Commission on Planetary Health
Human health and well-being in the Anthropocene

Population

Poverty

Life expectancy

Energy use

Water use

Domesticated land

World Population (Billion)

Share of world population living on less than $1.90
Global life expectancy at birth (years)

World primary energy use (EJ)

Global water use (thousand km³)

Land used for agriculture globally (%)

1800 1850 1900 1950 2000

World Population (billion)

1800 1850 1900 1950 2010

1800 1850 1900 1950 2000

1800 1850 1900 1950 2000

1800 1850 1900 1950 2010

1800 1850 1900 1950 2000

1800 1850 1900 1950 2000
The Anthropocene epoch

The Dutch Nobel laureate Paul Crutzen popularised this term in 2000 when he argued that the current geological epoch should be renamed to reflect the impact of humans.

Holocene epoch
Covers about the last 11,700 years

Jurassic period (About 201m to 145m years ago) - Mesozoic Era
The middle part of the Mesozoic Era is called the Age of Reptiles, when large herbivorous dinosaurs thrived.

Early Sph

Devonian period (About 415m to 355m years ago) - Paleozoic Era
Named after Devon, where rocks from this period were first studied. Fish reached substantial diversity.

Cambrian period (About 541m to 485m years ago) - Paleozoic Era
The rapid diversification of life forms produced the first representatives of all modern animal phyla.

Early reptiles

Permian period (About 290m to 252m years ago) - Paleozoic Era
A mass extinction wiped out 95 per cent of all species. All life today is descended from the remaining 5 per cent.

Paleogene period (About 66m to 23m years ago) - Cenozoic Era
Mammals evolved from relatively small, simple forms into a large group of diverse animals.

Early Horse

Humankind is entering a new epoch, according to an influential group of geologists, ecologists and climate experts. The Holocene epoch, which began roughly 12,500 years ago, could be coming to an end due to humanity’s devastating imprint on the planet. Scientists suggest we could be entering the Anthropocene epoch.
Planetary boundaries
(Steffen et al Science 2015)
The emission pledges submitted to the Paris climate summit avoid the worst effects of climate change (red), most studies suggest a likely temperature increase of about 3°C (brown). Over 1000 scenarios from the IPCC Fifth Assessment Report are shown.

Source: Fuss et al 2014; CDIAC; Global Carbon Budget 2015
Historical cumulative GHG emissions by country

Cumulative emissions from fossil-fuel and cement were distributed (1870–2014): USA (26%), EU28 (23%), China (12%), and India (3%) covering 64% of the total share.

Source: CDIAC; Le Quéré et al 2015; Global Carbon Budget 2015
Estimates for 2012, 2013, 2014, and 2015 are preliminary
Source: CDIAC; Le Quéré et al 2015; Global Carbon Budget 2015

Uncertainty is ±5% for one standard deviation (IPCC “likely” range)
WATER STRESS BY COUNTRY

ratio of withdrawals to supply

- Low stress (< 10%)
- Low to medium stress (10-20%)
- Medium to high stress (20-40%)
- High stress (40-80%)
- Extremely high stress (> 80%)

This map shows the average exposure of water users in each country to water stress, the ratio of total withdrawals to total renewable supply in a given area. A higher percentage means more water users are competing for limited supplies. Source: WRI Aqueduct, Gassert et al. 2013
Our Global Ecological Footprint

- North America: 5 Earths
- Western Europe: 4 Earths
- Central and Eastern Europe: 3 Earths
- Latin America: 2 Earths
- Middle East + Central Asia: 1 Earth
- Asia Pacific: 2 Earths
- Africa: 0 Earths

Population (bar width)

http://8020vision.com/
Put simply, planetary health is the health of human civilisation and the state of the natural systems on which it depends.
Links with health

Environmental changes and ecosystem impairment

- Climate change
- Stratospheric ozone depletion
- Forest clearance and land cover change
- Land degradation and desertification
- Wetlands loss and damage
- Biodiversity loss
- Freshwater depletion and contamination
- Urbanisation and its effects
- Damage to coastal reefs and ecosystems

Examples of health effects

Direct health effects
- Floods, heatwaves, water shortage, landslides, exposure to ultraviolet radiation, exposure to pollutants

Ecosystem-mediated health effects
- Altered infectious disease risk, reduced food yields (undernutrition, stunting), depletion of natural medicines, mental health (personal, community), effects of aesthetic or cultural impoverishment

Indirect, deferred, and displaced health effects
- Diverse health consequences of livelihood loss, population displacement (including slum dwelling), conflict, inappropriate adaptation and mitigation
Inability to work due to thermal stress

Dunne et al. 2012
Record drought in Syria – risk more than doubled by climate change

Timeline of Events
Prior to the 2011 Uprising

1970s-1990s
Agricultural policies promote production of staple crops, leading to increase in number of groundwater wells and use of inefficient and outdated irrigation methods


12 March, 1971
Hafez al-Assad becomes president of Syria


2003-2010: Iraqi and Syrian Refugees and Internally Displaced Persons (IDPs) Net Urban Influx [in Millions]

2005-10:

2003-2010:

Syrian IDPs

Iraqi Refugees

Drought (2005-10)

Since 2005
Apartment prices in Damascus have more than doubled

Winter 2007-08:
Driest in observed record

Since 2007
Wheat, rice, and feed prices have doubled

March 2011
Uprising in Syria

Kelley et al., PNAS 2015

http://www.pnas.org/content/suppl/2015/02/23/1421533112.DCSupplemental/pnas.201421533SI.pdf
Saltwater intrusion and pre-eclampsia in coastal Bangladesh

Khan, Vineis et al 2009-14

High levels of salinity in drinking water for ~ 40 million people

- Mean Urinary Sodium x 2 WHO/FAO recommended levels in pregnant women

- Adjusted risks for (pre)eclampsia and gestational hypertension increased with increasing sodium concentrations
Effects of multiple environmental changes on food availability and quality

- Land degradation and soil erosion
- Water scarcity
- Loss of pollinators
- Overfishing/Ocean acidification
- Climate change
  - CO₂ fertilization
  - Ozone
  - Pests, mold and fungi
CLIMATE CHANGE: Poor Countries Projected to Fare Worst

MODELLED CHANGES IN CEREAL GRAIN YIELDS, TO 2050

UN Devt Prog, 2009

Percentage change in yields between present and 2050

-50 -20 0 20 50 100

No data
Future drought impacts on yields under climate change (Rice, maize, wheat)

Yield changes:
- Avg. RCP2.6: (+3%; -9%)
- Avg. RCP4.5: (+0.4%; -17%)
- Avg. RCP8.5: (+0.8%; -23%)

Using 15 models, and 3 RCP scenarios for each
Full pollinator service loss would lead to an estimated 1·42 million (1·38–1·48) additional deaths per year. Myers et al Lancet 2015
• In 2015, one in three people (2.4 billion) still use unimproved sanitation facilities, including 946 million people who still practise open defecation.

• Inadequate water accounted for 685,000 deaths from diarrhoeal disease in 2012.

• Incidence of diarrhoeal disease expected to increase 8-11% globally by 2040 despite prevention and treatment campaigns.
Emerging diseases

- Cyclosporiasis (1999)
- Marburg haemorrhagic fever (1967)
- vCJD (1996)
- Cryptosporidiosis (2008)
- E. coli O104:H4 infection (2011)
- Schmallenberg virus infection (2011)
- Diptheria (1990–1996)
- Vancomycin-resistant S. aureus infection (1995)
- Enterovirus 71 infection (1999)
- Drug-resistant malaria (2006)
- Nipah virus infection (1999)
- Dengue fever (2009)
- Hantavirus infection (1996)
- Marburg haemorrhagic fever (2005)
- Lassa fever (2005)
- Extremely drug-resistant tuberculosis (2011)
- Ebola haemorrhagic fever (1976, 2014)
- Typhoid fever (2004)
- Rift Valley fever (1931, 2006, 2012)
Estimates of air pollution deaths

(Why 2014, Lim et al LANCET 2012; 380)

- Ambient particulates \( \sim 3.7 \) m deaths p.a.
- Household from solid fuels \( \sim 4.3 \) m deaths p.a.
- Around 7 million in total
- Tropospheric Ozone \( \sim 150 \) k deaths p.a.
Annual average global mortality (1997–2006) due to Landscape fire smoke

Reproduced from Johnston and colleagues 2012; by permission of Environmental Health Perspectives.
Disasters and displacement – the example of Pakistan
Meeting the challenges – Imagination, Knowledge, Implementation
Developing sustainable and healthy cities

- Active travel/public transport
- Reduced fine particulate air pollution
- Green spaces – biodiversity, reduced heat island and mental health benefits
- Watershed conservation
- Access to healthy food
- Increased resilience to floods, storms, and droughts
2.4 m deaths averted from measures aiming to reduce black carbon emissions (UNEP 2011)

- Improved biomass stoves
- Modern coke ovens
- Remove big smokers / DPF
- Cooking with clean fuel
- Pellet biomass heating stoves
- Improved brick kilns
- Coal briquettes replacing coal
- Reduce agricultural burning
- Reduce flaring
Health Economic Benefits of reducing air pollution

- Air pollution reductions in EU: €38bn/year by 2030
- Global 36% renewables --- avoided health costs of $230bn/year by 2030
- Benefits of avoided mortality $50-380/tCO2
Multiple approaches for meeting increased food requirements

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<th>Past production</th>
<th>Future needs</th>
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<table>
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<th>2007 data</th>
<th>Area (x10^6 hectares)</th>
<th>Production (x10^6 tons)</th>
<th>Yield (tonnes per hectare)</th>
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<td>Rice</td>
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<td>Wheat</td>
<td>214</td>
<td>606</td>
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Reducing food waste

Nearly 30% of the world’s total agricultural land is used to produce food that is never eaten.
Reduced GHG emissions and land use requirements from healthy diets

We are using grains to feed animals!

While the world’s population has doubled in the past half century, its appetite for meat has quadrupled. To produce more than 200 million tons of meat a year, livestock are now fed about 40 percent of all grain harvested.

Pounds of grain needed to produce one pound of bread or one pound of live weight gain in each animal.
Future fish requirements

Need for Sustainable aquaculture

- Aquaculture
- Wild (capture) fisheries

Year:
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010
- 2020
- 2030
- 2040
- 2050

Million tons:
- 0
- 20
- 40
- 60
- 80
- 100
- 120
- 140
- 160
- 180
- 200
- 220
Ecosystem strategies to increase disaster resilience e.g. Wetlands, mangroves and coral reefs can protect coastlines
How Forest Conservation Reduces Disease risks – examples from the Brazilian Amazon

Malaria transmission
(-) fewer vector breeding sites.
(-) larger vector predator populations and greater diversity of mammalian species (promoting dilution effects)
(-) microclimate inhibits anopheline mosquitoes.

Acute Respiratory Infections (ARI)
(-) forests may filter air particulates.

Diarrhea
(-) fewer fires and lower smoke emission
(-) reduced collection and burning of biomass fuels

Diarrhea
(-) forest may reduce flooding and filter pathogens from surface water.

Bauch, Birkenbach, Pattanayak and Sills PNAS 2014
Is your health system resilient?

- **Aware?** Detects health threats before they strike.
- **Adaptive?** Rebounds from shocks stronger than before.
- **Integrated?** Rapidly deploys resources from beyond the health system.
- **Diverse?** Delivers range of services with universal health coverage.
- **Self-regulating?** Prevents health disruptions from turning into disasters.

#HealthForAll
Policies for taxes and subsidies that support planetary health
Increasing access to modern family planning

Around 225 million women who want to avoid pregnancy are not using effective contraception.

Access to family planning could cut maternal deaths by around 30%.

Meeting the needs for modern contraception in low-income countries would cost only an additional $5.3 billion per year.

Source: UN Millennium Development Goals Report 2012
Integrating Planetary Health with the Sustainable Development Goals
Moving towards the circular economy
Our Planet, Our Health funding opportunities

Our Planet, Our Health: call for ambitious, transdisciplinary programmes that research the ways complex changes in our environment affect our health and develop potential solutions to enhance resilience.
• Solutions lie within reach and should be based on the redefinition of prosperity to focus on the enhancement of quality of life and delivery of improved health for all, together with respect for the integrity of natural systems.