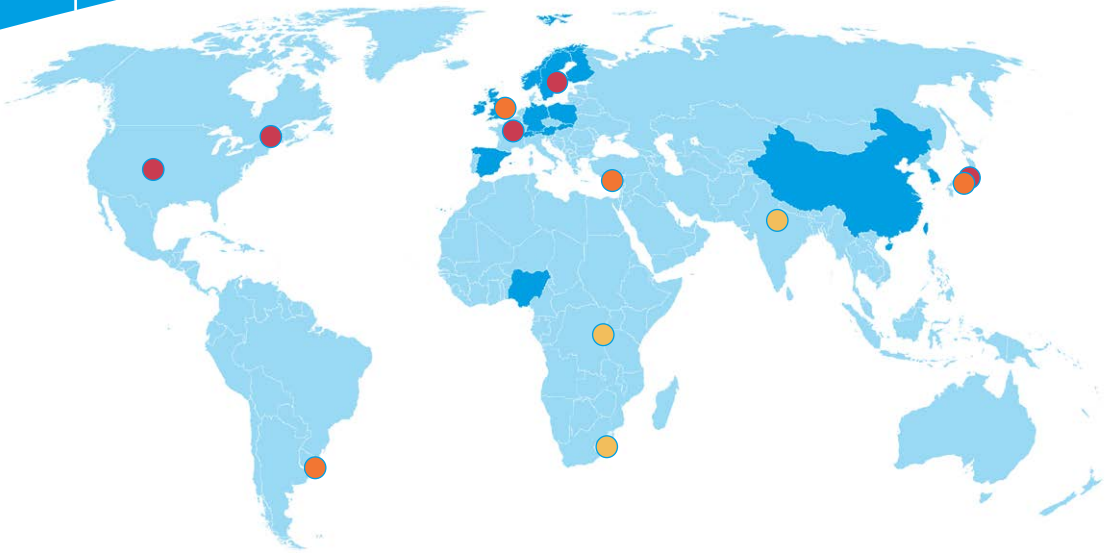
Future Earth Annual Highlights 2015-2016

futureearth
research for global sustainability

A global community for sustainability research



Future Earth is an open network of researchers, projects and institutions committed to increasing knowledge of the Earth and finding solutions to the most pressing challenges facing humans and the planet. Today, our network includes five global hubs (red dots) and seven regional centres (orange dots) and offices (yellow dots), and national committees have established or are forming around the world (countries in dark blue). We also sponsor more than 20 global research projects that produce findings relevant to society on topics from the air to the oceans and biodiversity to sustainable cities.

Here, we highlight some of the biggest news and scientific findings to come out of our network in the past year.

Front cover photo: The Anthronaut Experience – our Virtual Hackathon at COP21 – attracted filmmakers, journalists, developers and Earth systems scientists to explore the potential of Virtual Reality for connecting with the biosphere. This was the second Future Earth Media Lab hackathon and was sponsored by the International Council for Science and Oculus Rift. Photo: Erik Pihl

Booklet design: Jerker Lokrantz/Azote

Global carbon emissions are flat, while economic growth continues

Future Earth's Global Carbon Project projected a second year of slow growth, or even a stalling, of global carbon emissions during 2015. The project reported its findings in its annual update of the Global Carbon Budget, published to coincide with the United Nations climate summit in Paris in December 2015. For 2014, they showed that emissions grew by only 0.6% and might have declined by around that same percentage the next year. A separate International Energy Agency study came to the same conclusion in 2016. This flat trend was primarily explained by a drop in coal use in China, with contributions from a surge in renewable energy worldwide.

Read more:

Jackson, R.B. et al. 2016. Reaching Peak Emissions. *Nature Climate Change* 6:7-10

Le Quéré, C. et al. 2015. Global Carbon Budget 2015. *Earth System Science Data* 7:349-396

Background photo: Smog over central Shanghai and the Huangpu river. Photo: Nils Ryrholm/Azote

Global carbon emissions projected to stall

Understanding past climate change

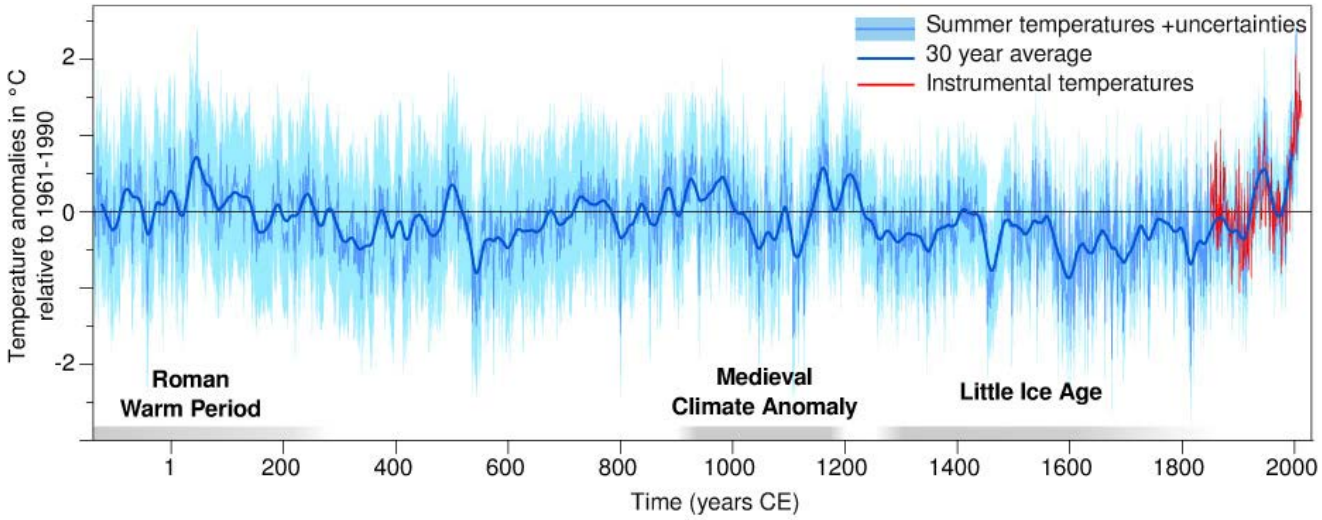
Two new studies provide insights into modern climate change by looking to the past

Recent research out of Future Earth's Past Global Changes (PAGES) project gives a new look at what's in store for the planet as climate change continues. In the first study, published in July 2015, an analysis of the planet's geologic past suggests that current trajectories of climate warming could lead to six metres or more of sea level rise. Researchers examined several warm periods in the planet's history, including one about 400,000 years ago, when temperatures were similar to or slightly hotter than they are today. They discovered that at the time, sea levels were 6 to 13 metres higher than they are now, the result of melting polar ice. Today, the polar ice sheets are again melting and may continue to do so for centuries even if the world acts to slow the pace of climate change.

Professor Andrea Dutton (right) and colleague Jody Webster investigate fossil corals in Seychelles to find clues about past sea level rise. Dutton, of the University of Florida, is a member of Paleo Constraints on Sea Level Rise (PALSEA), which is a group in Future Earth's Past Global Changes (PAGES) project. Photo: Dan Zwartz

Read more:

Dutton, A. et al. 2015. Sea-level rise due to polar ice-sheet mass loss during past warm periods. *Science* 349



A reconstruction of summer temperatures in Europe, showing a sharp spike in the modern era.
Graphic: Luterbacher et al. 2016

European summers are warmest since Roman times

A second PAGES study exploring tree ring records and historical documentary evidence from Roman times to the present found that European summers are the hottest they've been in 2000 years. Since 1986, summer temperatures on the continent have risen about 1.3°C, and the most recent 30 summers were warmer than the summers in any 30-year period in two millenia. The findings support the conclusion of the Intergovernmental Panel on Climate Change that temperatures during the past 30 years are mostly manmade and outside the range of natural changes from volcanic eruptions and the sun's heat output. The study also found that historic European summer warmth was more variable than previously thought, suggesting that the continent could undergo powerful swings in temperature in the years ahead.

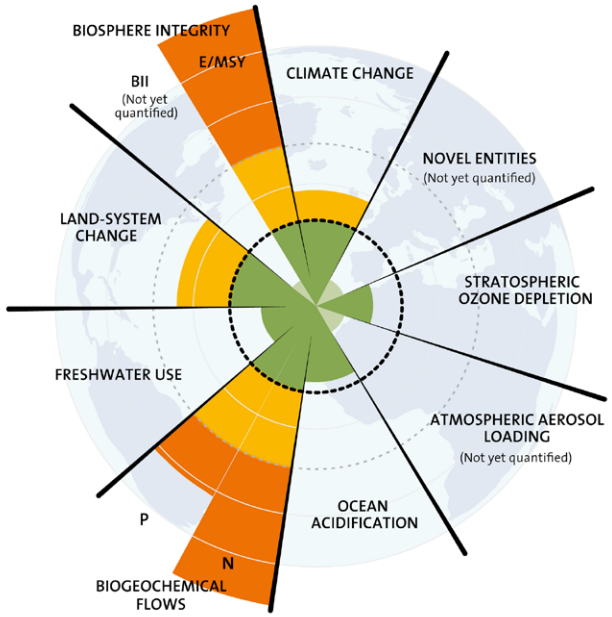
Read more:

Luterbacher, J. et al. 2016. European summer temperatures since Roman times. *Environmental Research Letters* 11(2)

Indicators identified of the Anthropocene age

Four of nine planetary boundaries have potentially been crossed

Earth has transgressed planetary boundaries as a result of human activity, increasing the risk of reaching dangerous thresholds that could tip the planet into a new state. That is the conclusion of a 2015 study by a team of international researchers, including Future Earth Science Committee member Belinda Reyers. These "planetary boundaries" are climate change, biodiversity loss, land cover change and the flow of nitrogen and phosphorous around the world.



The nine planetary boundaries. Those that have been crossed are in orange. Graphic: J Lokrantz/Azote

Lead author Will Steffen of the Australian National University led a related study identifying a dashboard of 24 indicators that suggest that mankind has driven a "Great Acceleration" in social and environmental change around the globe — a concept pioneered by the Future Earth predecessor, the International Geosphere-Biosphere Programme. These indicators include an acceleration in population, gross domestic product, energy use, water, transport, deforestation, crop fertilizers, telecommunications and atmospheric chemistry. Wendy Broadgate and Owen Gaffney from the Future Earth Sweden Global Hub contributed to this study.

Read more:

Steffen, W. et al. 2015. Planetary boundaries: Guiding development on a changing planet. *Science* 347

Steffen, W. et al. 2015. The trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review* 2:81-98

Plant trait database a unique tool to analyse which plants might grow together in the future

An online archive recording 5.6 million different measurements of 100,000 plants species built over the past 10 years has revealed the traits that constrain how plants grow, survive and reproduce. These measurements come from the TRY database, an effort of the bioDISCOVERY research project of Future Earth. According to a 2016 study, a suite of six traits, including plant height, seed mass and leaf and stem characteristics, play a crucial role in influencing how plants function. That study was led by Sandra Diaz, a member of Future Earth's Science Committee.

A second effort, led by Georges Kunstler of Irstea in France, connected the same archive to tree growth data from around the world to show that a set of key measurements can also predict how trees compete with each other. The study contradicted a tenet of classical ecological theory that suggests that similar species will compete more than dissimilar ones.

Read more:

Díaz, S. et al. 2016. The global spectrum of plant form and function. *Nature* 529:167-171

Kunstler, G. et al. 2016. Plant functional traits have globally consistent effects on competition. *Nature* 529:204-207

Professor Sandra Diaz (right) and her colleagues Valeria Falczuk and Lucas D. Gorn. Diaz is at the Universidad Nacional de Córdoba, Argentina. The Plant Trait database was built from an IGBP-DIVERSITAS Fast-Track Initiative collaboration and continues as part of bioDISCOVERY. It is hosted at the Max Planck Institute for Biogeochemistry in Jena, Germany, in collaboration with the German Centre for Integrative Biodiversity Research (iDiv). Photo: Sandra Diaz

Plant measurements predict future functioning in the face of change

A historic year for global sustainability policy

2015 was the year of the Paris Agreement, the Sustainable Development Goals and much more

The past year was a landmark period for international environmental and sustainability policy. In June 2015, Pope Francis released "Laudato Si," a new encyclical that called the world to act on climate change, to halt pollution, the loss of species and other indicators of the Anthropocene. September saw the establishment of the United Nations' Sustainable Development Goals, a set of targets against which every country will assess its contributions toward sustainable development. Then in December, nations adopted the Paris Agreement, pledging to limit warming from climate change to 2°C. Future Earth researchers made important contributions to these historic processes.

A participant wears a Virtual Reality headset during the Anthronaut Experience at COP21 (top left). Future Earth research partners convened a packed conference on the final day of COP21 about the science of warming of 2°C (right). The United Nations lights up its headquarters in New York to commemorate its 17 Sustainable Development Goals. Photos: Erik Pihl; Future Earth; UN/Cia Pak

Scenes from the Our Common Future conference. Photos: INRA/C. Maitre

Finding solutions for humanity's common future

Ahead of COP21, Future Earth, the International Council for Science (ICSU) and UNESCO co-organised and sponsored the landmark conference "Our Common Future under Climate Change" in July 2015 in Paris. The conference represented a new kind of scientific meeting: It brought together 2000 researchers from across disciplines and 100 nations to discuss climate change and its relationship to other global challenges and to the United Nations' Sustainable Development Goals. But participants also talked about new ways of connecting science to policy and action. At the end of this four-day event, the conference released an outcome statement that highlighted the problems and potential solutions for making those connections. Among other conclusions, it stated that "science is a foundation for good decisions at COP21 and beyond".

Learn more:

Our Common Future under Climate Change website

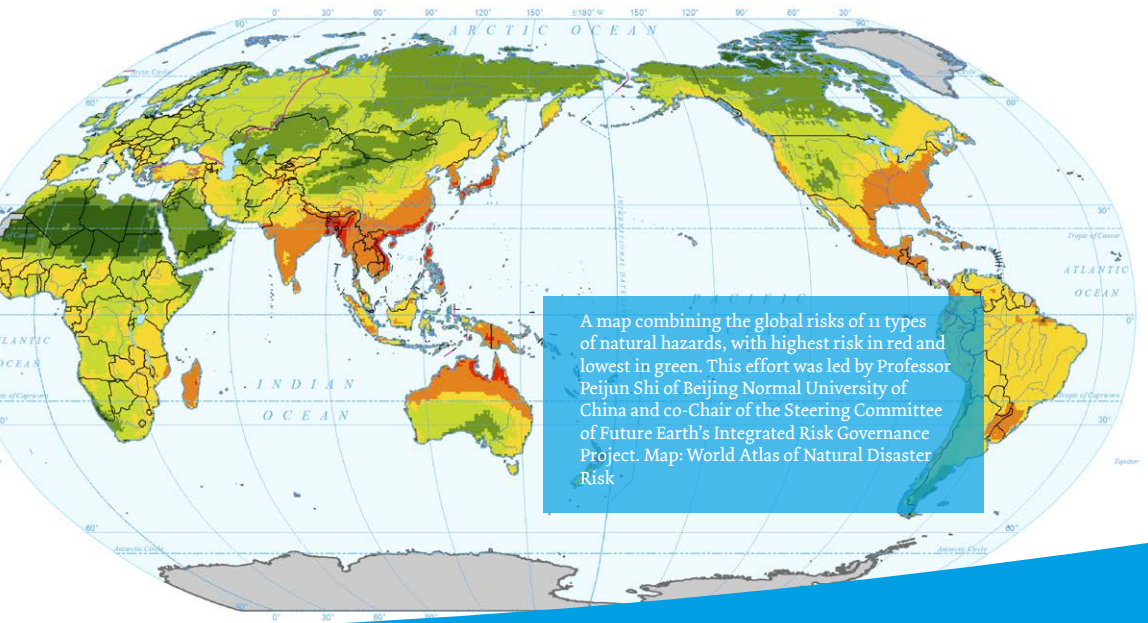
World Atlas of Natural Disaster shows risks to lives and livelihoods

Three hundred maps track 11 natural hazards on a global and nation-by-nation level

A new atlas published on the eve of the United Nations World Conference on Disaster Risk Reduction in March 2015 in Sendai, Japan, maps the economic and human effects of natural disasters on a global scale and on a nation-by-nation basis. The goal of the atlas is to help people and organisations to better understand the natural hazards that impact their communities. It was produced by the Integrated Risk Governance Project, a global research project of Future Earth. The Atlas comprises over 300 risk maps for 11 types of natural hazards, including earthquakes, volcanoes, sand-dust storms and droughts, as well as maps showing the combined effects of multiple risks. The Atlas also quantifies how these disasters influence nations' expected annual mortality and property at risk.

Read more:

Shi, P. and R. Kasperson. 2015. *IHDP/Future Earth-Integrated Risk Governance Project Series: World Atlas of Natural Disaster Risk*. Springer



A map combining the global risks of 11 types of natural hazards, with highest risk in red and lowest in green. This effort was led by Professor Peijun Shi of Beijing Normal University of China and co-Chair of the Steering Committee of Future Earth's Integrated Risk Governance Project. Map: World Atlas of Natural Disaster Risk

Future Earth has a presence across continents, regions and countries

Future Earth builds on more than three decades of global environmental change research conducted by the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environmental Change (IHDP) and DIVERSITAS. In 2015, the IGBP, which was originally formed in 1986, closed its doors. Many of of the research projects of IGBP, IHDP and DIVERSITAS have now transitioned to Future Earth.

In the past year, Future Earth became operational around the world with the appointment of Executive Director Paul Shrivastava and Global Hub Directors in five hubs. They are located in Colorado, Montreal, Paris, Stockholm and Tokyo. Also newly operational are four Future Earth Regional Centres hosted by the Inter-American Institute for Climate Change in Montevideo, Uruguay, for Latin America and the Caribbean; the Cyprus Institute in Nicosia, Cyprus, for the Middle-East and North Africa; the Research Institute for Humanity and Nature in Kyoto, Japan, for Asia; and the Tyndall Centre for Climate Change in Norwich, UK, for Europe.

Next year brings new regional offices to Rwanda, South Africa and South Asia. Many countries are already participating in Future Earth by starting up their own national committees and networks. We have also launched eight Knowledge-Action Networks to organise our research strategy around key themes in global sustainability. Stay tuned for news from Future Earth in 2016 and beyond.

We thank all of our global, regional and national funders for their support. Total funding for the five Global Hubs in the first financial year of Future Earth (2015 to 2016) was 4.6M USD. 33% has been spent on start-up and operations, 30% on delivering the strategy, 26% on scientific & engagement activities (including strategy, research enabling, synthesis & foresight, capacity building and coordination) and 11% on communications.

To see a list of our funders, visit http://futureearth.org/funders.

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Building on a 30-year legacy

Our Directors

Paul Shrivastava
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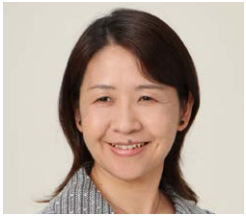

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