

“Resource Interdependence”
Plenary Talk

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A guy is standing on the roof of his porch, flood waters up around his waist. A boat comes by and the rescuers say, “Come aboard, we’ll take you to safety.” But the guy on the porch roof says, “No, God will provide.” A little while later the guy is standing on the roof of the house, flood waters many feet higher, and another boat comes by and they say, “Come on, we’ll take you to safety.” But the guy on the roof says, “No, God will provide.” Finally the guy is standing tippy toes on the top of the chimney, and a helicopter comes by and they yell, “Here, grab this; we’ll take you to safety.” You know what the guy says. So a little while later, the guy is standing at the Pearly Gates, and he says to the angel, “What happened? I thought God would provide?” And the angel said, “What do you want? We sent two boats and a helicopter!”

That story was told to me back in the early ‘80s by someone I thought of as a wise friend as I was heading off to live in the rainforest of Borneo. It was a warning, an admonition to pay attention, and I’ve thought about it many, many times in the years since then. It has often reminded me to be attentive to the signs and messages that are out there, and to ask myself, what am I missing, and by extension, what are we, as a broader community, missing?

These days I think there is a very clear message being offered us, but we’re not getting it. There are a lot of parts to this message, so let me take a few minutes to try to lay them out.

First, humanity is riding on three very important, large-scale, long-term trajectories. The first is increasing population -- headed to 8 or 9 billion in the next few decades. The second is increasing resource consumption. Everyone in the world wants three cars in the garage and a TV in every room – and the health and security that goes along with wealth like that. The third is decreasing resource availability -- whether that resource be freshwater, oil, wheat reserves, fertile soil, forests, fisheries, atmospheric resilience, ecosystem services in general, or even the ability of our bodies to carry loads of synthetic chemicals, endocrine disruptors, and carcinogens.

And all of these trajectories are interdependent.

For example:

- We can't feed the increasing populations without increasing water and energy consumption. Some of that water will be for irrigation, but some is for making the energy to pump the water. And we will need petrochemicals, energy, and water for producing fertilizer, pesticides and herbicides, and then yet more water for diluting the waste.
- Another example: We will need to bring more marginal land into cultivation for agriculture, which has an impact on deforestation. The additional tilling increases erosion, and the additional fertilization increases the nutrient loading in rivers that in turn expands the area of hypoxic zones in coastal areas around the world – in those increasingly rare places where major rivers still flow to the sea.
- Another example: We will need more and more oil to grow and move the food. All the easy oil has been found, so we need to drill

in more and more difficult and dangerous places, so we'll have more oil spills and more oil wars. (And by the way, if you think that the recent spill in the Gulf has been a disaster, look into the decades-long and ongoing spills continuing now in the Niger Delta and the Amazon Basin.)

- One more example: Even when we look to alternatives, we have trade-offs. We may end up with more corn being grown for fuel than for food, placing upward pressure on global food prices and leading to more food riots. Or maybe we'll end up with our horizons and all our spare acreage filled with windmills and solar collectors, which won't be so attractive once the novelty wears off and we realize they are simply fueling overconsumption and utility company profits. And on top of it all we may end up in regional or international conflicts over the rare Earth minerals that are required for making all these technologies run.

These three interdependent trajectories -- increasing population, increasing resource consumption, and decreasing resource availability – are the big drivers right now. They've been playing out for a long time, in an increasing number of places around the world, and they are hard to change. But they have brought us all to a very unique point in human history. For the first time we have sufficient scientific knowledge of the past, a sufficient view of the big trajectories and where we are on them, sufficient computing ability, and sufficient social/intellectual/professional approaches to make reasonable projections of those trajectories into the future. We can see where we have come from, and where we are headed, and how our efforts and activities may affect the future. But we, collectively, all of us, aren't getting it. The signs are out there but we're not understanding them.

Climate change – for example -- is a good wakeup call, but in my view climate change is only the crisis *du jour*. It's an instructive crisis, since it integrates so nicely across so many interdependent systems – population growth, energy demand, atmospheric chemistry -- and in fact it may be one of the most important challenges of our time. But it isn't an independent phenomenon, and we won't solve it, I believe, in any reasonable time frame, by carbon sequestration, or by burning ethanol or algal biodiesel instead oil, or by putting solar panels on 3,000-square-foot houses full of electronics and appliances, or by raising organic, grass-fed, hormone-free beef that we then all overeat. Climate change is a sign, and it's pointing at a fundamental problem, and I believe we won't solve climate change without addressing that fundamental problem first.

That fundamental problem, in my view, the message that is being given to us, is that we're all just using up too much stuff, too quickly.

I think one of the best examples of us NOT getting that message, NOT seeing the signs, is that we are feverishly trying to figure out how in the future we will meet projected water, energy and food demands in our ever expanding human economy. How can we expect to meet an ever expanding demand in a world of limited resources? New Mexico water issues offer a great case in point. Our water is already over-allocated, but growth projections just keep pushing projected water demand up. That water, in the short term at least, will come from agriculture, whether we like that or not. The middle Rio Grande Valley was once food self sufficient, as recently as the 1950s I have been told, but no more. If water scarcity in other regions (like California's Central Valley)

keeps worsening, and rising transportation costs drive food prices up, then we may be facing our own kind of food security issues right here.

Fossil fuels offer another important example of us ignoring the signs. It seems abundantly clear that a very large part of the material wealth of the developed world -- the roads, bridges, hospitals, high-rise cities and overstocked mega-stores, our food supplies, transportation and shipping, even our educational systems and health care systems -- are all products of cheap fossil fuels. Sure, we can credit human ingenuity and human enterprise -- but the power for industrialization, and research and development, and our skyrocketing population and consumption has come from gas, coal and oil. And now oil availability, like so many other resources, is on the decline. There is nothing, so far, that can replace oil, nothing so full of energy, so fungible, so easy to get out of the ground (at least up until recently), and so easy to move around and sell. The decline of oil availability -- leading to ever deeper wells in ever more dangerous places is a sign.

The study of ecology and even of human history is replete with the stories of systems that expand, over consume resources, and then collapse. It happens in predator/prey dynamics; it happened on Easter Island, it happens when microbial populations deoxygenate a eutrophied pond. We understand this boom and bust cycle now. And yet as a nation and as a global community we are hell-bent on continued economic expansion. Our addiction is not to oil. Oil is the enabler. We are addicted to increasing consumption.

There's no water crisis, there's no energy crisis, there's no climate crisis, there's no food crisis. We're facing an overall ecological crisis on this planet that is manifesting in the decline of all our resource systems,

all at the same time, and all because of our general, long-term overconsumption of all resources. We are seeing declines in ecosystem services around the world. Those are services provided free of charge by well functioning ecosystems to human systems, and in fact to all biological systems. They include the delivery of fresh water and fresh air, maintenance of soils, fisheries, forests, and the composition of our atmosphere. We're seeing all these declines in specific systems, but if we focus on each of those systems independently, then we are missing the point.

There are lots of solutions. Let me identify a few.

Increasing women's rights and increasing education for women around the world reduces population growth. Family planning around the world reduces population growth. These are no longer solutions that we have the luxury to avoid, or marginalize, or politicize. Population growth, over consumption, limitless economic expansion, and the decline of living systems all over the Earth are issues of U.S national security, of global security, of our own personal well-being and that of our children. We cannot afford to allow these issues to be sacrosanct, and above or beyond discussion.

We need to be moving more strongly toward cradle-to-cradle design and production, so that everything that is designed and built can be taken apart later on, recycled, and reused, with close-to-zero waste streams. We need to be working hard on co-location technologies, so that waste streams from one process become feed stocks for the next. Using urban wastewater to grow algae as a feedstock for transportation fuel and other products is one application like that – although the viability of algae for those uses is still far from proven. Goods and services must be priced so

that they reflect the true consequences of their production and consumption. We need to move beyond the corporate ethic in which capital pursues the greatest economic return, regardless of the consequences to ecosystems, social systems, indigenous populations, and cultures all around the world.

We need to be actively working toward a steady-state economy, outlandish as that may sound -- one that isn't constantly demanding more and more throughput of everything. Economist Herman Daly writes eloquently about steady state economies. We need to figure out how to get by on less material wealth, less travel, less freedom to consume. Moving into the future with the idea that our economies can continue growing, that our consumption of all resources can continue to increase, is absurd, and probably disastrous. The signs are all pointing that way.

This point of view, if you buy it, brings up all kinds of sticky, personal questions. Should we eat meat? (I do.) Should we fly across the country or around the world for work, or conferences, or vacations? (I do.) When my daughter wants me to drive her to a swimming pool half an hour away, should I take her, or tell her no? Should I buy a new, lighter mountain bike? At a higher level, how should we design and re-design our homes, offices, factories, cities, transportation systems? Should we be designing them like some technological breakthrough will allow us to continue constant growth, or should we be designing them like the future well-being of ourselves, our children and our grandchildren, depends upon it.

Reducing consumption is not a popular idea – it might even be “un-American.” What politician can run a campaign on the idea that we will

be less materially prosperous in the future than we have been? We must ‘transcend consumerism,’ but that doesn’t mean that we need to be worse off. This is the great challenge. Can’t we all imagine a life with fewer LED lights glowing in the night, fewer miles driven or flown, less effort and stress over maintaining a life so far from thermodynamic equilibrium? I’m not talking about reducing our quality of life. I’m talking about breaking the link between increasing quality of life and increasing consumption. The two do not have to be correlated, but we are very used to thinking of them that way.

I’m not being self-righteous when I make all these arguments. My lifestyle is part of the problem, and I feel pretty locked into it. But I do believe that all together we shape the world we live in, everyday, and that for the world to change, our idea of it has to change. How do we get there? Do we have the imagination, and to what extent do we have the power and control to get ourselves there? Must we be victims of our own evolution? In my view, these are the deepest issues associated with “resource interdependence” – the interconnections between resources, ecosystems, humans, and our view of the world. It seems quite likely that we are all moving into a future of less wealth. If so, will we make the move gracefully, and in a creative and peaceful fashion? Will we use all our humanity and our wisdom to anticipate it, and plan for it?

We cannot wait for others to address these issues. I got into science because I felt like science is one of the most important drivers in the evolution of our material world. Its science and engineering that gives us **some** of the insight, **some** of the understanding, and **some** of the tools with which we can solve these problems. I am not advocating a new technological fix for the problems created by our last technological fix.

Some technological fixes can help, but not by themselves. I remember 15 years ago a big issue in the field of conservation biology was whether or not scientists should be outspoken advocates for conservation – but as the loss of biodiversity continues unabated, as ecosystem function declines at all scales, that discussion has simply evaporated. We, the scientific community, must be pursuing solutions at all scales, communicating those solutions to policy makers and the public, and advocating for the visions and perspective that our work on resource management issues has given us. We mustn't be guilty of rearranging the deck chairs on a sinking ship.

We live in a world of disinformation, misinformation, deceptive advertising, political double speak and just plain bullshit. The world is in desperate need of truthful leadership. Where on Earth will that come from? The only answer I have for that is that it must come from all of us, from the bottom up. The responsibility falls on all of us.

I know that history has been full of prophets in sack cloth and ash forecasting gloom and doom, and this talk had plenty of that -- maybe too much. But I want to emphasize that the bleak terms in which I'm describing all these trajectories are certainly not set in stone. I and others who see them could be wrong, and even if we aren't there could be technological advances, or spiritual or cultural advances, or other kinds of non-linear developments that change things very quickly in positive, creative, peaceful ways. **But here's an important point.** If we plan for best case, and we get the worst, we'll be in big trouble. If we plan for the worst case, and things turn out better, then we can probably have a much rosier future for everyone.

So, in closing, perhaps we are at a momentous time in human history. We can look back, we can see the big trajectories that we are on now, and we can look forward and see where we are headed. A myriad of crises are popping up at all scales all around the world, and we are treating them as if they are independent of each other, but they are not. In fact they are all signs and symptoms of our real ailment –and that’s our dramatic overconsumption of all resources, and our blind faith that the economic bubble that has been expanding for the last hundred years or so can go on expanding indefinitely. If we think it can’t, then is there any way to change the trajectory we’re on – technically, socially, philosophically -- or are we just along for the ride? To what extent can we take control of our future? It may be a very hard thing to do, but the least we can do is broaden the discussion.

Thank you all very much for letting me have this opportunity.