generally speaking. I have a really long story about that and I won't get into it.

Nate Hagens (00:03:58):

Let me ask a quick question there. So they teach human evolution in college, but they don't teach about what that means for our current situation. So it's kind of like an anesthetized version of human evolution. Are you saying the same thing happens in ecology that we teach about trophic pyramids and frogs and ecosystems, but they don't include the human in that?

William Rees (00:04:24):

Well, not in the way that we really ought to. Humans are always noticed as being at the top of the food chain and so on. So when we look at food chains or energy pyramids, that sort of thing, people are in there, but there's no real discussion of the implications or what that means. For example, if you look really at energy and material flows through ecosystems today, human beings are the single largest consumer and producer and predator, not predator and carnivore, predator and herbivorous species in every single major ecosystem type on the planet.

(00:05:05):

Now, think about that. Have you ever learned anywhere that human beings are the primary species in every single ecosystem on the planet? Ecologists don't really teach that. They may think about it themselves, but it's not part of any curriculum anywhere that I'm aware of. So here we have a very odd situation in our culture. On the one hand, economics, which really ought to be human ecology because it's the study of how humans acquire and allocate and distribute resources, which is a fundamentally ecological question, but it pays no attention whatsoever to the actual ecosystems with which the economy interacts in the real world.

(00:05:46):

Ecologists who study primarily non-human species don't really interface in any significant way with economists. So in some respects, neither economists nor mainstream plant and animal ecologists have anything useful to say about the human conundrum right now. Because one doesn't study the

relationship between humans and the biophysical environment. The other tends to study only non-human species and ignores the economic implications.

(00:06:18):

Look, I want to go back to my early years. I was extremely fortunate in having been able to grow up in my youth part-time on my grandparents' farm in Southern Ontario. It was during that experience of being a farm hand basically, along with several other cousins that I recognized, and this is really curious for a 10-year-old I suppose, the old expression, we are what we eat. So one afternoon, literally just after noon, we were sitting in my grandmother's country porch, huge meal because we'd all come in, 14 of us from the fields and we're getting basically everything we had grown up until then, June. So we're getting our first lettuces and tomatoes and so on and so forth. And it hit me that everything on my plate, I had actually had some hand in growing.

(00:07:12):

Now, I'm a 10-year-old and suddenly it was if somebody had pulled the chair out from under me, I just fell. I felt like I was in free fall in an elevator and realized how profoundly connected to earth that I was. We are what we eat, and to get what we eat, we have to expend energy and work and labor and here it was on my plate and I was consuming it directly. It was a general purpose farm. We had a market garden, 23 dairy cattle, an apple orchard. We were essentially self-sufficient. It struck me even then that this was a rare and privileged position to be in, because most of my city friends hadn't a clue about any of that, that they're connected to nature in any way.

Nate Hagens (00:07:57):

So at 10, your path diverged from being an investment banker or a tech developer to being an ecologist.

William Rees (00:08:05):

Well, that was the first, I suppose, insight into the human ecological reality that we are of the Earth. So it was 10 years later, I was kind from a working class family, but I won a scholarship to university and suddenly I had to make a decision, what should I study? I always liked science. I did very well in sciences. And this whole experience that I just described on the farm came rushing back to me and it said, "You've really got to learn more about this. You've got to become an ecologist." So I wanted to be a human ecologist, and this is where I first encountered this, the siloed nature of our educational system. You couldn't be a human ecologist at that time unless you studied geography or a weird branch of human ecology in sociology, which I don't want to get into criticizing the sociologists or the geographers, but what they were calling human ecology was nothing to do with what I thought of as ecology is the biophysical relationships between organisms and their systems. The whole idea of the thermodynamics of energy and material flows and relationships defined by those kinds of things.

(00:09:18):

So I was told over and over again, "Well, we don't do human ecology. There is no course on human ecology in a biology department." So I had to settle to become an animal ecologist. My PhD was actually on bird population and competitive ecology. After I graduated, I sought a job as a human

ecologist. No university would entertain that position. I mean, I applied to dozens throughout the United States and Canada. I did get job offers from three universities, provided that I abandon this human stuff and did my standard bird or small mammal ecology. I was astounded, astonished. I finally got a job, but it was not in ecology at all. I taught in a school of community and regional planning for the whole of my academic career because it was the only place at the time, we're going back to this 1970s now, where I could actually apply what I learned in ecology to human beings freely without being hamstrung by the departmental, this, that, or whatever, over publications and whatnot in ecology per se. So I published an enormous amount, but it's not in the standard ecological journals at all.

Nate Hagens (00:10:33):

So why was that the case then? And you and I both know that that is still the case now. Why do you think that is?

William Rees (00:10:43):

Well, there's a whole number of reasons, but the simplest starting point is something called human exceptionalism. There's a kind of philosophical underpinning to the whole of, I suppose, mainstream techno industrial society. It goes way, way back, several hundred years, but flourished in the, I suppose, the enlightenment and scientific revolution that kept humans separate from nature. We are not like the other species. We are in denial of our animal nature. And so this isolation or separation of humans from the rest of the nature is why ecologists don't study human beings. And economists in setting up the economy, don't consider it as part of the natural environment. Look at the horrible situation we're in here.

(00:11:27):

Another problem about human beings we can talk about later, something called the social construction of reality. That is we develop mental models of how things are, and that's all they are. Mental models based on our beliefs, values, assumptions, and experience in some cases. And then we articulate these models, we discuss them, they become formal theories and people buy into them. But then we start to live out of these models as if they were real. So if we look at economics, we start from the position that humans aren't part of nature. So the economy is set up as a self-perpetuating, well, it's called the exchange value model, where you have firms and households, the households spend money on products produced by firms, but then the firms pay the household salary and dividends so that money comes back to the households. And so it's a circular self-perpetuating circular flow of exchange value. But the basic models in every single economics textbook and that we're still teaching in class shows as Herman Daly, the late Herman Daly has frequently pointed out and tried to get across. These models make no connection to anything outside themselves.

(00:12:43):

So we have the economy operating in complete isolation from the environment as a separate discreet, non-dependent system. Once you believe that and attached to it, the notion that human ingenuity is our most important natural resource, so that technology will help us out of any kinky situation we might get into with respect to the natural environment. Those two beliefs that we're separate from nature and

that technology can handle any residual problems are all you need as a mental construct, a social construct to develop a whole world economy based on the idea that there's no limits to growth that technology can't resolve.

(00:13:25):

And so we have now underpinned our belief in human exceptionalism. It's now moving forward on a foundation of economic thinking that completely ignores the natural environment. Now flip over to the ecological side of things. Here, we have an economy and a set of economic paradigms and laws and strategies and so on that sees us separate from nature. When any material flows analysis of the kind we've done in my work shows that humans are the single most important and major species in terms of material flows through every ecosystem on the planet. So we're operating-

Nate Hagens (00:14:08):

And in history.

William Rees (00:14:09):

Exactly, and it's getting worse and worse. So how can you possibly imagine governing a planet where we are the single largest component of every ecosystem using models that don't even consider us to be connected?

Nate Hagens (00:14:24):

Well, here's a thought. I agree with you that the genesis of this was human exceptionalism, but now circa 2022, 19 terawatt metabolism, climate change, species loss, everyone's becoming aware of these things. To actually open up and widely teach and disseminate human ecology is a bit like having a cancer cell become self-aware. I mean, it's almost like a dangerous thing now to have the full truth from a human ecological sense. Yes? Or what do you think about that?

William Rees (00:15:08):

Well, it may appear to be dangerous, but I think it's absolutely necessary. You put your finger on something extremely important here. That is the very recent awakening to the realities that we are the fundamental... We're far more important than Tyrannosaurus Rex in any real ecological consideration. But it's all happened in many respects, in almost all important respects in just the last 100, perhaps 200 years. So if you think of the human species, anatomically modern humans as being say 250,000 years, people keep juggling this number. It took us the first 250,000 years basically of human history to reach one billion people in about 1810. Then in just 100 years, we're more than double that. And in 200 years, by 2010, we're up at six, seven billion by 2010. So there's a 250,000 years to reach one billion and then 200 years, that's one 1250th as much time we expand by sevenfold.

(00:16:15):

Now, this is because we've become ecological beings again. For the first long, long period, human population growth was held in check by negative feedbacks because we were part of ecosystems. And disease, famines, resource shortages, those sorts of things kept human populations in check, just like

every other species. Humans are no different from other species in our population dynamics. We have a natural propensity to expand exponentially, but we're held in check by the natural negative feedbacks of the human ecosystem. Along comes fossil fuel, particularly in the early part of the 19th century when we began to use it in great quantity, as well as an advance of public health measures. So fossil fuel provided the means by which humans could acquire all the food and other resources needed to grow the human enterprise and public health improvements increased the longevity and health of the population. So for the first time in human history in the last, about one tenth of 1% of human history, humans were able to realize our full potential for exponential population growth. Until then, it had been suppressed.

(00:17:37):

So we took the cork off the bottle and we've had this enormous population and boom of the whole human enterprise in just the past 200 years. So what we take to be the norm, I mean this is what 10 generations at most of people, the last 10 generations of people who take 2%, 3%, 4% per year of growth in... Well, population never got above 2%, but the economy has certainly grown faster than that. What we take to be the norm is the single most abnormal period in human history. So I've begun to refer to this as the, we are like any other species exposed to an abundance of resources that goes through a population boom. There will be a bust, there has to be a bust because the boom can't continue. Any system that is primarily driven by positive feedback is self-destructive because it means that it will grow forever in a situation, in a context which is clearly not going to grow forever. And we're no different.

(00:18:42):

Moreover, we've got this enormous population, this enormous accumulation of manufactured capital now, all dependent on the continued flow of abundant, cheap energy and resources, but that well is running dry. And so we're, in effect, suspended - I've used this term in something I wrote recently - we're suspended on a kind of gusher of oil, but that gusher is losing its power and we're going to have to come down along with it. Unfortunately and my lexicon means that, I'll put it bluntly, we are in the plague phase of a one-off human population boom bust cycle. We're nearing the top and we will come down because of the onset of negative feedback. Nature will restore balance between that positive and negative feedback and who knows what will come of that.

Nate Hagens (00:19:44):

You mentioned the plague phase. From an ecological scientific perspective, are you labeling humans a plague species?

William Rees (00:19:55):

I'm not labeling us as a plague species. I'm saying that our population dynamics resemble that of every other species that we've labeled as a plague species. So if we are no different, in fact we're acting precisely the same way. We are going through the one-off population boom bust cycle. And if it happens with mice as it often does or grasshoppers, we call it a plague. So yeah, it's not a stretch to say that humans have become a kind of plague on planet Earth in the sense that we've reached numbers

that can't be sustained by the normal flow of energy and material from nature through the system. We've got there because we've used an extra somatic or outside the body source of energy fossil fuels, but that too is running down.

Nate Hagens (00:20:46):

I have lots of questions, Bill.

William Rees (00:20:48):

Yeah, I know.

Nate Hagens (00:20:48):

Let me insert this thing that I've thought about. What is the difference, since you mentioned mice, what is the difference between an R-selected and a K-selected species? I know that humans are normally considered K-selected, but from a metabolism perspective, if you consider the 500 billion invisible laborers we get from hydrocarbons and fossils every year, might modern humans, the last few generations be considered behaviorally R-selected species. What do you think about that?

William Rees (00:21:26):

Well, let's just for our audience sake, when we talk about a K-selected species, K stands for carrying capacity. So K-selected species have certain characteristics, they tend to be large, they tend to have very low reproductive rates, they tend to have high degrees of parental care, that sort of quality. So if you think of humans, we're fairly long-lived as mammalian species go, very high levels of parental care and so on. What this means is there's a high level of infant survival, relatively speaking. This means that K-selected species tend to always to press up against the available carrying capacity of their environments. They're always using whatever resources are available. By the way, that was Malthus's great insight. He realized that if more food was made available, human beings being K strategists would in effect always rise to the level of food availability. So in our-

Nate Hagens (00:22:29):

He was right about that, but wrong about the timing.

William Rees (00:22:32):

Well, I think that's exactly right. He wasn't aware of the power of technology to increase. And it goes back to what we were talking about earlier, the-

Nate Hagens (00:22:40):

Nor of fossil fuels, nor of debt or globalization or in any of those can kick the measures that we did.

William Rees (00:22:47):

I'm glad you mentioned globalization because it is currently one of the greatest threats to the integrity of the ecosphere. We can come back to that later if you like. But yes, he missed the point that human beings, this is our ingenuity, clicks in. We have found ways to relieve the negative feedback, allowing the positive feedback to take off. Now as I said, the reason K strategists are called K strategists, because we're always pushing up against that level of carrying capacity. So our success, our evolutionary success depends on high survival rates of infants and this constant pushing up against that carrying capacity. An R strategist, R refers to the rate of reproduction. So an R strategist, it's completely different. They just throw millions of offspring out there and not even a fraction of a 10th of 1% of those offsprings survive. But if there's millions of them, that's okay.

(00:23:49):

So it's two completely different approaches, very few offspring, but you take good care of them and ensure a high survival rate or millions of offspring on the other extreme with an exceedingly low survival rate. But in each case, the strategy succeeds, provided there's an adequate replacement of the adults reproducing individuals in the next population. So I think that humans remain, frankly, a K strategic species even with our [500,000,000,000] extra energy slaves. What that means is we have an artificial means to keep feeding our K strategic way of being. And part of that I mentioned earlier is globalization. You see, if you have... Okay, there's a concept we haven't talked about called carrying capacity, which in ecological terms is the average maximum number of individuals of a given species that can live in a habitat without wrecking that habitat.

(00:24:53):

Now, if I'm going to take another step back. When I first went to UBC interested in human ecology, I was asked to present a seminar to a group of new faculty members and all faculty members, kind of a get-together, to bring us together of many different departments. I was struggling in my mind, "Well, what can I say? What can I say? I'm an ecologists in a planning school." So I hit upon this idea of carrying capacity. So I did a quick and dirty estimate of the carrying capacity of my region, the so-called Lower Mainland of British Columbia. It turned out that the carrying capacity, the capacity of that region to support people at our then current average material standards. It was about a 10th of what the existing population was.

(00:25:38):

So I presented this model to my group of colleagues and it was politely received and all that sort of thing. But at the end of the meeting, I was taken aside by a very prominent Canadian resource economist, and he said this to me, "Bill, you've got to come to lunch with me because if you continue," Don't forget, I'd only arrived at UBC a few months earlier, "if you continue your pursuit of human carrying capacity and similar ideas, I can guarantee you that your career at this university will be nasty, brutish, and short. And he invited me to lunch to expand on this thesis, and this is where I was introduced for the first time -- Again, this is a terrible admission to economics. You see, we're so siloed in our educational system that we never really get educated. There's an old joke, a PhD means piled higher and deeper. You learn more and more about less and less. But here I was encountering economic thought for the first time and being told that everything I had learned in ecology was irrelevant.

(00:26:47):

Why? Because humans can both trade - "Why should we be limited in this region to whatever the population estimate I came to?" In fact, he said, "You've disproved yourself. The population is 10 times greater than you said the carrying capacity was. That's because we can import from other places. And if we did run up against any constraints, technology will take care of it." And he gave me a stack of papers by economists this high to make the point. And by the way, this was '72 when Limits to Growth just came out. And he laughed. He said, "That's the biggest piece of nonsense you could possibly imagine. The economists have long shown that there are no limits to growth and carrying capacity is an irrelevant idea." So that was my introduction to academic life.

Nate Hagens (00:27:37):

The way that I have presented it in public talks is I show an image of the tortoise and the hare. And the hare is the economist and the tortoise is the ecologist. Because if that person who was a tenured economics professor in 1970 or whenever, he's probably no longer alive or retired or something, but during his lifetime it appeared that he was correct. Meanwhile, our actual carrying capacity has been declining a pace that entire time and the carrying capacity for other organisms and creatures we share this Blue Earth with. So it's almost one of those things that the truth will be back loaded and not really recognized until it's too late to really do something about. What do you think about that?

William Rees (00:28:31):

Well, I think you're absolutely right. Economists believe in something called the substitution factor that, okay, so we do use natural resources, but it doesn't matter because through technology, any product of nature is infinitely substitutable by something that humans can come up. Better efficiency or some new material together. There was a management science professor at the University of Maryland called Julian Simon. I guess he died in the mid '90s, but he's famous for this kind of statement, "We have now in our hands the technology to feed, clothe and provide energy for an ever-growing population for the next seven billion years."

(00:29:17):

Now, when you again disconnect humans from biophysical reality and you believe in the ingenuity, these are the same people who think... He made a statement, the human mind, human ingenuity is the greatest human resource, then everything we've been talking about becomes irrelevant. And so you have that mindset, that social construct, which is a very attractive one, keep in mind because it does show new limits. That's what the world has bought into. The biophysical reality is that human beings in the growth of the human system have displaced other species from their eco niches. It's a concept I call competitive displacement. Human unsustainability is a natural phenomenon. We are unsustainable by nature because all we're doing is following our natural propensity to expand and to fulfill all available habitat, but we do it better than any other species. So if you go back 10,000 years, humans were fewer than, or less than 1% of the biomass of mammals on planet Earth. Then with agriculture and just more recently in the last couple of 100 years with fossil energy and the massive expansion of the human enterprise, humans have become 36% or 34% of the biomass of mammals. And by the way, the biomass itself has gone up.

(00:30:42):

But our domestic animals are another 62-63%. So that when you add all of that together, it means that wild mammals on planet Earth today are about 4%/3% of the total biomass of mammals. So all those great herds you see in Africa are a trivial appendage on the biomass of mammals, which has absolutely been commandeered by both humans and our domestic animals. So there's been an enormous displacement of non-human species, and the remaining populations in the last 50 years have been reduced by 65-70%.

Nate Hagens (00:31:18):

It's actually worse than that because it's only all mammals, including ocean mammals. So if it's only land mammals, it's 98%. So at this pace, Dr. Rees, we're going to run out of time or your computer is going to run out of batteries. Because I got a lot of questions for you, sir. So getting back to Julian Simon, I think that was a missed opportunity because unfortunately he got into a bet with Paul Ehrlich, who is a mutual acquaintance of yours and mine, and Paul lost and lost badly. And now, the cultural backward looking story there is that Julian Simon was right. Even though the statement, the quote you just read, about 7 billion years, the sun will have cooked the Earth long before that. Not to mention many other problems. But the general zeitgeist in our culture believes that Simon was right and Ehrlich was wrong. Do you have any comments on that?

William Rees (00:32:22):

Yeah, two, first of all, Simon was right because of a unique window in history, when in fact, resources were flowing at an extremely good rate. Let's keep something in mind, economists measure scarcity by one means, and that's price. So according to Simon resources, were getting more and more abundant because prices were declining. But prices were declining because we were using very cheap energy to exploit ever diminishing sources of resources. The quality of the resource base has been in steady decline. And had that bet been made today, Simon would've lost. That's my first point. Second point, his assertion, which many people still quote and believe in. Albert Bartlett, who is a wonderful physicist at the University of Colorado, wrote a little paper called 'The New Flat Earth Society,' in which he took Simon at his word, even contacted him, and anyway, Simon said, "7 billion years of population growth."

(00:33:28):

So Bartlett said, "Look, let's give Simon credit. Let's assume that the human population, which at the time is about 5 billion, grows at 1% per year for 7 billion years." The bottom line is this. He was readily able to show that the number of people would be greater than the number of atoms in the known universe. Something like 10 to the 37,000th of power. So that statement by Simon, which is taken at faith by so many, or at least similar statement, is so mathematically challenged as to be ludicrous. And yet, you said it yourself, that's the star we have hitched our wagon to. And that is another reason why we're blindly going down this path to a big surprise within this century.

Nate Hagens (00:34:17):

So this gets to another question. You and I both are active in this space trying to educate and inform both policymakers, citizens, students, and in our networks. I come across lots of pro future well-intended humans working on this or that aspect of our unsustainable system. But I am starting to group people. I

used to group people in those that watch TV or those didn't because they're behaviorally different I had found. But now I group people into those that view the future in an ecology lens like yourself or that view the future in a technology lens, which is the 2020s version of Julian Simon with AI and renewable energy and all kinds of other things. So let me ask you this, Bill. When I taught my class at the University of Minnesota, the main textbook was The Social Conquest of Earth by EO Wilson. And in that book he said that religion and evolution as explanations for our origin and how we're here are two views that can never be reconciled. So are ecology and technology a similar pairing, or can we reconcile ecology and technology somehow?

William Rees (00:35:41):

Oh, I think they have to be reconciled and they in theory could be reconciled. Look, every level of human cultural development has involved technology of some kind or other, simple mallets and bows and arrows are technology. So there's no inherent conflict between technology and ecological thinking. The conflict comes from assuming you can use the technology to overcome the biophysical reality within which we are embedded. So if we decided as a species 200 years ago, that the carrying capacity of planet Earth indefinitely was say 2 billion people, we could have used technology at an appropriate scale to ensure the continued wellbeing is some 2 billion people at infinitum. But we didn't do that. The assumption was that technology can increase carrying capacity indefinitely, which is really what my economist colleague was telling me. That carrying capacity, his words has no relevance to human beings. He even got a little bit crazy on this because he talked about the planets are out there and we have people today, Elon Musk among them who say, "We got to get out there and colonize the rest of the universe." It ain't going to happen.

Nate Hagens (00:37:10):

So in a recent paper of yours, and I can't believe how prolific you are as an emeritus professor, you're writing, seems like every month or two you have a new paper out there. But in your public speaking and in recent paper, you highlight, and this is a view that is patently obvious to me, but I still think is a minority view in the environmental movement. You highlight that climate change isn't the problem, but instead is a symptom. Can you unpack what you mean by this?

William Rees (00:37:46):

Sure. To do that, I'm going to have to take a wee step back. I believe that human beings and our cognitive capacities have become obsolete in the world in which we live. So if you think about the evolution of humans, we grew up in relatively simple circumstances. We were in small groups living in home ranges that weren't all that extensive. We lived and died within a few dozens of kilometers of each other. So there was no real, I suppose, pressures on the human mind to think beyond simple cause effect relationships. Bottom line is this, that the human brain, our cognitive capacities tend to be limited in most people to rather simplistic reductionist perspectives on reality. And if you think about that, climate change is a perfect illustration because there are hundreds of things happening, but we fixate on climate change.

(00:38:51):

The focus gets shifted a little bit when something like a pandemic comes along. But then, it's all about the pandemic we forget about climate change. Then there's the war in Ukraine, and we talk about that for a while, and now we're back to climate change. And nobody bothers to connect all of those dots because human beings are not inherently intrinsically capable of thinking systemically. When's the last time you had a dinner conversation about lags and thresholds and chaotic behavior and collapse syndrome, which is called catastrophe and systems theory and so on. It just doesn't happen. Okay, so climate change is our fixation because there are obvious symptoms that many people can relate to, but it's only one. We could spend the whole day talking about plunging biodiversity, ocean acidification, soil and land erosion, on and on and on. Every single so-called environmental problem is a symptom of the same issue, which is overshoot. Overshoot is the fundamental issue, and the fundamental issue is the cause of all of these other problems.

(00:39:59):

So overshoot means that human beings are using even renewable resources, the products of ecosystems much faster than they can regenerate. And we're dumping wastes far in excess of the natural assimilative capacity of ecosystems of the ecosphere. So on the one hand, we're drawing down all of our natural capital. Fish stocks are collapsing, soils are eroding at 10 to 40 times the rate of restoration. We're polluting far beyond the capacity of the systems to assimilate. Climate change is a pollution problem because carbon dioxide is the single largest waste product by weight of industrial economies. So the anthropogenic component of climate, the carbon emissions is a waste product. It's a waste management issue. The earth system cannot cope in a timely manner. It will over time, but not in time with the quantity of carbon dioxide that we're putting out there.

Nate Hagens (00:41:01):

Wait a minute, by weight, CO2 is the largest waste product? I never thought about it that way. I mean, because it's like an invisible gas, but if you add it up, it actually adds a weight.

William Rees (00:41:12):

Absolutely.

Nate Hagens (00:41:12):

In tons.

William Rees (00:41:13):

We're putting out 36 billion tons a year of carbon dioxide at the atmosphere of which a significant proportion is the carbon. And by the way, it's what goes in as fuel. The coal, oil, natural gas is all carbon based. And of course, it has to go through the system and is emitted as waste. But as you say, because it's an invisible gas, no one tends to think of it as waste. By the way, you get the counter-argument from people who don't look systematically at this, "Oh, carbon dioxide disease central for life on earth, green plants needed for photosynthesis." So it's a good thing that this carbon is in the atmosphere and so on and so forth. But again, you have to put this in total context. So overshoot is the problem. Human beings are destroying the biophysical basis of their own existence. We are literally consuming that,

which we need to maintain the system even at a reasonable size, and it's not at a reasonable size any longer.

Nate Hagens (00:42:10):

How do you define overshoot and how does that relate to carrying capacity?

William Rees (00:42:16):

Well, overshoot means you've exceeded your carrying capacity. So that if you think any farmer who has a bunch of cattle knows that if you put too many cows out in the pasture, they'll eat the grass until there's nothing but mud and then they die. Now, if you import a lot of grass from other farmer, you can keep your cattle going. So that's what humans have been doing. I mean, we talk about urban ecology, that's nonsense. The city is not a complete ecosystem. The city, as I currently think of, it's the human equivalent of a livestock feed lot because you have all of these consumer organisms jammed into one area and geographers and urban economists often say, "Well, cities are no problem and are only 2-3% of the surface area of the Earth." But that's from their narrow keyhole reduction as simplistic perspective.

(00:43:14):

If we look at human beings and from an ecological point of view, then each city occupies on Earth an area anywhere between a 100 and a 1,000 times more land than is within the political or built-up area of the city. So the human urban ecosystem now is larger than the entire planet because cities have become parasitic on their environments because of globalization. I did an early study of Tokyo. Tokyo is 38 million people, the whole population of Canada. But Tokyo, people used to say to me, "Oh, how can you explain Tokyo?" I said, I explain it this way. "Tokyo uses more bio-capacity than the entire nation of Japan, about twice as much as a matter of fact. So the ecological footprint of Tokyo is larger than the entire country of Japan, and it's only something like a quarter or a third of the Japanese population. So Japan has exceeded its carrying capacity because of globalization, the capacity to bring in the resources needed to sustain its overpopulation."

(00:44:27):

And because we can do that, we become blinded to the reality of our overshoot. As long as you can import from elsewhere, you are blind to the fact that you've exceeded your local carrying capacity. But what you're doing in the meantime is drawing down the available productive capacity in other places. And every country in Europe is in that circumstance. Japan is in that circumstance where they're living on imported carrying capacity or the assimilative capacity of the rest of the planet to absorb their carbon and other waste. We don't actually measure the other waste. So we're all in-

Nate Hagens (00:45:06):

And this is in addition to the energy flux being provided by fossil carbon and hydrocarbons.

William Rees (00:45:13):

Absolutely.

Nate Hagens (00:45:15):

All right. Well, the next question on my list, our viewers and listeners might speculate as to why this is the case. I was going to ask you, why isn't ecology more prominently taught, not in universities per se, because I think it is, but in high schools and grade schools. And if these are some of the things we learn, this is kind of a heavy load for a 10-year-old, yes?

William Rees (00:45:44):

I don't think so. Look, some of the basic principles are really easy. I often, I don't do it anymore, but I used to go into grade schools and talk to kids, and I would make this suggested to them, "Have you ever lain awake at night staring at the ceiling of your bedroom, asking just how much of the earth surfaces needed to support just me?" So, we've talked a bit about food production and the fact that everybody uses, but that ought to be the first question of human ecology. And it's not a difficult concept because every kid knows that they have to consume food. I have a wool sweater that comes from an animal which grew on land somewhere, and so on and so forth. So these concepts aren't that difficult, but we don't teach them because we don't have to think about them. Why should anybody worry about this stuff?

(00:46:38):

Urbanization has done two things, many things, but the important things that it has done from an ecological point of view is to separate people psychologically from the ecosphere and separate them physically from the ecosystems that actually sustain them. So many people can live all their lives, and most of our young people in school, in cities with no psychological or physical sense of connectivity to anything outside of themselves. So in some sense, it replicates the economist notion that we're disconnected from all things. When the reality is that every city on the planet would curl up and die, were we cut off from diesel transportation, the trucks that are required to provision those cities, the trucks, the marine transportation, the aircraft, there's a huge arterial network needed to supply cities. But in the process, we're depleting the resources of the land base all over the planet.

Nate Hagens (00:47:39):

So let's say that everyone on Earth understood and agreed with your diagnosis of overshoot and carrying capacity and everything that you've been talking about, but that none of the effects of this would manifest for 50 years. Meaning, we could continue everything roughly like today, but in 50 years, there would be all of the negative things that we can imagine. Would that change anything? Or are we such a biologically short-sighted species that would be like, "Oh my god, that's my lifetime, so it's not going to happen in my lifetime. I'm not going to change." What do you think about that?

William Rees (00:48:23):

Well, I think you've put your finger on it right at the end there. So again, humans are an evolved species like the others. And one thing that we have evolved to be is shortsighted. There's a number of wonderful papers on the nature of myopia. So even economists have recognized this in the concept of discounting. So we tend to prefer our present. We tend to prefer our close relatives and friends, and we tend to

prefer our home places over distant futures, other people who are complete strangers in other places. In fact, if you think of climate change, most people in our country or the United States or Canada think, well, it's probably important, but it's probably mostly going to hit somebody in India or in other lands far away. So it's not...

Nate Hagens (00:49:12):

Except for that suburb of Vancouver last year.

William Rees (00:49:15):

Oh, sure. And we all get hit from time to time. But the point is, it's still most people a distant prospect. So if you're a politician, you would much rather risk future damage to somebody else somewhere else than to impose right now on your own people today, constraints on their consumption, their growth, and all sorts of other things. That's a certainty. And it's certain to get you thrown out of office. So we have no incentives in the system being natural discounters to do anything about it. And if you tell me something's going to happen 50 years in the future, and I'm an economist, my automatic response is, well, then we better grow and get rich to have the wealth necessary to develop the technologies to head off those problems that may or may not come in 50 years. So you see, in many respects, it's our human nature that has got us into this conundrum. We operate from a belief set that is guaranteed once you relieve the negative feedback that get us into a crisis situation.

Nate Hagens (00:50:27):

But it's also human nature that has allowed you and I to have this conversation, the technology that is allowing someone in Vancouver to talk to someone in Minnesota and the care and wide boundary empathy that we're doing this to hopefully somehow affect steering away from the worst trajectory and the pro-social sharing of information to others using technology. So this too is part of human nature.

William Rees (00:50:59):

Of course, it is. I mean, nothing's ever black or white. But again, Nate, first of all, the world is not a uniform place. It's incredibly heterogeneous. So you and I are a very minority culture now. The advanced societies that perhaps a quarter of the world's people who have the privilege of doing what we're doing. There's another 800 million people, nearly a billion who don't get enough food to eat every day. Who aspire to acquire the same level of at least material comfort as middle income countries. And then there's the middle income countries which are not only growing economically and hence consuming more and more, but have still, a very high population growth rates. In fact, I've just finished a paper that shows population growth is one of the major drivers of overconsumption. So it's not a uniform place to say something.

Nate Hagens (00:51:57):

Yeah. Well, I was more getting on to the cultural evolution side of things. There is human nature, but is it possible that instead of universities advertising the STEM programs, science, technology, engineering, management, that it becomes STEEM and we put an extra E in there for ecology? I mean, I guess, I'm

asking two questions. Could ecology become more prominent in our educational awareness around the planet? And then, a second question is, we now know, thanks to the work of you and people like you, where we came from, how we got here, what we're doing, what we need, what the consequences are, what sort of limits there are, what technology in tandem with hydrocarbons and fossil minerals can provide. Is this a, "we had to go through this overshoot, we had to train people as human ecologists to figure out our situation?" Is that worth anything? Can that self-awareness as a culture at the height of the carbon pulse amount to some possibility for change?

William Rees (00:53:23):

Well, of course, it can. Look, I hate to be pessimistic about this, Nate, but we've reached the point where what you're suggesting involves what's called social learning. It's a huge change in the nature of our education system, which itself will take a decade to implement. And then, for it to have any impact on the way graduates think and affect society is another two or three or four decades. So social learning is a very slow way of moving us through the kinds of crises that I think we're about to head into. So yes, it's a wonderful dream, but keep in mind, there's no incentive for most people to do it. You and I are talking here, we think this is necessary, but we're two people and not many others would agree that this is a possibility at the present time. I see no evidence whatsoever in my own university of anything like this taking over.

(00:54:27):

In fact, I'll go a little bit further than that. There's resistance to this idea because it goes against the fundamental grain of the way people think today, point one. Point two, if you plot, you said, we know all of this now. We knew all of this 50 years ago. I mean, in fact, exactly 50 years ago, The Limits to Growth study was published. And before that, we had Rachel Carson, we had dozens of other authors heralding the kinds of things that we now see occurring around us. But if you plot the trend lines for various pollutants or resource consumption against the number of meetings and so on that have taken place to declare an end to all of this, there's no effect whatsoever. So for example, we've had what, something like 30 climate meetings, 36 maybe, there's been 27 COP meetings, there's has been six formal agreements, all of them oriented toward reducing human emissions of carbon dioxide.

(00:55:31):

But if you plot the dates of those along with the scientists warning to humanity, the limits to growth book at any other number of major announcements, they've had no effect whatsoever. The trend line just keeps going on. So what does it take for social learning to kick in to have a significant effect on these trendlines? And I see no evidence whatsoever that there's been an effect in the past 50 years, nor is it likely that there will be an effect in the next 20 or 30 years, which I think is critical to resolving this in a relatively peaceful manner. Not peaceful, but less chaotic manner.

Nate Hagens (00:56:15):

I'm going to come back to that because I have some questions on that. But can you, as a former college teacher - do you still teach? No.

William Rees (00:56:27):

No, I'm not formally. I mean, I get invited to do guest lectures from time to time, that's it.

Nate Hagens (00:56:32):

Right. Can you speculate, Bill, on the current relationship between science and post-modernism in the universities around North America or just on the scientific process in general? Circa 2022.

William Rees (00:56:49):

Look, I've been out of it for 10 years now, Nate. So I think I'd be sticking my neck out. My general sense is that post-modernism has been a catastrophe for teaching in universities. I used to get students standing up in my classes from other departments, not so much our own planning students, but I'd get economists and sociologists coming in and say, "Well, isn't that just your opinion?" And after all, there's no objective reality, it goes back to this social construction of reality that we were talking about earlier. That it's post-modernism in its radical form, really suggested that whatever one person thought was equivalent to whatever somebody else thought, regardless of the evidence based upon any of these kinds of theorems.

(00:57:40):

So we wound up in a situation where you would get into class debates where people simply insisted that their view was as good as any other view, and who are you to say that I'm not right? So that I think has been a catastrophic development, and I don't know the extent to which it still exists, but the whole woke movement is moving as I think even further in that direction where evidence doesn't mean a thing. And what matters is what you think about things, how you feel about them, much more than what the evidence says.

Nate Hagens (00:58:15):

Tomorrow actually, the podcast that will be coming out on The Great Simplification is Tomas Björkman, who had a really great example here on the relationship between oxygen and money, that if everyone agreed that we didn't need oxygen at all and we voted on it, it wouldn't mean a thing because we absolutely do need oxygen. But if we decided that we didn't need money, which is a social construction of claims on energy and resources and such, we could do without money if we created some other alternative metrics. So there are things that are biophysical realities that someone's opinion doesn't matter, but there are other things that are socially constructed. So I do kind of like to think about it that way.

William Rees (00:59:01):

I do too. In fact, I keep saying things like this. I did a paper not long ago in which I pointed out that economics is a social construct. There are many different forms of economics, communist economics, neoliberal economics, and so on. But they're all invalid to the extent that they don't recognize there are certain biophysical realities. Which if they are not incorporated into an economic theorem, invalidate that economic theorem. So you're absolutely right. There are certain real physical phenomena which

simply are, and what you think about it makes no difference whatsoever, they are. But things like civil rights, democracy, communism are pure constructs of mind. They don't exist in nature outside of the human domain. So those are things that we can change, but we cannot change the fundamental biophysical realities and the necessity that we have as human beings for fresh air, fresh water, decent food, and so on and so forth.

Nate Hagens (01:00:12):

I've parsed that into the term energy blind, but I think we're also ecology blind and systems blind as you've kind of pointed out. So piggybacking on that, could a broader understanding of biophysical reality, either self-taught because people are learning on the internet or YouTube videos, or formally taught in high schools and grade schools and universities, help in mitigating our upcoming reality? Or does it just make people more depressed and anxious? Big question.

William Rees (01:00:56):

It's a huge question. I'm not sure I can answer it. I think that knowledge is liberating if you actually understand the nature of that knowledge. We're in a situation right now where this, I mean, you'll read a, I read a hundred papers a week. Everybody is talking about what must be done, if only we changed our value system, if only we change our behavior, if only we change this... It's all about the what, what, what, what. And there's almost no focus whatsoever on the how, how, how, how. So how is it that you go into a culture, such as Western Techno-Industrial Society, where our entire political foundations, our economic foundations are dependent on the concept of perpetual economic and material growth and tell people, well, there's a limit on that.

(01:01:55):

And now in order to be sustainable, we, in the Western world, in fairness to other millions of human beings in poor countries, we have to reduce our consumption of energy and material by 75 or 80% so that the impact that we have is equitable and fair. And everybody living at that level would be able to live within the short term carrying capacity of the planet. How do you do that? By what political means? By what policy measures do you take an entire culture and convince them that they need to reduce their material well-being, at least that's how they will perceive it, by some 75 or 80%?

Nate Hagens (01:02:41):

You couldn't do it for 5% even. So no, that's not going to happen.

William Rees (01:02:48):

So what are we stuck with? We're stuck with a-

Nate Hagens (01:02:51):

You know my view, Bill, is that we are not going to tighten our belts, but the momentum and the metabolism of the financial overshoot, which is overlaid on top of ecological overshoot, is going to snap back. That rubber band is going to snap back and there's going to be a 20 to 40% drop in the size of

the economy in the not too distant future, and from that moment, predictions are futile. But we could then, if things are in place ahead of time, could be resource and carbon taxes, all kinds of different possibilities. Because if such a drop were to happen, we would only go back to 1990s level of GDP, which wasn't a disaster.

William Rees (01:03:37):

Of course not.

Nate Hagens (01:03:38):

I'm trying to plant the seeds of what could we do during that moment or ahead of that moment. I mean, we are in the liminal space between total belief in economic growth forever, and the post-growth living. These years that you and I are doing these conversations and we're having emails and writing papers and doing podcasts, this is the liminal space between those two eras. What can we be doing? What recommendations do you have? Even if they're not practical, what can people think about?

(01:04:16):

I mean, I do personally, I've gotten tired of watching environmental movies. "Look at what we're doing to the oceans, look at what we're doing to elephants. But wait, it's not too late if we do these wind turbines and circular economy." And there's always got to be a hope, little carrot at the end. And I think, I don't know what you think about the word hope. I do think humans need something to look forward to, and that's a dopamine thing. We need to have a motivation, but it has to be grounded in some biophysical reality. And I think there are lots more humans than you might think, Bill, that are ready for that path, which is the whole goal of this conversation. So what do you think?

William Rees (01:05:08):

Look, I'm on your side, Nate, but I look at history, and I look at our current situation, and look at the directions we seem currently to be heading. So if you ask me what we could do, you've mentioned one thing already. I think ecological tax reform is an extremely important first step that we could as a society, in theory, take. And by that I mean that we attempt to move toward what I would call full cost or full social cost pricing of our goods and services. Right now, almost everything we consume is produced at less than the true costs because we're allowed to pollute, we're damaging the ecos, we're changing the climate. All the climate damage costs are really the costs of production that have not been included in the prices of goods and services that we... Now, the problem is what's been the success in your country in getting even a simple carbon tax implemented across the board?

Nate Hagens (01:06:11):

Zero.

William Rees (01:06:12):

Absolutely. So if we started talking realistically about the political willingness of a population, keep in mind that we go back to our earlier conversation. We are still largely in ignorance about the nature of

our dilemma. So there needs to be a huge catch-up in the educational system, in the popular media. The media don't consider these issues, but why don't politicians even get up and describe the situation in real terms? We have to do this because they don't. Because for one thing, they're beholden to the corporate sector that has no interest in imposing these terms on their current.

Nate Hagens (01:06:54):

Well, and the other is from a discounted standpoint, the damages from climate change are largely in the future, the big damages. And so if you discount that at any positive rate back to the present, they're very small.

William Rees (01:07:09):

Well, they aren't any longer, Nate, but politic... Again, it goes back to something I said earlier. Our politicians would much rather risk damages in the future that may or may not occur or are more likely to occur to other people far away than impose immediate pain upon their own people today. That's the dilemma they find themselves in.

Nate Hagens (01:07:32):

Put on your crystal ball, Bill. Will nations in the world ever have systems, ecology, language, and politicians talking about the things you're talking about today? Will that ever happen?

William Rees (01:07:52):

I don't believe it will, Nate. Listen, we are embedded in a culture that has a set of beliefs, values, assumptions, and narratives that have largely been socially constructed during an era of abundance. You and I have lived through an era of unprecedented abundance during which a whole set of completely unrealistic and false assumption didn't matter. Even if they were wrong, it didn't matter. And so we have acquired an incredible cultural momentum such that it becomes almost impossible to start even here where we have the resources to do so. To make matters worse, we've spread this set of beliefs, values, and assumptions to the entire world. So we've created a set of human expectations that they too can follow in these trends. By the way, they feel absolutely that they have the right to do so and condemn us for not allowing them to do so. And by the way, they're correct.

(01:09:02):

They're absolutely right in this. There's no moral reason why they shouldn't be allowed to follow the tracks that we followed. We didn't pay any attention to the constraints. Why should they? So I guess I see what we could do is completely separate from what we will do because of the inordinate momentum that our culture has acquired in just in the past 50 years. Combine that with something I think most people, again, don't understand and I'll credit Albert Bartlett with saying "the greatest shortcoming of the human race is a inability to understand the implications of exponential growth." One half of all the fossil energy, oil and gas, particularly ever used by human beings, have been used since 1990. I was born in 1943. 90% of the fossil fuels used by human beings has been used in my lifetime. So with exponential growth, you have a constant doubling time, but the amount of materials and energy and

whatnot used during one of those doubling periods is equal to the sum of all the energy and material used in previous doubling periods.

(01:10:12):

So here we are on a planet expecting to double the scale of the economy in the next 35 years or so, increase the population by what, 2 billion or so? And we're already in a state of overshoot by something like 47%. So if we maintain the current relationship between energy and resource use and the scale of the economy, we will consume more stuff in the next 35, 40 years than has been consumed since the, say the beginning of the industrial revolution at great damage to the planet. We're already, as I say, in a state of at least 40, 70% overshoot. So I don't see that that's a biophysical possibility. I don't see that it's conceivable in the short timeframe we're talking about here because of this exponential function for social learning to catch up to the biophysical reality within which we find ourselves. So yes, we could, but we won't for the reasons, many of the reasons that we've been talking about.

Nate Hagens (01:11:20):

So you were born in 1943 and you just said that our culture, our species has used 90% of the fossil carbon hydrocarbons ever since you've been alive on the planet. Do you feel like you as a human being hit the lottery that you won or you have gratitude or do you feel shame or sadness that simultaneous with that there's an unfolding tragedy? How do you at approaching 80 years old, look at that all?

William Rees (01:11:56):

All of those things, again, we're no different from any other species. Human beings have a tendency and will consume all the available resources. We could get into a big argument about this around first nations and indigenous people, but I'm not going to get into it because I'd have to... Oh, I will get into it. Let me say this, that in many cases the relationships, the stable relationships that indigenous peoples have developed with their natural environments occur after they've obliterated the natural environment. They incur after they've hunted out all of the megafauna, the large easily caught species. If you just think of New Zealand, which has been settled since Christ, it's 800 years ago or so, 12 species of gigantic birds, the moa went extinct as a result of the deprivations of the indigenous people that now occupy New Zealand.

(01:12:52):

Australians - a wonderful book by Tim Flannery called The Future Eaters. The decimation of populations of large mammals rather, or marsupial mammals in Australia just follows the progression of the occupation of that subcontinent by aboriginals in the last 50,000 years. So yes, we can develop a harmonious relationship with our ecosystems, but it's often only after we've inserted ourselves into those ecosystems and appropriated the habitats and food chains of many of the mammals that-

Nate Hagens (01:13:31):

Do you think that 800 years ago in New Zealand or Australia or any one of these prior cultures that had a negative effect on the population of megafauna, do you think there were a few environmentalists at that time saying, "Wait a minute, look at the population of moa. They're declining, we need to hold

off." Or has energy privilege living in the era that you've just described, allowed an environmental ethic to populate and have this podcast and lots of people worried about climate change, et cetera? Is our concern for the environment a product of our energy surplus?

William Rees (01:14:17):

I think our concern for the environment is a product of our capacity to see that it's coming apart around us. But listen, Nate, I live in a privileged position. You live in a very privileged state. And neither of us have voluntarily taken the steps that we need, we know need to be taken to reduce our standard of living to the point that it could be shared equally by 8 billion people on planet Earth.

(01:14:48):

So again, I just really have to emphasize here that knowledge per se doesn't change behavior. Knowledge per se, does not change behavior. There's been a number of studies of the relative purchasing patterns of the best informed people on the environmental issues compared to the average population, and there's virtually no detectable difference. So simply knowing the nature of our circumstances doesn't really alter behavior all that much. Once at a meeting of what was called the heads of meeting committees at my university suggested to my colleagues that perhaps it would be smart to show leadership to the community by refusing our next salary raise on grounds that we were already overpaid and over-consuming relative to the equitable capacity that we were entitled to.

(01:15:45):

I was practically run out of town. I can't think of a single circumstance in which a significant number, society, let's just leave it at, that has voluntarily said, "Okay, we've screwed up. We've now got to cut back to the point where this, this and this is going to be the case, and we will do that on behalf of the future." I just don't see human beings in that light at this time.

Nate Hagens (01:16:17):

Well, I've certainly not cut back to be the equal share of 1/8,000,000,000th of humanity, but I have cut back quite a bit from when I worked on Wall Street 20 years ago. And I think the issue now is those people that can simplify first and beat the rush, not to save the planet or to be equitable per se, but to be more resilient and flexible and act as pilots or examples of a lower material throughput on the future, that's not a bad idea.

William Rees (01:16:49):

No, of course it's not a bad idea. In fact, if I have some hope, it's a very large number of NGOs and community organizations that are attempting to do exactly what you're talking about. So they're fringe organization, I think of them as the lifeboats. The mainstream society is the Titanic, and these little lifeboats are going out there exploring what the future might look like with a much reduced material lifestyle, with much greater community development, with much greater cooperative instruments and so on and so forth.

(01:17:27):

But I, look, I have to wonder myself whether this is only possible because this is a time of relative abundance. What happens when push comes to shove and the grocery stores don't have supplies? What happens when you can't get around? What happens when we have to cut down every tree in a neighborhood to heat our homes and so on and so forth, should fossil fuels become too costly or simply run down in the next 30 or 40 years, and there's no reasonable substitute in the form of alternative so-called green energy, which to my mind so far is mythic. So again, it's the sheer momentum of the situation that scares me more than anything else. And the fact that we're sending out these little lifeboats is encouraging. It's hopeful, but I just wonder whether they're going to founder in the eddies and whirlpools created by the sinking of the much larger ship.

Nate Hagens (01:18:30):

I've known you for a long time, and I think you're such a kind and wise man, but you always at the same time kind of bum me out when we talk.

William Rees (01:18:41):

Well, I'm sorry about that. Look, I don't know what to do about it, Nate. And if I was-

Nate Hagens (01:18:49):

I know, I want you to be honest, and I think we have to have an honest conversation as a culture. I did not mean that comment as pejorative. I love you man, but this is heavy stuff, and you are not afraid to say what you think in your lifetime of scholarship on this. So I appreciate that.

William Rees (01:19:10):

I think much of it comes, Nate, it goes back to just basic population ecology. And the simple fact of the matter is that any species capable of exponential growth will respond to a period of resource abundance. And many species in nature go through cycles. Okay? It's a boom bus cycle. Things get good, we expand, then negative feedback kicks in, we crash, then we get good and expand. Humans have never done that, not globally. We've done it locally.

(01:19:42):

But now for the first time we've managed to, in effect, colonize the entire planet. We've grown by, listen, we are growing by liquidating our capital. As a former financier, you should understand what that means. You cannot continue to grow by liquidating the natural capital basis of your own existence. And so we get to the point where we become so large, there's simply insufficient there to maintain even the maintenance activities, let alone further growth. Then things get really tough because you're now in a competition for the residuals.

(01:20:21):

And by the way, what do you think is going on in the world today around food and energy and the war in Ukraine and cutting off this, that, and something. We're learning very quickly. And maybe this is a good thing, the extent to which we are dependent on fossil fuel, the extent to which we are dependent on global trade for fertilizers. What happens when we can't grow food with fertilizer any longer? And

we haven't taught ourselves about agro-ecology and all of the other fundamental ways of growing food in equal abundance that don't destroy the planet in the process. We've gotten lazy. We're intellectually lazy. We're technologically lazy because look, agro-ecology is a technology of superb potential, but we don't do it because it's easier just to throw poisons and fertilizers out on the landscape and make more money in the process.

Nate Hagens (01:21:18):

Yeah, we're going to need a lot more people that have to go back to the land instead of 3% working on agriculture. It's going to have to be something higher.

William Rees (01:21:28):

I once worked, look, right now, look, if you go back to 1920 in the United States, there were 20 million horses working the fields. They've been replaced by tractors. There'd have to be 75 or 80 million horses working the fields now just to give you the same proportion of horses to people as there were in 1920. But now you've got to have three hectare or three acres of land to feed each of those 80 odd million horses. So we, it's a hugely complicated issue and we haven't really begun as a culture to think it through. If we could stimulate one senior politician, supposing the next president of the United States stood up in the world courts, I mean the forum that presidents of the United States occupy and said, "Look, we've really screwed up here and this is what we've got to do instead." That would be an earth-shattering moment, a moment of unprecedented leadership that would force everyone from the Prime Minister of Canada to Macron in France to say, "My God, you're right." When is it going to happen?

Nate Hagens (01:22:34):

You and I both know the challenge of that is any person that would be willing to say that wouldn't choose to be president, nor would they get elected.

William Rees (01:22:45):

Well, that's right.

Nate Hagens (01:22:47):

So Bill, you are known for among many other things, being the co-creator of the ecological footprint. What was the thinking behind this metric? What is the ecological footprint? How does it differ from the carbon footprint and what has been its impact since you developed it?

William Rees (01:23:06):

The thinking behind it, Nate, was that I had a profound sense that humans remain utterly dependent on ecosystem, the productivity of nature for our basic survival. And yet here we were confronted with an economic model that suggested we were decoupling from nature and that the economy was a separate functional entity altogether. So I set about to disprove that thesis. I had been challenged at one point in my early career that ecological ideas such as carrying capacity were utterly irrelevant to human beings.

So I thought if I take the economists seriously and think that we can trade infinitely, they're right. Why should this region be limited in its population, for example, if we can import resources from everywhere else. But there was something basically wrong, it's still stuck in my craw. So if you turn the carrying capacity ratio over, instead of asking you how many people can this region support, which becomes irrelevant if you can import stuff from all over the place, ask a different question.

(01:24:12):

How much area, how much productive ecosystems is required to support this population no matter where on earth those productive ecosystems are? So it struck me that if we could develop a way of looking at this, a model using material flows analysis, incorporating trade flows into the consumption patterns of a particular region, and if we could quantify the amount of land area required to produce all those goods and services consumed in this region and extrapolate that out into the rest of the planet, we would have some idea of the total, I used to call it the human impact index or something of that nature.

(01:24:53):

By the way, I got a new computer which had a smaller tower footprint on my desk, and one of my colleagues came in, I was just writing the first paper on this other concept, and he said, "Oh, you got your new computer, how do you like it?" And I said, "It's fine, there's a much smaller footprint." Another epiphany. There it was. I was writing about the ecological footprint, the amount of land, let me define it formally, A population's ecological footprint is the area, the physical area of productive ecosystems required to produce all of the biological resources that that population consumes and to assimilate its wastes. Basically we looked at carbon waste, so it becomes the carbon footprint.

(01:25:38):

So when we undertook this kind of modeling, we discovered that the eco footprint was an inordinately powerful tool in convincing students in our own program, a land use planning part of the program, that the city of Vancouver, for example, wasn't the dot on the map, but rather an area about 325 times larger spread all of the planet. And we could create a map with little stickers and arrows showing where all of our land imports took place and so on. So that's what an eco footprint is. It's a way of showing through trade flows and direct consumption data, it's a consumption based index and it corrects for trade, both imports and exports. It's a way of showing the absolute quantity of land required to sustain any defined population.

Nate Hagens (01:26:29):

So what's the ecological footprint of global human civilization?

William Rees (01:26:35):

Right now? It's something over 21 billion hectares. So by the way, let me explain something else. I was interested in showing this connectivity to the land. So it was ecosystem appropriation, really the appropriation of ecosystems productivity by the expansion of the human enterprise that I was interested in measuring. That's what the footprint shows. So it leaves out all sorts of things. We don't account for many forms of pollution or the destruction of land by this or that or desertification. So

there's all sorts of other things going on, which if you added them into the footprint, would make the footprint estimate much larger than it is.

Nate Hagens (01:27:16):

Well, not to mention that you're measuring ecosystem impacts and productivity, but we're also adding historical productivity to our system in the form of fossil carbon.

William Rees (01:27:29):

Absolutely. So the basic global footprint now is over 21 billion hectares, but the amount of biocapacity available on earth is somewhere between 11 and 12 billion hectares. So the actual quantity of-

Nate Hagens (01:27:45):

How can consume more than we have?

William Rees (01:27:48):

By depleting-

Nate Hagens (01:27:48):

... with the exception of fossil fuels.

William Rees (01:27:50):

Okay, you're a financier or used to, think of interest in a bank account. If you had a million dollars in a bank at 5%, your income would be $50,000 a year. Now if you chose to live on 50,000 a year, you could live in perpetuity. This is a sustainable, what we would call sustainable income because you haven't touched your capital. Well, ecosystems, the soils, the fisheries, and so on and so forth, forests, grasslands are capable each year producing an annual output. If human beings were content to live on that annual output, we could live in perpetuity without destroying the capital base, as it were. But instead, we've continued to grow and grow and grow under the illusion that there are no limits because trade flows abolish the illusion of limits, for example. It's only one of many things. Technology helps to do that as well.

(01:28:44):

So what we've done is managed to grow the human economy beyond the biocapacity of the planet. But that's why fisheries are being depleted. That's why we've eliminated 94% of the mammalian biomass on the planet and replaced it with humans and our domestic livestock and so on. So we are living literally by liquidating the basic natural capital base that we are utterly dependent upon. Growth is destructive once you're beyond carrying capacity.

Nate Hagens (01:29:15):

So to summarize that roughly, rough numbers, we have 10 billion hectares of productive land. We're using 20 billion hectares worth of resources. So we're doubling our consumption, drawing down our bank account. At the same time, the whole enterprise is supported by fossil energy and materials.

William Rees (01:29:39):

Absolutely.

Nate Hagens (01:29:40):

Which makes that fact worse.

William Rees (01:29:42):

You've put your finger on an extremely important point. The means by which we have been able to over exploit every ecosystem on the planet is through the use of fossil energy. We all have these energy slaves digging deeper, our farming, more and more soils, producing fertilizers and pesticides to enhance the productivity of those things and keep in mind the footprint just measures the amount of land we're using with all of those inputs. If the inputs were eliminated, if we abandoned fossil fuel use or ran out of economically viable supplies of fossil fuel and we're no longer able to fertilize or irrigate and so on and so forth, then the natural footprint would increase by probably half an order of magnitude. So we're in rather more dire straits than even eco footprint analysis shows.

(01:30:32):

Let me just make two final points. We are currently about 75% in overshoot. We're using the planet as if it were 75% larger, and that's an underestimate. And to put it in very simple terms, the per capita biocapacity on Earth is about 1.58 hectares. That's in 2018. So each of us would be entitled to the productivity in assimilative capacities of about 1.58 hectares. A hectare is 2.47 acres. But on the planet right now, the average eco footprint at inadequate average material standards is 2.77 global average hectares. So we're almost, as I say, 75% over the top. Each of us... And that's average. In North America, we're eight hectares per capita, which means we're three or four times above the fair share of our planet.

Nate Hagens (01:31:28):

Does that include land all around the world that's maybe less productive or non-productive like deserts and high mountains and things like that? This is productive land.

William Rees (01:31:37):

No, we're only counting in these numbers. We ignore deserts and ice caps and that sort of thing. So we're looking at those lands and waters that are capable of producing adequately to support a human population.

Nate Hagens (01:31:51):

And you had a second point.

William Rees (01:31:53):

I think maybe I made it.

Nate Hagens (01:31:54):

Well, here's-

William Rees (01:31:54):

That our per capita...

Nate Hagens (01:31:58):

I think it's even worse than that, what you just said, because if there's 12 billion hectares and we're using 21 or whatever the number you said, that presumes that all those hectares of productive capacity are for humans and there's 10 million other species.

William Rees (01:32:16):

Absolutely. And as I've talked about many times, the expansion of humanity into other species' ecosystems. I mean, this is one of the great ironies. Human beings, as I've said, are the single greatest consumer organism the planet has ever seen. We're the major predators, we're the major herbivores, the major carnivores, and every single accessible ecosystem on the planet, we're part of those systems in the biggest way you can imagine. And yet we're operating from a model that says, "Well, we're decoupling from nature. The economy is dematerializing." In fact, every growth of the economy, every growth in income increases the human demand on the shrinking biocapacity of Earth. It's a perfect example of how the mental models from which we live often have no correlate in the natural world upon which we are living. What an incredibly stupid situation for a so-called intelligent species.

Nate Hagens (01:33:16):

So of course, I know most of the things you're telling me today, but if someone was trained in economics or in business and was listening to this podcast, this sounds obvious, but it also sounds, "How come I've never heard this before? How can this possibly be true?" So let me just start this where I'm starting to ask this of all my scientific guests that have done work on something, how might you be wrong about this? About overshoot carrying capacity or any of the things we've discussed so far?

William Rees (01:33:52):

That's a really good question, and I have to say I don't think we could possibly be wrong, Nate. If you think of climate change, nobody disagrees. Even economists realize now we're deeply into climate change. But it's interesting how they dismiss it. For example, a Nobel laureate economist is well known for saying, "Well, climate change is likely mostly to affect agriculture. And since agriculture is only 3% of GDP, just two years of growth, and we've obliterated the effects of climate change." Well, that obviously is an... That's what I call a keyhole vision of the nature of reality. And yet that's where most of us are coming from. So I suppose we could be wrong. Here's how we're wrong. We're underestimating the total

human impact. We are underestimating the total human impact. So I admit to being wrong, but I'm being wrong in the kind of conservative cautious way of saying, "Look, if I'm wrong, what I'm saying is an underestimate of what's going on here."

(01:34:57):

We can't avoid the reality that humans are biophysical entities, that we are ecological species that have evolved as components of nature and that we require just to breathe a certain energy flow. Historically, that energy flow has always been solar energy through our food supply. We broke from that, oh, just about 200 years ago. And with this exosomatic or outside the body source of energy called fossil fuel, we vastly increased our capacity to exploit and destroy the planet. And so we see everywhere measurements of the decline in forest fertility. North America has lost 50% to 70% of the organic nutrients that took 11,000 or 12,000 years in the Postglacial period to accumulate. So in less than 200 years of deep tillage agriculture, half of that's gone or 70% is gone. And the only way we maintain the productivity of the Great Plains is through the massive applications of fertilizers and pesticides and increasing irrigation. US agriculture, heavily irrigation dependent, but the Ogallala reservoir, which surprised so much of that, the groundwater supply is drying up.

(01:36:13):

California is in deep trouble. They provide what a third of on the table vegetables in North America. And yet we're within a decade or two of seeing the biophysical basis of that productivity destroyed because of the overshoot that we can illustrate clearly through ecological footprint analysis. Now, the other side of the coin is, well, technology will solve all our problems. That's the economist talk. But it's an article of faith. Josh Farley, a very good friend of mine who said, "Look, I'm immortal. How do I know? Because I've lived for 21,000 days and every day that I live is additional affirmation of my belief that I am immortal." And that's how economists think.

Nate Hagens (01:36:57):

You can make the same chart of a turkey that grows and lives until a week before Thanksgiving. So you have-

William Rees (01:37:05):

So far so good.

Nate Hagens (01:37:07):

And Josh is a very good friend of mine, as you know. I have just made an impromptu plan after hearing your last four minutes. I think it would be great to have a friendly debate between you and someone like Bjorn Lomborg, the skeptical environmentalist who is a reasonable person, but he has a completely different lens with which to view the future than you do. The challenge is that it's kind of like getting a Christian and an atheist or a Muslim and a Christian in a debate, even if they're well-intended people, if they're using different lenses with which to view the future, it's almost impossible to have a conversation. But I'm going to work on that, Bill.

William Rees (01:37:55):

Okay. Just for your information, I've actually debated Bjorn right here in town.

Nate Hagens (01:38:00):

Oh, you have?

William Rees (01:38:01):

Oh, yeah. And in Nature Magazine, he published a critique of ecological footprint analysis, but it was clear he didn't understand where he was coming from, and I had to rebut that critique. So that's in the record.

Nate Hagens (01:38:16):

So Bill, we don't want your computer to run out of batteries. So I'm at the point of the interview where I ask you some questions, some personal questions that I ask all my guests. So first of all, given your lifetime of scholarship, of teaching, of research, of reflection on these issues, do you have any personal advice to the listeners of this program at this time of, as you have adroitly pointed out, global overshoot?

William Rees (01:38:48):

Yeah. Look, this is an extremely confusing domain, obviously, and there are many different, as you put it, windows on reality. So I think every person who has any even whisperings of concern about this has a personal obligation to do what they can to understand the scientific and material basis for the various claims that are being made. So first of all, educate yourself. Follow those rabbit holes where they take you, and then come to some kind of considered judgment about the nature of reality facing us. Keeping in mind that you and I, all of us are biophysical entities that require a certain quantity of energy, a certain quantity of material just to maintain ourself, nevermind to grow anything. And the point is, this is a finite planet that has a limited productivity, which is in now steady decline precisely because of overshoot and the fact that we're depleting those assets.

(01:39:47):

So self-education is an extremely important thing. Then recognize that this is a... It's a collective problem. One of the kind of false leads we've been given from our current very individualistic capitalist kind of society is that there's 101 things you can do to save the planet. And we see over and over again this offloading of responsibility onto the individual. But individuals can't do screw all. I can't as an individual create the rapid transit systems in my city that would greatly reduce the transportation footprint. I cannot as an individual implement the ecological tax reform, the carbon taxes necessary to change the economy through the price incentive into more conservative ways of resource use and so on. So individuals have very, very limited capacity as individuals, but as a collective, we theoretically, certainly in democracies, have control over the circumstance. So you have to become a political animal here.

(01:40:58):

Even writing letters are important. I used to understand, I worked for a political party, I will leave it unnamed, but for every 10,000 letters they got, they knew there was another a hundred thousand people out there that thought the same way but didn't bother to write. So letter writing can influence the way politicians think. We've got to appear at political meetings, we have what we call all candidate party meetings up here where during an election, representatives from each party, there's several, get to speak. We need people in the audience to ask the embarrassing questions that we're talking about right now to force them to begin to think. Ultimately, however, I think, look, you and I are now engaged in and all of us on this podcast in what's called social learning. It's an exercise in passing information, gradually increasing one's cognitive understanding of the situation, raising to consciousness the nature of the problem.

(01:41:55):

But it takes decades to have an effect. We're getting to the point now where we don't have decades, where what is going to make real change is people in the thousands, in the 10 thousands on the street raising bloody blue hell about the things that they can see going wrong on the planet today, and I'll give you a perfect example that I'd like to see happen. Right now, my own government, your government are both subsidizing the production of EVs, electric vehicles, on grounds that this is a great salvation for climate. Well, look, first of all, climate isn't the real issue, overshoot is.

(01:42:32):

Secondly, if you do a full lifecycle analysis of an average large EV, it's a worse option ecologically overall and also culturally and socially because of the slave labor involved in the mining and the refining and manufacturing and so on and so forth, it's probably a worse option than a standard internal combustion vehicle. And yet taxpayers are now being asked, in fact, to subsidize an option which is really engineered not to solve the climate, not to solve overshoot, but to keep the machine going, to maintain investment, to maintain jobs, to increase the expand of the economy. In other words, to maintain what I call business as usual by alternative memes. But it's business as usual that has got us into this situation. So get politically engaged.

Nate Hagens (01:43:21):

And by an electric or non-electric bicycle.

William Rees (01:43:26):

Uh-huh.

Nate Hagens (01:43:27):

So moving on, you are a retired college professor who has outlined the human predicament to students for a long time. What specific recommendations do you have in addition to what you just said for young humans who become aware of energy climate, biophysical constraints, overshoot, and the human predicament?

William Rees (01:43:51):

I guess my first piece of advice is to be aware that they're standing on very fluid grounds, that it is very easy as a student, and I see this all the time, to get sucked into the need to find a job in the existing system and so on and so forth. I think each young person today has an obligation through self-education, beyond what they're getting in universities. Universities don't educate. What they do is narrow your focus in a single discipline. So look beyond that. My education didn't start until I graduated with a PhD and came face-to-face with economists and sociologists and geographers and others who disagreed utterly with what I'm saying. That is the source of real knowledge where you're confronted with your own beliefs, by other beliefs that are totally at odds and you have to reconcile these things. Young people do that. You may decide after doing that, that you should get together with some other friends and even developed some kind of land cooperative in the outback somewhere where you can perhaps salvage something of a life, should The Great Unraveling occur as rapidly as some of us think it may be occurring.

(01:45:07):

If you look into the historical record, a very simple little society called Tikopia, an island in the South Pacific, just a few square kilometers. For some 3000 years, it seems, managed to control its population in the vicinity of 1200 people, 1200 people over 3000 years. But they did it using seven forms of birth control, including by the way, when things got tough in the lean years, the old guys like me would set themselves out into the ocean and disappear. The Inuit in Northern Canada and the US did the same thing, departed on ice flow so that there'd be more resources for young people. Now, I'm not recommending that we do that. I'm just saying that in desperate times people do desperate kinds of things. But we can head off those desperate times by thinking through what our options are, and one of the options is to be prepared for the coming years of deprivation.

(01:46:06):

What tools would you need to survive in the absence of many of the kinds of conveniences that we have today? What would you do if you were left with very intermittent or perhaps no electricity for days on end? We're getting some very valuable lessons, I suppose, out of the current war in Ukraine and because what that war has shown us is the utter dependence of modern techno-industrial countries on a constant steady supply of energy, a constant steady supply of fertilizer, a constant steady supply of electricity and water and so on and so forth. But in the great unraveling, many of those things will just either gradually be whittled away so that we have time to adjust or suddenly they just disappear. What would happen to a city like Tokyo or Shanghai, which is currently utter dependent on fossil fuel transportation for its provisioning. Those cities have ecological footprints several hundred times larger than the cities themselves, but all of the productivity of those ecosystems is being transported into the city where they're consumed and waste's produced and exported out to the city by fossil fuel. Well, what are you going to do when you can no longer provision our major cities with fossil fuel? And there will be no alternatives, in my humble opinion, in the short period of time that we have left to consider.

Nate Hagens (01:47:30):

But that may be 20, 30, 40 years out. So a young person that's 20 years old listening to all this, I was just more curious as to what you would tell them at a dinner table, giving them advice.

William Rees (01:47:43):

I'd tell them exactly what I've said now that you've got to look that far ahead. What are your children going to do? Look, humans unfortunately, and you've illustrated it right there, are naturally conditioned to be shortsighted. Economists call it discounting. Discounting, that is to say not paying too much attention what's going to happen in the future, because after all "not going to affect me, it's other people somewhere else". Well, Nate, it may not be 20 years, it may be 10 years. 10 years ago, I didn't think it conceivable that I would see the obvious evidence of the climate change that was ahead. A year ago in this region we saw billions of dollars of damage to agriculture and communities that were completely flooded out by an unprecedented atmospheric river that inundated this area in rain that we haven't seen ever before. So it's happening. It's happening now, and you can't depend on it not happening for another 20 or 30 years. So it may happen to you. It'll certainly happen to your children, kids, and your grandchildren.

Nate Hagens (01:48:53):

Well, I don't have children for some of the reasons discussed on this call, but I'll ask you a question I didn't intend on. Is there an information hazard here? People that tune into this podcast kind of know what they're getting, but if you could press a button and have the whole world understand what you have outlined in this conversation, would you do that and might that have even worse effects if everyone believed what you're saying?

William Rees (01:49:25):

That's an un-performable experiment. I don't know the answer to that question.

Nate Hagens (01:49:29):

I know, I know.

William Rees (01:49:30):

But I do know this, Nate, that look, we need to have a common understanding of our future and perhaps this isn't the correct future. Maybe I'm a complete bullshit artist and everything I've said is untrue. On the other hand, most people don't know about the kinds of things you and I are talking about. So I think we have an obligation to put that in their toolkit of possibilities so that every individual at some point can better interpret the kinds of information they hear daily coming through the media of one kind or another. Eventually there will be a gelling around the truth about the nature of reality here. My primary hope is that this gelling, this sense of communal responsibility for the future of our species and that of thousands of other species is something we really have to take seriously. And I think unfortunately, many of our cultural heroes today simply don't take it seriously. If you think of the Elon Musks of the world who want to abandon this wrecked planet and start all over again on a dead rock half a million light years away, it just makes no sense to me whatsoever. This planet is still essentially functional, and it makes far more sense to rescue and rehabilitate and reconstruct that which works than to attempt to colonize a dead rock like the moon or Mars.

Nate Hagens (01:51:00):

So slowing down a little here, two more questions. What do you care most about in the world, Bill?

William Rees (01:51:08):

That's a really tricky question. Obviously I love my wife and my immediate friends and family, but in the world, Nate, look, we have romantic images of nature, but I'm one who has been in places. And when I did my PhD research in the Arctic in Canada, I literally wept on the ground sometimes of the sheer beauty and the incredible illustrations of the productivity of life. There were birds nesting everywhere. I mean, I've seen wolves, I've stepped on a polar bear that was sleeping and nearly saw an immediate… That was a really interesting story, but doesn't really fit. It was astonishing. No, look, nature is not all that pleasant. If we go back a couple of hundred years, you're going to have lice and fleas and parasites, and nature is a cool place. It's a competitive ballgame, but it's also a thing of immense beauty.

(01:52:01):

And when you begin to understand how life itself is created, the living film on the planet and maintains and regulates the environment so that all of it can survive, it becomes a thing of immense beauty. Just understanding the way the system operates to self-produce and, look, all the material necessary for the life as we see it, has been recycling through the ecosphere for literally millions of years. You undoubtedly have thousands of molecules that once roamed the great plains of what is now North America as Tyrannosaurus Rex. We are the exemplars of natural recycling, and yet we're totally unconscious of this and think we're disconnected from it all.

Nate Hagens (01:52:46):

I think evolution is one of the most amazing things that has have ever happened. And I think humans puzzling out that evolution happened is equally amazing. And just what you just said is a parallel to that, that the natural world is so beautiful, but understanding how it works, the systems ecology that you've helped us unpack a little bit in this conversation, understanding the drivers, the biogeochemical processes, the trophic flows, how everything is connected, that also is beautiful and maybe not to everyone, but I think to you and certainly to myself and a lot of our colleagues, the understanding of how the human and earth ecosystem fits together is a thing of beauty, I think.

William Rees (01:53:41):

You're absolutely right, and human beings are an ecosystem or at least part of every ecosystem, and that's the thing we have forgotten. Human beings are the major consumer organism in every single ecosystem. We should be husbanding and caressing every single ecosystem upon which we depend, but we're operating from a mindset that says it's not important. We can exploit this to the hilt and then simply move on to the next ecosystem or next planet. An absurd self-defeating mindset in my opinion.

Nate Hagens (01:54:20):

So we have reached the last question, Professor Rees. And given everything you've said so far, I'm reluctantly looking forward to hearing your answer. If you were a benevolent dictator, Bill, and there was no personal recourse to your decision, what is one thing that you might do to improve human and planetary futures?

William Rees (01:54:46):

I suppose the one thing I would attempt to do is to create a new constitution for the world based on the concept of avoidance of overshoot. And that would mean recognition, the need to implement somehow I would think in as gentle and non-coercive manner as possible. A mental attitude, a mindset, totally different from the current mindset from which we operate. Keep in mind the humans don't live in reality. They live in the social constructions the way they think the worlds work. Well, we created a mindset, a paradigm, if you want to call it that, a set of beliefs, values and assumptions that are totally self-destructive because they were created in ignorance as if we were apart from nature. So the new paradigm, the new vision, the new cultural narrative has to be one which sees human beings as an integral component of the ecosystems upon which we literally... Currently we're parasitic, but we now have to become conventionalist.

(01:55:56):

How can we live on this Earth in ways that sustain and support the rest of the systems that support us? And to do that, we need to develop policies that increase equity. That is to say that the distribution of natural wealth among the human species, we need to do that while reducing our overall consumption by at least 45% or 50% that would be 75% or 80% in rich countries. And we need to do this while getting a grip on human population because on a finite planet with a limited reproductive capacity or biocapacity, you can support twice as many people on a little bit or half as many people on this... What am I saying? If you have a given flow of resources, you can either support X people or 2X people, but the 2X people won't be living nearly as well as the X people.

(01:56:54):

So that's a simple relationship, and we have to understand that we're on a finite planet whose capacity is actually shrinking because of our overwhelming predisposition to deplete, literally to liquidate the natural capital that's supporting it. So population control is absolutely, I think, essential in the future if we want to have a reasonable standard living for, say, somewhere around one to two billion people on a planet that could exist in perpetuity, at least for the next couple of billion years. We won't be around for all of that, but let's keep it going.

Nate Hagens (01:57:33):

Well, you are 25 years older than me and seem to have two x the energy, so I suggest you do write such a constitution and maybe it would serve as an Overton window sort of tool for others.

William Rees (01:57:46):

Thank you.

Nate Hagens (01:57:48):

Thank you so much, Bill, for your lifetime of scholarship and speaking truth to power on ecology and these issues. And thank you for your time today.

William Rees (01:57:59):

Thank you very much, Nate. I think you're about the only person who's listened. Certainly none of the politicians have paid a whole lot of attention to what we've been talking about.

Nate Hagens (01:58:09):

There's a lot of people listening.

William Rees (01:58:09):

Anyway, it's been a pleasure talking to you again, old friend. Take care.

Nate Hagens (01:58:13):

Thanks, Bill. If you enjoyed or learn from this episode of The Great Simplification, please subscribe to us on your favorite podcast platform and visit thegreatsimplification.com for more information on future releases.