
Future Earth:

A science agenda for sustainability and human prosperity

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On 21 June 2013, the British Academy and the Royal Society co-hosted a UK 'town hall' meeting at which researchers and a range of stakeholders were able to discover more about the new *Future Earth* initiative, which is being led by the International Council for Science (ICSU). More information can be found via www.britac.ac.uk/intl/future_earth.cfm

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The planetary dilemma

In the run-up to the UN Conference on Sustainable Development held in Rio de Janeiro in June 2012, the leaders of a global scientific convention *Planet under Pressure* concluded:¹

Research now demonstrates that the continued functioning of the Earth's system as it has supported the wellbeing of human civilization in recent centuries is at risk. Without urgent action, we could face threats to water, food, biodiversity and other critical resources: these threats risk intensifying economic, ecological and social crises, creating the potential for a humanitarian emergency on a global scale.

GEO 5, the Fifth Global Environmental Outlook of the UN Environment Programme, reached similar conclusions²

As human pressures on the Earth system accelerate, severe critical global, regional and local thresholds are close or have been exceeded. Once these have been passed, abrupt and possibly irreversible changes to the life support functions of the planet are likely to occur, with significant adverse implications for human wellbeing

We are starting to stray outside the 'safe operating space for humanity', as described by Johan Rockström and his many colleagues.³ They believe that we have the scientific evidence that humanity is near or past safe boundaries in the areas of climate change, biodiversity loss, nutrient cycling, and ocean acidification. Although such boundaries are fiendishly difficult to define, the concerted scientific effort on the contingent outcomes of ubiquitous climate change shows that it is reasonable to agree on them (in this case, staying below 2°C global warming).

The real difficulty lies in staying within the boundaries. Such boundaries are rather akin to a jagged ceiling, where the 'stalactites' display the variations of such guardrails over the planet as a whole. For example, Rockström and Klum pointed out that there are four 'slow' boundaries which are patchy in provenance and effect over the planet as a whole.⁴ These are biodiversity loss, freshwater use, land use change, and human interference with the nitrogen and phosphorus cycles. These dynamics offer a planetary boundary through aggregation of cause and effect at local scales and regional agglomerations. In many parts of the developing world, there is scope for more careful additions of fertiliser usage (one key component of the nitrogen and phosphorus cycles) which could be offset by reductions in excessive usage already in place. Hence the evidence of the jagged ceiling, the contours of which are deeply elusive to observe, measure and predict.

But equally problematic is the jagged 'floor' of this safe operating space. Here Kate Raworth, formerly of Oxfam, shows that the undulations of equality and justice are really very profound.⁵ They apply to hunger, education, poverty, democratic voice, gender and health. At the heart of all of this is resilience and resourcefulness. This addresses the capability of the human family in all of its configurations to be able to predict and prepare for stresses from an ever more 'unfriendly' planet and an ever more unequal society and economy. The aim is to adjust human use of the processes of planetary dynamics so that the overall outcome of development is survival in peace, health, prosperity and companionship.

¹ L. Brito and M. Stafford-Smith (eds), *State of the Planet Declaration* (London, Planet under Pressure, 2012).

² GEO 5, *Environment for the Future We Want* (Nairobi, UN Environment Programme, 2012), p. 5.

³ J. Rockström, et al., 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity', *Nature*, 461 (2009), 472-5; J. Rockström

and M. Klum, *The Human Quest: Prospering Within Planetary Boundaries* (Stockholm, Langenskiolds, 2012).

⁴ Rockström and Klum, *The Human Quest*, pp. 168-200.

⁵ K. Raworth, *Planetary and Social Boundaries: Defining a Safe and Just Safe Operating Space for Humanity* (Oxford, Oxfam, 2012). See Rockström and Klum, *The Human Quest*, p. 263.

This is a hugely challenging order. In *Addressing Tipping Points for a Precarious Future*, a volume of essays they have edited for the British Academy,⁶ Tim O’Riordan and Tim Lenton believe this challenge has to be addressed by the end of this decade to overcome the ‘lock-in’ effects of planetary unfriendly technology and inflexible political institutions which will drive the more rapid onset of ‘tipping thresholds’, with seriously adverse human consequences. This will especially be the case for the vulnerable and the most disadvantaged, those in the troughs of the planetary floor. Persistent and increasing inequality is the death knell of sustainability, as outlined by Wilkinson and Pickett in their award-winning book *The Spirit Level*.⁷ Inequality encourages over-consumption, loss of social trust, and undermining of democratic values and of the willingness to contribute to overall wellbeing. Disparity of income and of opportunity has to be reduced if sustainability is to prevail. This is a very tough prospect and will involve ingenious science and politics.

Future Earth

This is the setting for *Future Earth*.⁸ This is a 10-year international research programme launched in the UN Conference on Sustainable Development, held in Rio de Janeiro in June 2012. Its aim is to create the critical knowledge required for understanding the relationships between the dynamics of planetary processes, their tolerances for human interference, for development and greater equality, and the kinds of cultures, behaviours, and governing arrangements from micro local to global, which will be required to respond to this scientific appraisal.

Figure 1 outlines the conceptual scope of Future Earth. At its heart are pathways to sustainability for all humanity, living and still to be born. To create these pathways will require a fuller understanding of global environmental change through the coupling of earth system processes on land, air and water, with human drivers for reorganisation of these processes, linked to establishing overall human wellbeing in the form of health, prosperity, justice, co-operation and dignity.

Future Earth will build upon and integrate all existing global environmental change research. These include the International Geosphere-Biosphere Programme (IGBP); the World Climate Research Programme (WCRP); The International Human Dimensions Programme (IHDP); and Diversitas – the biosphere science and Earth System

Science Partnership (ESSP). But it will extend well beyond these established networks to include all manner of new academic and research bodies and the brightest minds from a broad range of disciplines and countries.

Future Earth will be overseen by the Science and Technology Alliance for Global Sustainability. This consists of a high profile group of sponsors. These include the International Council for Science (ICSU) (of which the Royal Society is a member) and the International Social Sciences Council (ISSC) (of which the British Academy is a member). It also includes the Belmont Forum of international funding agencies (of which the Natural Environment Research Council and the Economic and Social Research Council are members), three UN institutions – namely, the UN University (UNU), the UN Environmental Programme (UNEP), and the UN Educational, Scientific and Cultural Organization (UNESCO) – and the World Meteorological Organization (WMO) as an observer.

Future Earth will be run by a Governing Council. This consists of a range of representatives from the collaborative worlds of engagement and research that form the special collaborative qualities of the programme. This Council will be in turn informed and guided by an Engagement Committee. This committee will ensure the

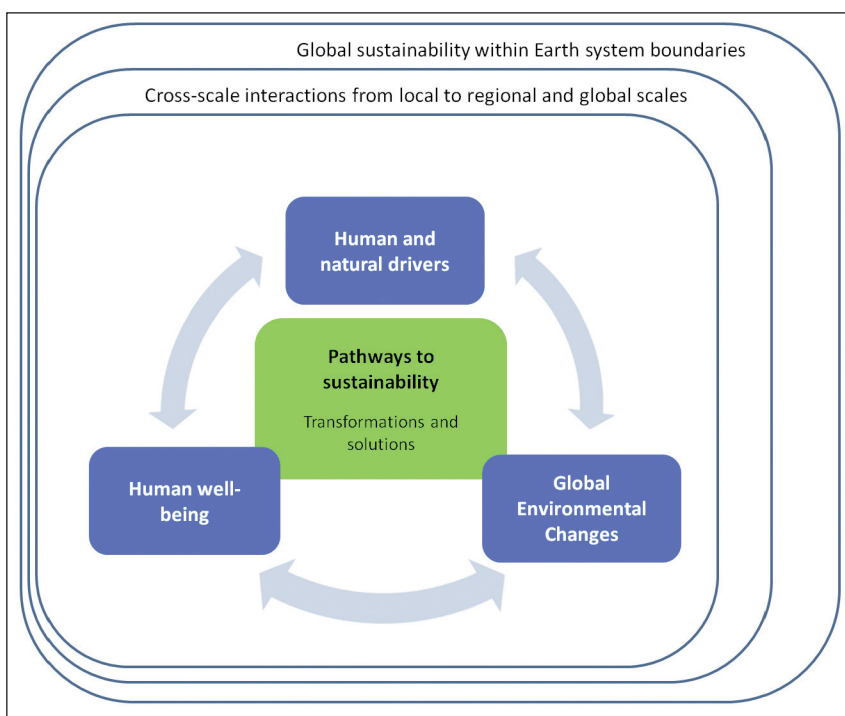


Figure 1. Conceptual framework for Future Earth.

research projects are co-designed by the user communities, and address communications and general outreach so as to be sure that the fruits of the research are reaching those who need to be informed and encouraged to make the

⁶ T. O’Riordan and T. Lenton (eds), *Addressing Tipping Point for a Precarious Future* (Oxford, Oxford University Press/British Academy, 2013). See also Tim O’Riordan and Tim Lenton, ‘Tackling tipping points’, *British Academy Review*, 18 (Summer 2011), 21-7.

⁷ R. Wilkinson and K. Pickett, *The Spirit Level: why more equal societies almost always do better* (London, Allen Lane, 2009).

⁸ www.icsu.org/future-earth

vital shifts to sustainability. Communications and genuine co-operation with a wide range of business, civil society organisations and community groups, as well as governmental, political and regulatory agencies, will ensure the success of the programme. There will be a significant effort to widen the basis of information flows and bilateral involvement, through innovative development and use of social media as well as the conventional forms of communication.

The Governing Council will also be informed and guided by the Science Committee, which will provide scientific guidance and strategic direction. It will work with the Engagement Committee and existing and new projects to deliver the knowledge needed to support global sustainability. One of us (Corinne Le Quéré) has been appointed to serve on this Committee. All of these bodies will be managed by an executive Secretariat, which will play a key role in supporting the integration of activities across countries, scales, disciplines, and between societal actors. The Secretariat will be co-ordinated across continents in effective regional alliance.

Challenges for Future Earth

As a global programme for scientific and humanistic understanding, Future Earth is hugely ambitious. The goal of developing knowledge and practice for responding to the risks and opportunities of global environmental change and supporting the societal transformation towards global sustainability is awesome in scale and complexity. Future Earth will strive to achieve this goal through:

- solution-oriented sustainability research;
- interdisciplinary co-operation;
- generation of knowledge to provide timely information for policymakers;
- broad-based participation in the co-production of research agendas and knowledge; and
- increased capacity-building in science and technology and innovation.

Here are the nine key challenges facing the proposed programme of research.

1. *To develop excellent science*, robust in quality and integrity, that can reach out to business, civil society organisations and governments. In so doing, this science must compellingly engage without being subsumed by the particular agendas and ways of seeing the world that shape the outlooks of any stakeholder. This will require a special form of scientific enquiry and engagement which explicitly recognises the benefits of co-operation and mutual learning. This role for applied and co-operative research depends on the effectiveness of the contacts and ways of undertaking collaborative research. Any communication needs to be sensitive and even empathetic to the styles of operating in stakeholder circles. This kind of approach could be very exciting, especially for young researchers who can now be offered the opportunity and

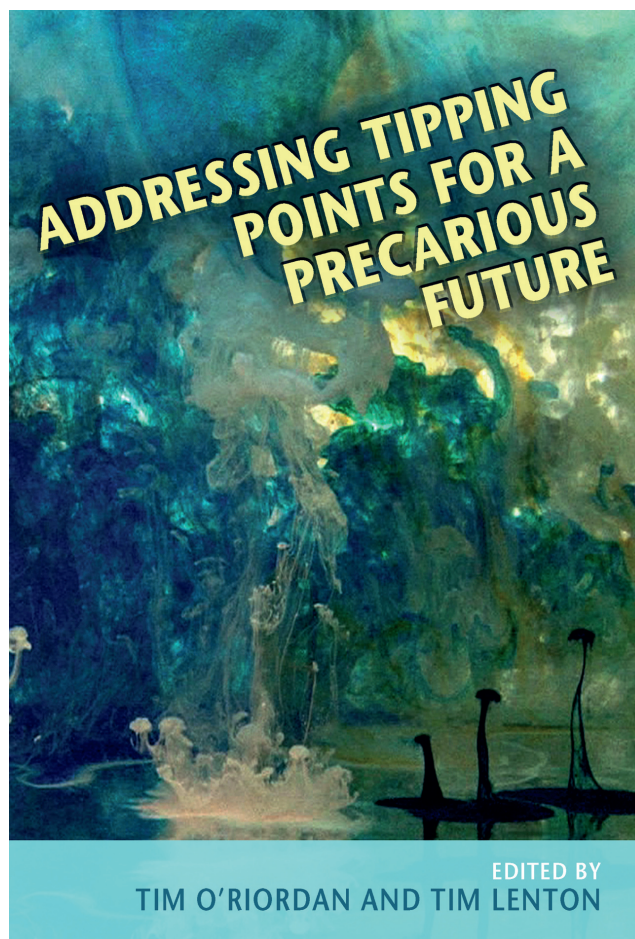


Figure 2. 'Addressing Tipping Points for a Precarious Future', edited by Tim O'Riordan and Tim Lenton, was published by the British Academy in August 2013. More information is available via www.britac.ac.uk/pubs

to co-design research with stakeholders and focus on solutions. Nevertheless any such innovative arrangement will need the confidence and the communications skills which are yet to be fully developed by research training programmes both at the undergraduate and postgraduate levels in most higher education academies.

2. *To develop an appropriate international scope* to enable and to encourage mutual endeavour between scientists and their partners working for sustainability across the world. This approach will benefit from compatible training schemes across all universities and research institutes, sensitive to the cultures and politics of host nations. Indeed it will also look to the higher education sector to create campus-wide empathy for sustainability, where the fundamental tenets of any meaningful transition to sustainability is taught and practised throughout all courses and research initiatives. What is being looked for here is an approach to campus-wide commitment to the ideas and behaviours of the transition to sustainability being developed by the Green Academy programme in the UK.⁹

⁹ Green Academy, *Curricula for Tomorrow* (London, Higher Education Academy, 2012).

3. *To set sustainability and human wellbeing at the heart of the research agenda.* This incorporates the connections between resilience and vulnerability, between wellbeing and democracy, and between fairness and inequality. All of these are treacherously slippery notions with aggravatingly varied interpretations. It will be by no means easy to gain traction here. Wellbeing has two dimensions. One relates to personal flourishing and capability-building, which leads to self confidence and a deep sense of self worth and aptitude. The other applies to a surrounding of nurture in families and social relationships as well as community trust building and overall security.¹⁰ Getting measures of wellbeing to run alongside more formal economic measures to guide social progress in all nations will be a massive task, as is discussed by Forward Scotland.¹¹

4. *To champion integration* not only between the natural and social sciences, but also including the humanities, the professions (law, accountancy, architecture, engineering, medicine), and adaptable technology. Here there is a conundrum. On the one hand, most established scientists call for basic discipline-focused competence. On the other, practitioners look for adaptability and flexibility especially at the boundaries of familiar knowledge and theory testing. In many instances even cognate groups of natural scientists find it difficult to establish intellectual common ground. But for social scientists, where there are many provenances of interpretation of 'problems' and 'solutions', intellectual agreement is more intractable. Future Earth will test the social sciences and the humanities into fresh ways of communicating across the sciences, and into the murky world of societal transformation to sustainability. Here is where highly innovative approaches to visual styles (video imagery, drama, artistic creativity), and storytelling will be encouraged.

5. *Co-design and co-production lies at the heart of research endeavour.* The purpose here is to ensure that the private, civil and public sectors become companions in the design and conduct of research, experimental schemes and pilot studies, and that appropriate metrics are in place to test for success or failure. This is a particularly challenging area, new to the way most research has been conducted in the past. It will require particular efforts and co-ordination by the Science and Engagement Committees to engage wide and disparate groups of users, and understand and define the issues of common concerns that can progress with targeted research efforts. There are promising signs that the business world, especially in the role of social entrepreneurship, is ready for this opportunity.¹²

6. *The research agenda should be initiated by research teams dedicated to the co-production approach.* This will test the process of setting the framework for the funding 'calls' as well as for evaluating possible research proposals. Here is another critical test for Future Earth. At present

there are few well-developed guidelines for research settings which explicitly encourage the styles of analysis and learning that are so very pertinent for Future Earth-type research. This will involve not only the tricky aspects of sharing interpretations of 'problem definitions' and 'solutions pathways' (by no means easy to achieve in a sustainability framework). It will also introduce interesting and exciting forms of learning. Some of these will require more critical reflection on the part of scientists as to how and why various stakeholders think and act the way they do. But some will also introduce forms of learning in the street and the field where the research partner is also a source of knowledge and measurement. It will not be easy to move whole research agendas into the particular requirements of Future Earth. This will require a special protocol involving much delicate discussion and communication.

7. *Rather than endlessly analyse the 'problems', Future Earth will be solution-oriented.* This will place an emphasis on 'doability' rather than transformability. Innovation is at the heart of its mission, on the basis that most activity and its institutional framing create non sustainability. It is very likely that genuinely radical solutions will be required. Examples include: creating not-for-profit trusts to promote and grant aid to sustainability initiatives at the local and regional scales; creating socially motivated corporations which straddle the increasingly fuzzy divide between the public, private and civil sectors; and developing legal frameworks to value the environment and the ecosystems and their associated supporting services. These examples are offered as a prospective range of approaches which will encourage a much more open solutions-driven agenda than is common in much of science nowadays, but where there is a genuine willingness to innovate.

8. *Future Earth is designed to be inclusive and enhancing.* On the one hand, this ensures that Future Earth builds on the foundations, structure and activities of the existing global programs under the ESSP, which have led to our current knowledge base. On the other hand, it is a demand for a much more inclusive approach, embracing disciplines, professions, practitioners and policymakers. Much knowledge exists in these wider communities that could be fed back into the common pool of understanding. In addition, there is an even greater challenge to attract the marginalised and the un-confident into sustainability transformational actions at the personal and community levels. These normally non-participating actors are the 'quiet shadows' of humanity, who are normally neither seen nor heard. They are the poor, the ethnic minorities, recent arrivals, the disabled, the unborn, and the never-attended-to. Getting all such people into the transition to sustainability will be a huge task, embracing all aspects of learning and democratic arrangements in very unusual ways. Here is where the platform of fairness

¹⁰ T. O'Riordan, 'Sustainability beyond austerity', *Analyse Social* (2013, in press).

¹¹ Forward Scotland/Scotland Foundation Council, *A Wellbeing Framework for Scotland: A Better Way for Measuring Society's Progress*

in the 21st Century (Edinburgh, Forward Scotland, 2008).

¹² J. Elkington, *The Zeronauts: Breaking the Sustainability Barrier* (London, Earthscan, Taylor and Francis, 2012).

of treatment and much better redistribution will have to be faced.

9. *Styles of learning and confidence building between researchers and practitioners.* The UN Economic Commission for Europe explores 'learning competences' in education for sustainable development.¹³ These relate to four main processes: *learning to know* (holism and systems thinking, envisioning, and being unafraid of transforming); *learning to live together* (enabling teamwork, compatibility, diplomacy, and mutual understanding of differing cultures, faiths and aspirations); *learning to do* (critical appraisal of current political and social arrangements, and the opening of the mind to creative

consciousness as described above); and *learning to be* (to be motivated to have self awareness, to be self confident, and to flourish in achievement). Coming out of this approach are fresh ways of engaging all students and all researchers in self promotion, in empathy, in being unafraid of failing, and in being consciously self-critical as to why the world is the way it is, and what realistically, yet incrementally, can be achieved for the betterment of all. This may prove to be the greatest challenge for the success of Future Earth. For what we are talking about here is leadership for transformation beginning in the teen years and evolving through adulthood in a world which is as yet unable to offer reliable employment for the vital practitioners for any sustainable age to come.

¹³ UN Economic Commission for Europe, *Learning for the Future: Competences for Sustainable Development* (Geneva, UNECE, 2012), pp. 14-15.