Initial Design Executive Summary
Future Earth is a 10–year international research programme launched in June 2012, at the UN Conference on Sustainable Development (Rio+20) that will provide critical knowledge required for societies to face the challenges posed by global environmental change and to identify opportunities for a transition to global sustainability.

Future Earth will answer fundamental questions such as how and why the global environment is changing. What are likely future changes? What are the risks and implications for human development and for the diversity of life on earth? It will define opportunities to reduce risks and vulnerabilities, to enhance resilience and innovation, and show ways to implement transformations to prosperous and equitable futures.

Future Earth will deliver science of the highest quality, integrating, as necessary, different disciplines from the natural and social sciences (including economic, legal and behavioural research), engineering and humanities. It will be co-designed and co-produced by academics, governments, business and civil society from all regions of the world, encompass bottom-up ideas from the wide scientific community, be solution-oriented, and inclusive of existing international Global Environmental Change projects and related research activities.
The need for a step-change in Earth system research

Human activities are altering the Earth system with significant impacts on the environment at the local, regional and global scales. Changes in the Earth’s climate and loss of biodiversity are undermining improvements in human well-being and poverty alleviation. The challenge of achieving a transition to global sustainability is urgent given the potentially catastrophic and irreversible implications for human societies. On the one hand, this is a threat to human prosperity on Earth; on the other, it provides incentives to exploit and develop new opportunities for innovation that supports sustainable development.
Connecting research and responses to societal challenges

Future Earth will address issues critical to poverty alleviation and development such as food, water, energy, health and human security, and the nexus between these areas and the over-arching imperative of achieving global sustainability. It will provide and integrate new insights in areas such as governance, tipping points, natural capital, the sustainable use and conservation of biodiversity, lifestyles, ethics and values. It will explore the economic implications of inaction and action and options for technological and social transformations towards a low-carbon future. Future Earth will explore new research frontiers and establish new ways to produce research in a more integrated and solutions-oriented way.

Recent foresight exercises on the challenges facing Earth system research converged on the need for a step-change in both the conduct and support of such research. More disciplines and knowledge fields need to be engaged, bringing together both disciplinary and interdisciplinary excellence. Close collaboration is essential between the scientific community and stakeholders across the public, private and voluntary sectors to encourage scientific innovation and address policy needs. More financial support for these collaborations is required. Together, these changes will help realise a new ‘social contract’ between science and society to accelerate the delivery of the knowledge that society needs to address pressing environmental changes (Lubchenco 1998). At the Rio+20 United Nations (UN) Conference on Sustainable Development in June 2012, governments agreed to develop a set of Sustainable Development Goals (SDGs) that will integrate environment and development goals for all nations. Future Earth will provide integrative scientific knowledge needed to underpin the SDGs and sustainable development more broadly.

Future Earth will build upon and integrate the existing Global Environmental Change (GEC) Programmes — the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP), DIVERSITAS—biodiversity science, and the Earth System Science Partnership (ESSP). It will also have to expand significantly beyond the existing global networks and engage new institutions and researchers. It must ensure research excellence by being open and inclusive, attracting the brightest minds from a broad range of disciplines and countries.

The research and complementary capacity building and outreach activities of Future Earth will be co-designed by the broad community of researchers (including natural and social sciences, engineering and humanities) in partnership with governments and business and other stakeholders, in order to close the gap between environmental research and policies and practices. Future Earth will deliver a step-change in making the research more useful and accessible for decision-makers.

The conceptual framework

The conceptual framework for Future Earth (Figure 1), which will guide the formulation of research themes and projects, recognises that humanity is an integral part of the dynamics and interactions of the Earth system and that this has important implications for global sustainability. It recognises that many of those socio-environmental interactions occur across different spatial and temporal dimensions.

The conceptual framework illustrates the fundamental interconnections between natural and human drivers of change, the resulting environmental changes and their implications for human well-being. These interactions take place across a range of time and spatial scales, and are bounded by the limits of what the Earth system can provide. It emphasises the challenge of understanding and exploring avenues for human development within Earth system boundaries. This fundamental, holistic understanding is the basis for developing transformative pathways and solutions for global sustainability.

The initial research themes

The conceptual framework guides Future Earth research towards addressing key research challenges, expressed as a set of three broad and integrated research themes:

(i) Dynamic planet—understanding how planet Earth is changing due to natural phenomena and human activities. The emphasis will be on observing, explaining, understanding and projecting Earth environmental and societal trends, drivers and processes and their interactions, as well as anticipating global thresholds and risks. Building on existing knowledge, there will be a particular focus on interactions between social and environmental changes across scales.

(ii) Global development—providing the knowledge for addressing the most pressing needs of humanity including sustainable, secure and fair stewardship of food, water, biodiversity, energy, materials, and other ecosystem functions and services. The emphasis of this Future Earth research theme will be on understanding the impacts of human activities and environmental change on the health and well-being of people and societies and on the interactions of global environmental change and development.
(iii) **Transformations towards sustainability**—providing the knowledge for transformations toward a sustainable future: understanding transformation processes and options, assessing how these relate to human values and behaviour, emerging technologies, and economic development pathways, and evaluating strategies for governing and managing the global environment across sectors and scales. The emphasis of Future Earth research will be on solution-oriented science that enables fundamental societal transitions to global sustainability. It will explore what institutional, economic, social, technological and behavioural changes can enable effective steps towards global sustainability and how these changes might best be implemented.

These research themes will be the main priorities for Future Earth research.
Cross-cutting capabilities

Addressing the proposed integrated research themes will depend on progress in, and access to, a number of core capabilities, including observing systems, Earth system models, theoretical developments, data management systems and research infrastructures. Future Earth will also support and deliver scoping and synthesis activities, communication and engagement, capacity development and education, and effective interactions at the science-policy interface. These capabilities are essential to advance the integrated science of global environmental change and translate it into useful knowledge for decision making and sustainable development. Many of these capabilities lie beyond the boundaries of the Future Earth initiative per se, residing in national and international infrastructures, training programmes, and disciplines. It will be important that Future Earth works in partnership with the providers of these capabilities for mutual benefit.

The governance structure

The governance structure of Future Earth (Figure 2) embraces the concepts of co-design and co-production.

The Science and Technology Alliance for Global Sustainability is responsible for establishing Future Earth and will promote and support its development as the programme’s sponsors. Its members consist of the International Council for Science (ICSU), the International Social Science Council (ISSC), the Belmont Forum of funding agencies, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations University (UNU), and the World Meteorological Organization (WMO) as an observer. Future Earth is led by a Governing Council, and supported by two advisory bodies: an Engagement Committee and a Science Committee.

The Governing Council and its subsidiary bodies will, as appropriate, involve representatives from the full range of stakeholder communities (academia, funders, governments, international organisations and science assessments, development groups, business and industry, civil society and the media).

The Governing Council is the ultimate decision-making body and is responsible for setting Future Earth’s strategic direction and policies. The Science Committee will provide
scientific guidance, ensure scientific quality and guide the development of new projects. The engagement committee will provide leadership and strategic guidance on involving stakeholders throughout the entire research process from co-design to dissemination, ensuring that Future Earth produces the knowledge society needs. The Executive Secretariat will perform the day-to-day management of Future Earth, ensuring the coordination across themes, projects, regions and committees, and liaising with key stakeholders. It is expected that the Secretariat will be regionally distributed. The development of National Future Earth committees will also be actively encouraged.

Towards a funding strategy

Future Earth will require both innovative funding mechanisms and enhancement of existing support. The success of the programme will depend on continued support for essential disciplinary research and infrastructures and a substantial strengthening of the funding bases for trans-disciplinary research and coordination activities. The Alliance will work with the Governing Council and Future Earth Secretariat to secure new and enhanced sources of funding. Already the Belmont Forum has launched in 2012 a new open and flexible process to support international Collaborative Research Actions (CRAs) through annual multi-lateral calls. Members of the Belmont Forum and of the International Group of Funding Agencies for global change research (IGFA), will need to proactively engage with other funders at national and regional levels to create adequate support. Strengthened engagement with development donors, the private sector and philanthropic foundations will be part of a diversified Future Earth funding strategy.
Towards a new model of communications and engagement

Future Earth will position itself as a lead provider of independent and innovative research on global sustainability. It will provide a vibrant, dynamic platform that encourages dialogue, accelerates knowledge exchange and catalyses innovation. Future Earth will develop a comprehensive, flexible communications strategy to engage all relevant users, at regional and global levels, working with regional partners to engage locally, combining the traditional top-down expert information sharing approach with more inclusive iterative dialogue and exploratory participatory and bottom-up approaches. New social media and web technologies provide exciting opportunities and the expertise to take full advantage of these must be embedded in the Future Earth Secretariat.
Future Earth will partner with programmes and networks that already work in the educational sector to ensure rapid dissemination of research findings and their implications for global sustainability to support formal science education at all levels. The identification of effective partners is critical to the success of Future Earth in the complex arena of formal education, with its diversity of local and national mechanisms, cultures and languages. The strengthening of existing partnerships with networks of science and technology centres also provides a valuable mechanism for contributing to the ‘informal’ education sector.

Future Earth has identified capacity building as a basic principle of all its activities and will adopt a multi-tiered approach to scientific capacity building, with both dedicated capacity building actions and capacity building embedded across all its activities and projects. Dedicated capacity building actions will include building a strong international network of scientists committed to international interdisciplinary and transdisciplinary research, a particular focus on early-career scientists and the development of institutional capacity. There will be a strong emphasis on enhancing science capacity in lesser developed countries, with regional partners playing an important role.
As an observer