

WHAT'S NEW ABOUT THE PLANETARY BOUNDARIES UPDATE?

A new version of the planetary boundaries analysis has just been published. Many of the authors are the same as those who wrote the initial articles in 2009. They haven't changed the overall picture fundamentally, but they have tried to take into account recent science and many of the criticisms that the original analysis provoked.

It may be that in another 5 or 6 years, the analysis will shift again. For some people, that just shows how unreliable it all is. For others, it demonstrates a lack of dogmatism and a willing to take on board new evidence and ideas. So before looking at the specific changes which have just been made, it is important first to ask the question: what sort of analysis is this? How is it possible for anyone to rally round a picture of the world which is subject to change at any time?

I think the answer has to be that the planetary boundaries picture of the world is a paradigm. That's become an overused word, but "planetary boundaries" is in fact a very good example of what it means. It is a basic overall picture, a set of organising principles, which provide both a general overview and a way of categorising and organising data. The data may change whilst the paradigm stays the same. For example, astronomers should now have a better idea than they did 200 years ago as to the average distance between the Sun and the Earth. That measurement has changed, but the paradigm – the basic picture, according to which the Earth goes round the Sun (and not vice-versa, as was previously believed) stays the same.

So I would judge the "planetary boundaries" picture not on the basis of whether this or that number or other detail should be different, but whether the picture as a whole gives us a good general overview and a useful way of organising information. In making this judgement, I think it's also fair to compare it with the competing paradigms, because unless we choose one paradigm or another, we are simply left with a chaotic mass of data, providing no overall view.

Very briefly, because the main purpose of this article is to summarise the new version of the analysis, it seems to me that there are four competing paradigms, three of which have a strong connection with Economics, and none of which in my view succeeds in improving on "planetary boundaries". These are:

(a) The view that there are no limits or boundaries, and that human impacts can safely grow and spread with no severe consequences. This has been the worldview embedded in conventional economics and business, but it looks increasingly implausible.

(b) The view that there is a limit to economic activity, and that it can be measured by total GDP. If we have already reached that limit (or when we do get to that point), this implies a no-growth economy is necessary. This view has provided a useful antidote to view 1, but it places too much reliance on the validity of GDP as an indicator. GDP was never designed to be, and is not, an indicator of environmental impact, even though there is a general correlation.

(c) The view that by expanding economic accounting to include monetary values for the natural world, conceptualised as a form of capital ("natural capital"), we can arrive at a picture of where the

limits and boundaries are. But this has the problem that monetary valuation generally implies something can be readily substituted for something else of the same value. It doesn't pay enough attention to the specificity of particular earth systems, and once we do that, we move in the direction of something like the planetary boundaries analysis.

(d) The view that the best way to cope with all the complexity is simply to narrow our concern down to a single problem and a few indicators to measure it – the usual favourite being climate change, concentrations of carbon dioxide in the atmosphere, and average global temperature. This has the advantage of a basis in physical science rather than economics, but obviously this exclusive focus on a single problem leaves out other important factors.

The “planetary boundaries” paradigm avoids these difficulties. It has a natural science basis, in the real physical world and with a great deal of scientific data, and it is not dependent on market variability (e.g. in the price of oil), which makes economic measures very limited in their long-term usefulness. It has also shown itself to be sufficiently flexible to take on board new information and perspectives.

Published in the journal ‘Science’, 15.1.15, with the title ‘Planetary Boundaries: Guiding development on a changing planet’, Will Steffen, et al., the update is different from the 2009 analysis it replaces in six different ways, and it is important to distinguish between them.

(1) In some cases, numbers have been updated in the light of recent evidence. The most important example of this is the reduction in the width of the zone of uncertainty for CO₂ concentration in the atmosphere. It is now clear that between 450 and 550 ppm is unsafe, making the uncertainty zone now range from 350 to 450 annual average, instead of 350 to 550 (currently it is at 396.5).

(2) There are various places where the concept of what the boundary is about has been changed, even though the same nine boundaries basically remain. “Rate of biodiversity loss” is now replaced by “change in biosphere integrity” (one imperfect measure of which is extinction rate). In place of “interference with the global Phosphorus and Nitrogen cycles”, there is a more wide-ranging “biogeochemical flows” boundary (although in fact measured by changes in Phosphorus and Nitrogen). “Chemical pollution” becomes the more wide-ranging “introduction of novel entities”, i.e. substances nature has not evolved to absorb. The other boundaries remain the same.

(3) There are some changes to what is measured in order to judge where the world is in relation to the boundary. The most important example here is that “land-system change” is now measured by change in area of forested land rather than in cropland, because of the major impact of forests on climate. This change in indicator leads to the claim that the planet has now exceeded four boundaries, rather than only the three identified in 2009 (climate, biodiversity, nitrogen). In the case of the “novel entities” boundary, no specific quantified boundary has yet been identified.

(4) One of the criticisms made of the 2009 analysis was that in focusing on the global level, there was a failure to adequately consider what is happening on regional and other smaller scales. This is particularly important for freshwater use, where there is now an additional indicator specific to each particular river basin, as well as the global boundary.

(5) There is also more emphasis in this new version on interdependence and interactions between the nine boundary factors, which create feedback effects of different kinds.

(6) A further change is the identification of two of the nine as “core” boundaries, in what is described as a “two-level hierarchy”. These are climate change and biosphere integrity, which are highly interrelated with each other and with all the other boundaries. They constitute the core of what is problematic about the current earth system.

This is merely a summary. The paper itself not only has further detail but is also backed up by 158 footnotes, almost all references to scientific papers. There is also available on the internet (through sciencemag.org) a whole set of ‘supplementary materials’. This is a pretty thorough job, taking us through from the big picture of the nine boundaries to a mass of detailed argumentation and evidence.

There is a significant limitation, however, on what the authors have achieved. As Johan Rockstrom and Katherine Richardson told the ‘New York Times’ journalist Andrew Revkin: the paper “is a natural science update ... It makes no attempt to enter the (very important) social science realm of equity, institutions or global governance.”

It seems to me that this group of scientists have done what they ought to have done, and of course research continues on the subject matter of all nine boundaries. But now this work needs to be taken up by others – in the media, in education, in the social sciences and humanities, business, law, everyday decision-making, and politics. In that sense, the planetary boundaries analysis – even in this updated version, with all its supporting evidence – is just the beginning.

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