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*"not what you know, but what your world is learning"*

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## The Limits to Growth - On the 40th anniversary of publication

1. There was a well attended meeting in Washington on Mar 1, the 40th anniversary of the Club of Rome sponsored study "The limits to Growth" by Dennis and Donella Meadows et. al. The study's major predictions are largely being upheld as accurate predictions of the future, as far as sharp resource shortages developing globally if no prompt action is taken (in the 1970's). The great interest in the subject has dwindled since then, accompanied by popular negative characterization of the study as "professional doomsaying that often dominates development discourse".

2. That is how Andy actually characterized them Mar 8 in Closer Look: Deep Poverty in Retreat, to contrast the views of resource scientists with the highly optimistic work of Charles Kenny, as "an invaluable counterweight", to said "doomsaying". There is undoubtedly cause for optimism about the limitless resources of the earth when looking how we have always succeeded in accelerating our use of them. What optimists like Charles Kenny omit, and others such as Hans Rosling too, is how very unsustainable that history is. All our giant steps of social progress over the last dozen generations have been based on inventing ways of depleting the earth's resources ever faster.

3. There is also a quite long history of first rate science on understanding our future being treated as "doomsaying" to be distained and ignored, with the limits to growth just one of them. To be balanced, of course, there is surely a great deal of the opposite in history too, lots of "doomsaying" that was popular for a moment but groundless. Instead of just falling flat of , what seems to happen to the good science treated that way is for social groups to select the more negative parts for ridicule? Ostracizing people and groups by selecting out offending aspects of what they represent is very common way of social decision making, as in the social discrediting of opposing politicians we see so very much of.

4. So it's not surprising that after introductions and formalities, one of the first topics Dennis Meadows raised was just that. Why did the public only give attention to ridiculing the danger of our doing nothing? A number of the scenarios the study presented showed successful outcomes, but the journalists who called him for comment simply never brought those up! All the public and popular press responded to was the chance to discredit the astounding predictions for ignoring the findings and doing nothing. Even the huge irony of that has been missed it seems.

5. The public never seems to notice that even the most pessimistic studies tend to show the very same thing as the most optimistic, up to the point when our fortunes suddenly reverse, as now seems to be taking place. The point has always been that getting better and better at using things up comes to a relatively sudden end. The deeper problem that warning is intended to help identify is that of the economy, our collective creativity, and their resource use, have long been managed to expand by ever bigger steps the bigger they get. That's also how money is managed and needs to pay ever growing returns to investors. It creates a kind of societal "joy ride" that people don't seem to understand much, and definitely don't want others to spoil for them.

6. Since Malthus published "The principle of population" two centuries ago, his finding that population growth seemed to have no limit but the exhaustion or the food resources of the earth has been ridiculed by generation after generation. We now see a substantial form of what he predicted physically happening, though, as a continually spreading world "food crisis". It's occurring even as prospering parts of society can continue to increase their food consumption. The form it is taking is as a global price spiral for all resources, not just food.

7. The important work of Stanley Jevons has long been discredited in popular circles too, for pointing to the quite clear evidence that technological efficiency makes resource use more profitable. It's very evident with no more analysis than just plotting the world GDP, energy use & energy use GDP efficiency, as I discuss in talks. Consequently it generally

gets used for profitable investments. That accelerates the expansion of the whole economy and the depletion of every resource the economy uses. It does save resources for any use, but then multiplies uses.

8. The major contribution to the field of J M Keynes was also ridiculed and discarded. He observed in Chapter 16 of "The General Theory" , to the great dismay of the economics profession, that over-expansion of capital investment would naturally cause "employment [] low enough and the standard of life sufficiently miserable to bring savings to zero." Identifying over-investment as making the economy unprofitable as a whole as a problem, the alternative he identified was for investors to voluntarily end their automatic use their financial savings to accumulate ever growing capital investments.

9. It's helpful compare the reception to the IPCC's studies of CO2 and climate change to that given The Limits to Growth. The two studies are quite similar, discussing ranges of good and bad scenarios, using similar kinds of computer models, having similarly valid assumptions and now being similarly successful in their predictions, for the "do nothing" option.

10. The limits for rapidly depleting the earth's resources are coming far sooner than the effects of climate change, is one difference, and the consequences would arguably be much more severe, already being felt with regularly escalating price spikes for resource of most kinds. Logically it would be given priority attention. At least everyone's heard of the IPCC studies, though, and most people today might never have heard of the Limits to Growth. The consequences are tragic, of course, whatever the cause. My other studies have led me to conclude it's real source is a major gap in scientific method, that scientists haven't learned how to study self-managing systems (see end note [i]).

11. There were only five other speakers after Dennis Meadows, giving each with ample time to go into their areas of expertise. Jorgen Randers, a co-author, made interesting observations on different societies on earth were more or less able to respond to great challenges, comparing the EU Commission's relatively free reign in making technical

decisions for all of Europe, and how the decision making of the democracies had become so very ineffective.

12. Lester Brown addressed the question "how much time did we have" before natural events cause humanity to be shocked into awareness of the "big crunch" now beginning to take place. He suggested it was just a matter of luck, that the Russian heat wave of last summer did not hit the US grain belt in the Midwest. If it occurred in a critical location like that it would have caused a drastic global food panic and shortage lasting the year at least. We can even see it coming, like a freight train, in the slow motion explosion of food and fuel prices already. Evidence of that is what Andy discussed on Dot Earth recently, in Beyond the Eternal Food Fight. I also published an article a British journal last year, as A decisive moment for Investing in Sustainability. It's from a more comprehensive view of the resource crisis, somewhat like Jeremy Grantham's, evidenced by all food and fuel resources having started rising in price about ten years ago, at around 20% a year, more or less all together.

13. Doug Erwin, Dean of Santa Fe Institute, discussed the mixed perils of biodiversity, as the rate of habitat loss and species extinction accelerate due to our ecological impacts. The present rate of loss doesn't seem on the verge of causing food chain collapses like the unrecoverable mass extinction events of the past, but precipitous ecosystem collapses seen to be the usual mechanism behind the great extinction events of the distant past. In addition to species loss the present effects seen in how over exploited species are evolving to become smaller and smaller. That's a trend that might be reversed in a few hundred years if a species is left to itself, rather than taking a the few hundred thousand years, to reverse the extinctions of a major ecosystem collapse.

14. The Penn State geologist, Richard Alley presented a collection of highly clear cutting evidence of climate change and its real pace at present. He started with what I have long hoped someone would, showing a heat image of the earth from outer space. The gaps in the spectrum of radiant heat from the earth exactly matched those of the various greenhouse gases, and one new clear indicator.

15. Neva Goodwin, the economics textbook author, professor at Tufts and co-director of the New Economics Institute, brought out a very important but rarely mentioned sustainability issue, that as hitting the limits to growth creates more and more difficult environments to work in, labor (and technology as automated labor) return less value for the material invested. Labor today is requiring higher and higher individual investments of education and effort for relatively shrinking returns. That's parallel to the declining resource productivity seen in it taking ever more energy to find more energy, as declining EROI, the subject of Charlie Hall's special collection of papers that my SEA paper on energy accounting is in.

16. What caught Andy's attention and prompted the suggestion I write this, was my comment on Dot Earth on how the discussion at the conference changed in going from wonderful discussions of "the problem" to shaky discussions of the solutions. The panel of all six speakers was called on for solutions, posed as "why don't we act". I noticed nearly all the panel switching from scientific to social thinking. I think that's what we all naturally fall back on when science offers no sound basis, such as for understanding how self-managing systems like economies work or what steers them. I've noticed that same switch at many other conferences too, from highly expert problem analysis to problematic wishful solutions. Most often the comments have the sense "we must to do *something*", "everyone can join together" and "we can be more efficient".

17. Maybe the most notable characteristic of economies, of course, is how they have *always* actively joined everyone together in dong things to become more and more efficient. That's the essence of growth, with efficiency devoted to making profits. If you apply efficiency to multiply profits that naturally results in economies consuming more and more, not less and less, and that's what the success of the economy seems based on. There were other good observations, but the best answer to why we don't act on such pressing common needs seemed to be from Dennis Meadows. He said he had studied it all his life and he didn't know.

A1.[i] I think the real reason the public is largely ignoring both is that science has not yet really found a good way to make sense of self-managing systems like weather systems and economies. Science is built around identifying how one thing controls another, not on how uncontrolled systems work by themselves, and somewhat lost in discussing the latter. Climate models seem a bit more reliable than economic models, as climate is still largely a behavior of unchanging physical processes following deterministic laws of science. It's just "the weather" that behaves a bit like economies in being ever changing.

A2. Economies differ most in inventing new kinds of lasting organization. Inventing new organization lets economies create new kinds of energy sources by way of making formerly useless things highly profitable to use and reproduce. Its natural limits are determined by the earth still, but how it works is self-invented and self-managed once new industries and cultures are invented.

A3. That causes a big problem for science, that makes both the problem and the cause fascinating to study. As how self-managing systems work is internally rather than externally determined, observers have no way to see how they really work, and so appear as enormous holes in our information about how the world works. This is also the subject of my longer research paper last year, System Energy Assessment (SEA) on how the traceable records of energy required for businesses to operate naturally omits commonly 80% of their real energy needs. There are no records of the outsourced energy demands of the many self-managing services that businesses employ. So prior energy use accounts have omitted the energy needs for things like labor, management, finance, technical services and societal services.

A4. How self-managed systems are identified is as active parts of otherwise passive environments, notably more complex than the forces on them, changing themselves and responding to things on their own, having visible inputs and outputs, but working by some invisible means. You see them societies, ecologies, local, regional or world economies. As for any person going to work, who only needs to be shown where to

work and will largely figure out how themselves, self-managing systems mainly need access to resources they can use rather than instruction on how to use them.

A5. Being internally organized, like how a family lives in their own home, means you may see something of the deliveries that arrive and wastes discarded, but generally nothing about what's done with them internally, making the family unit work. It's logically obvious once you think about it, but part of how an internally managed system must work is to collect more resources than needed. Surplus resources can be used for anything, so parts can help each other out, or doing new and purely enjoyable things. That's called "net-energy" and is a major key to how self-managing systems work independent of their surroundings internally, hidden from outside view.

A6. What those large gaps in our information about nature do for science is mess up everything. Science is a method of using information to identify reliable patterns. For subjects that science has no information about it makes public discussions wide open to argument speculation. It allows research findings that may be logically valid, but fit popular social values, to be socially rejected. Most scientists are ill-equipped to engage in social argument like that, and find themselves somewhat at sea with the subject itself. What science needs is a way to define questions about uncontrolled systems simple enough to be answered with high confidence. I think not having that yet is why these very serious subjects are not treated seriously.