Expert Group on Sustainable Space Utilization Supporting Sustainable Development on Earth

Working Group on Long-Term Sustainability of Outer Space Activities

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Terms of Reference - A/AC.105/L.281/Add.4

14. Topics for examination by the Working Group could include:

(a)Sustainable space utilization supporting sustainable development on Earth (Expert group A):

(i)The contribution of space science and technology to sustainable development on Earth, early warning of potential disasters and support for management of disaster-related activities;

(ii) The concept of sustainable development extended to the domain of outer space, including the avoidance of harmful contamination of celestial bodies;

(iii) Equitable access to outer space and to the resources associated with it, as well as to the benefits of outer space activities for human development;

(iv) International cooperation in peaceful uses of outer space as a means of enhancing the long-term sustainability of outer space activities and supporting sustainable development on Earth;

Four Topics for the EGA.

Identify, address and make recommendations regarding:

1 - Main sustainable development issues, including early warning and disaster management issues, that can be supported by outer space activities
2 - Technical capacity-building and international cooperation to ensure that all countries benefit from space applications and have access to space data that improves human development and contributes to sustainable development on Earth
3 - Equitable access to the limited resources of outer space and to the benefits of outer space activities for human development and sustainable development
4 - Sustainable development extended to the domain of outer space.

Guiding Principles

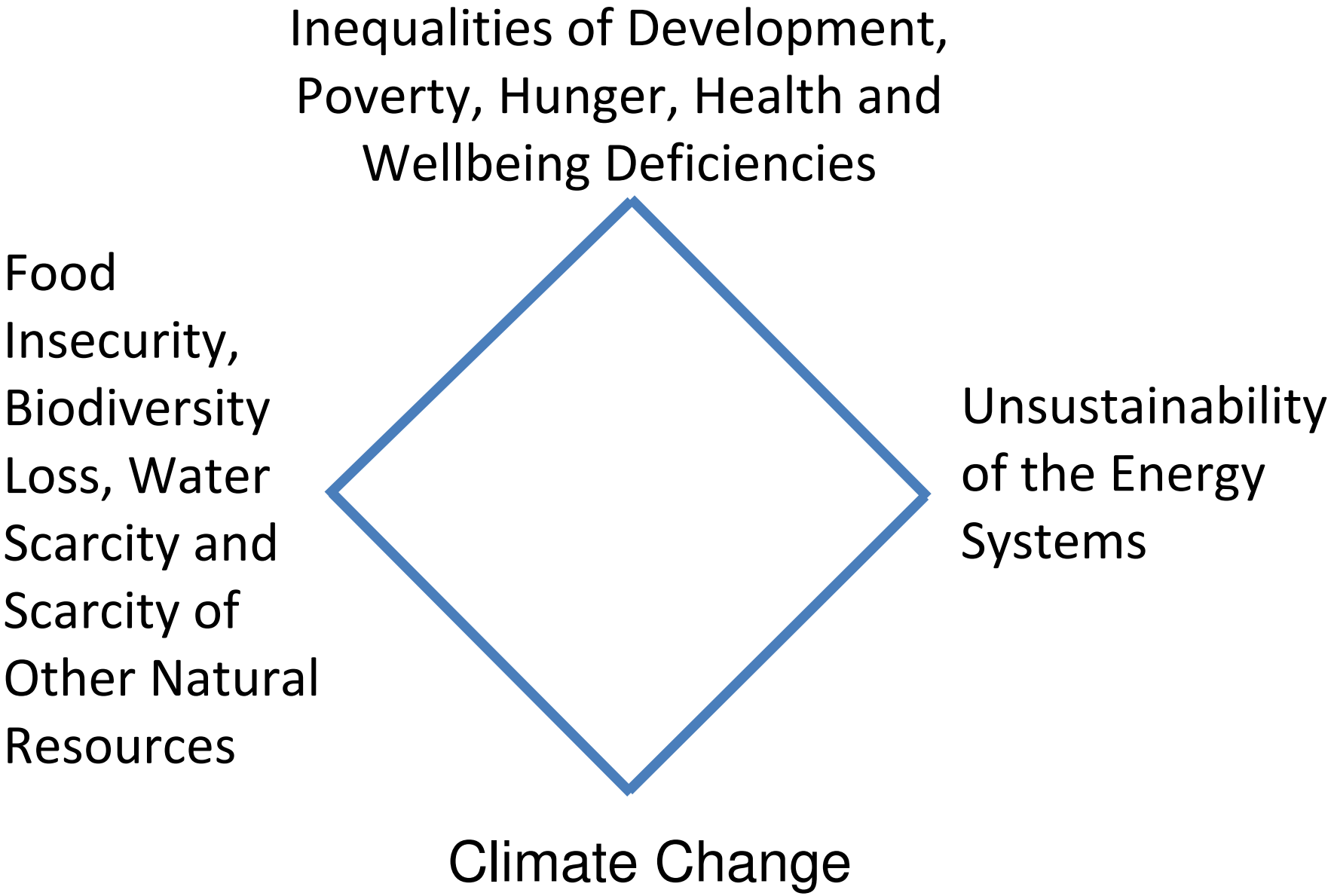
How outer space applications help to:

-address and mitigate the present drivers of unsustainability and keep humanity within safe planetary boundaries
-contribute to human development and in particular to the Millennium Development Goals for 2015
-improve disaster management and humanitarian relief

How to improve capacity-building and equitable access to space applications and space data

Emphasis on Long-term Sustainability

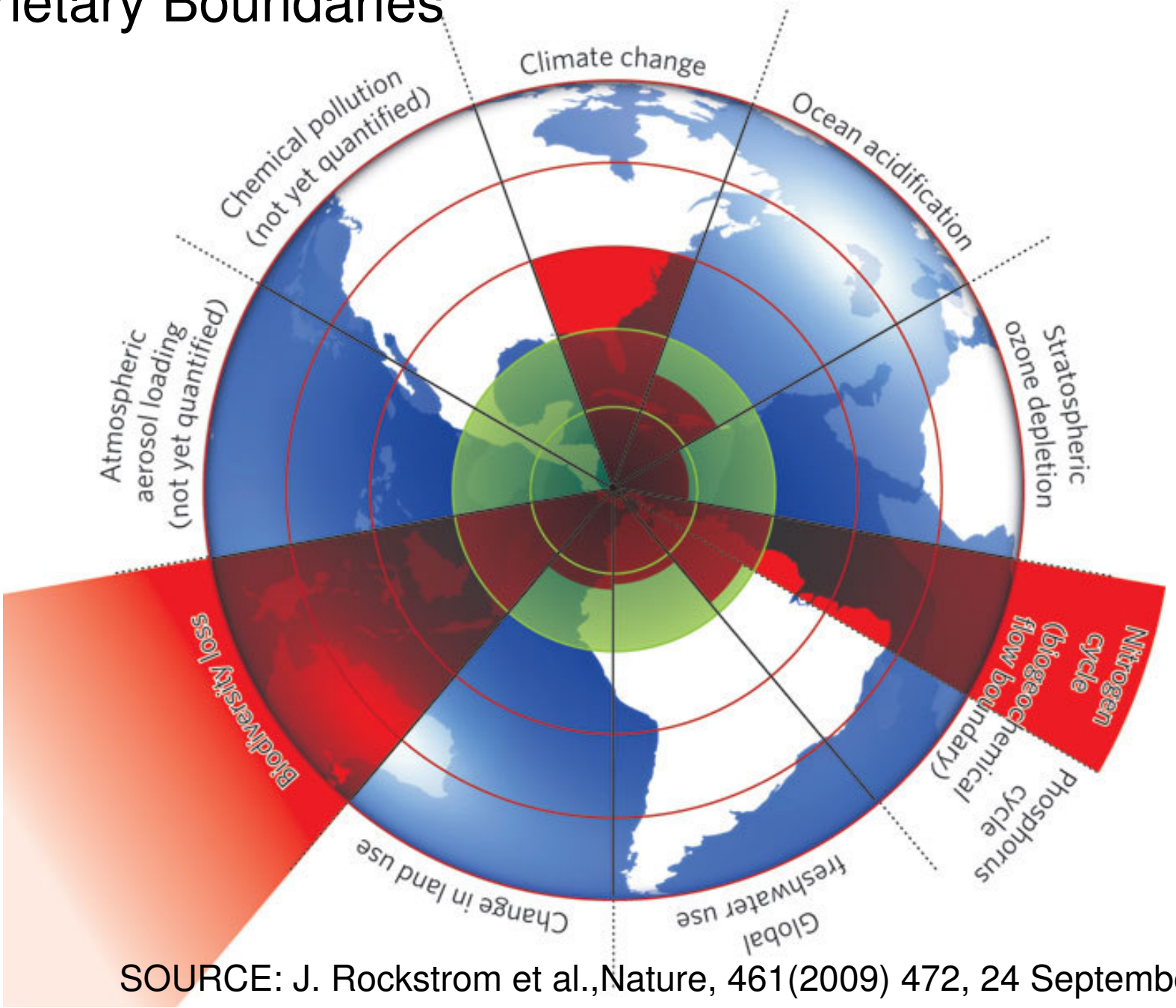
The Square of Unsustainability



-All 4 drivers of unsustainability are strongly interconnected and interdependent

-It is not possible to reach sustainable development without addressing the 4 simultaneously

Planetary Boundaries



SOURCE: J. Rockstrom et al.,Nature, 461(2009) 472, 24 September

ENERGY SUSTAINABILITY

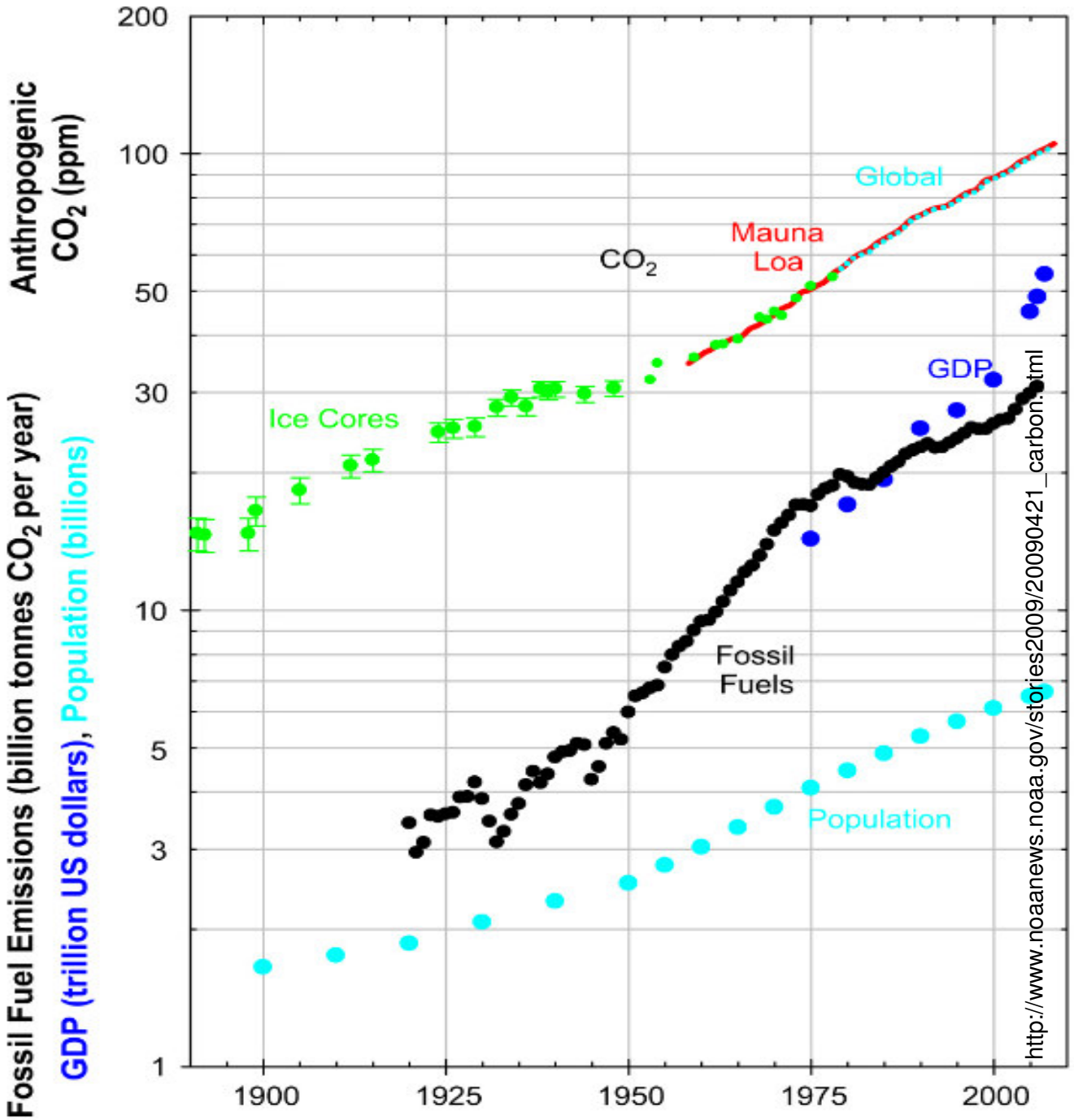
- Access to energy sources

- Price and competitiveness

- Environmental compatibility.

Approximately 80% of the world energy primary sources are fossil fuels – Strong connection between energy and climate change

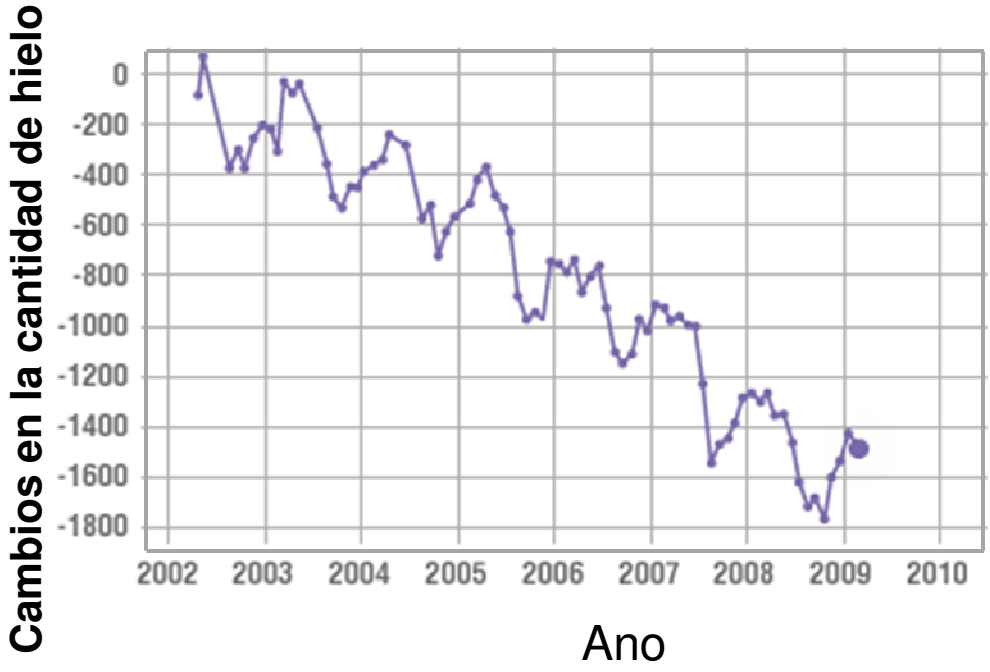
Anthropogenic atmospheric carbon dioxide, fossil fuel emissions, world gross domestic product (GDP), and world population for the past century. Carbon dioxide data from Antarctic ice cores (green points), Mauna Loa Observatory (red curve), and the global network (blue dots).

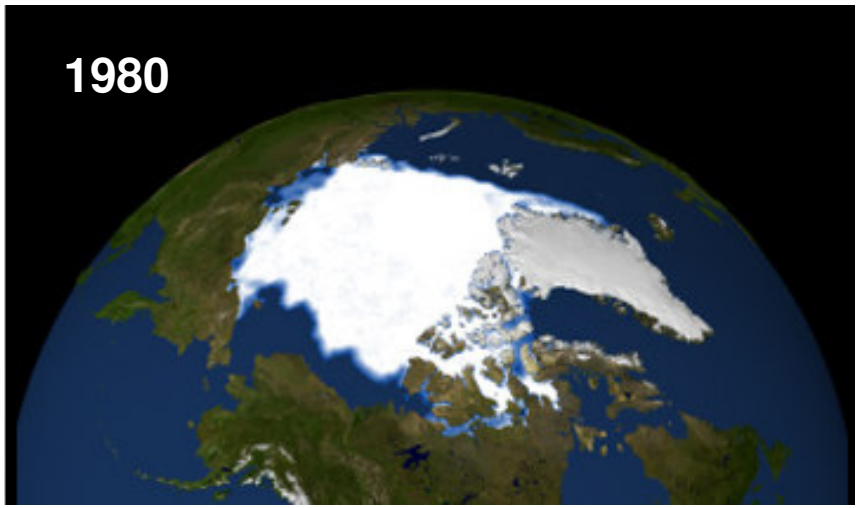


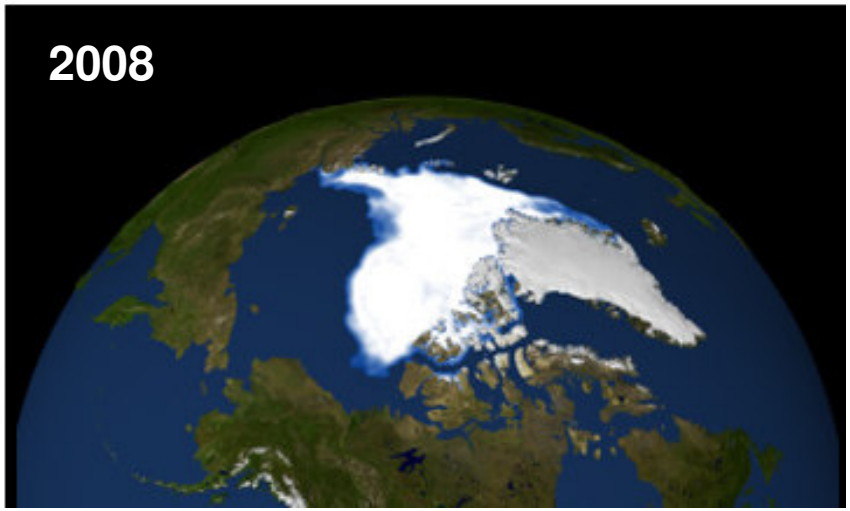
SOURCE: NOOA, April 2009

Fonte: NOOA, April 2009

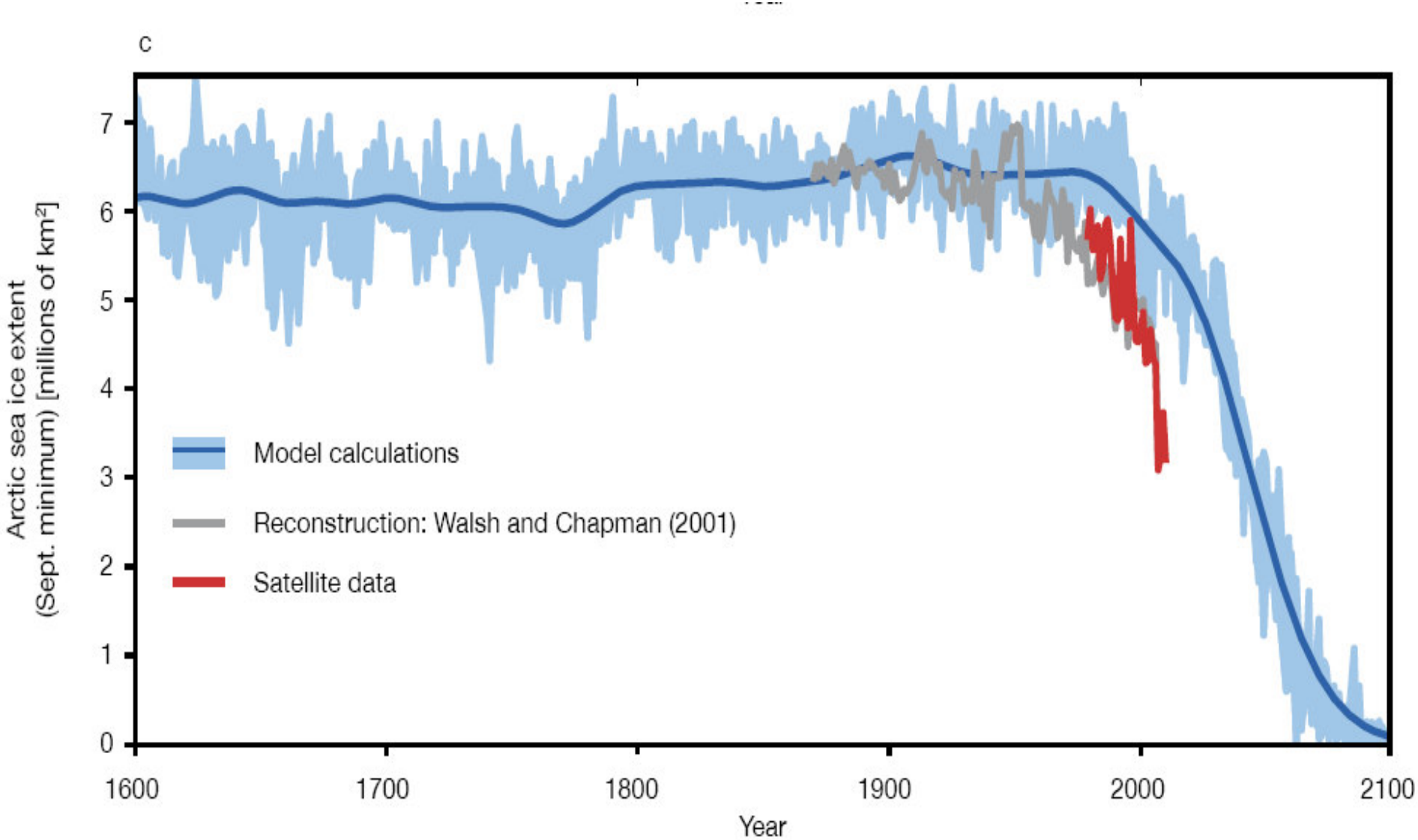
Arctic Sea Ice Area







SOURCE: NASA -University of California Irvine. 2010.



c) Extent of Arctic sea ice at the summer minimum (September), according to observed data, reconstruction (Walsh and Chapman, 2001) and a series of model calculations by the Max Planck Institute for Meteorology, Hamburg (based on Jungclaus et al., 2010).

Source: based on WBGU, 2009, amended

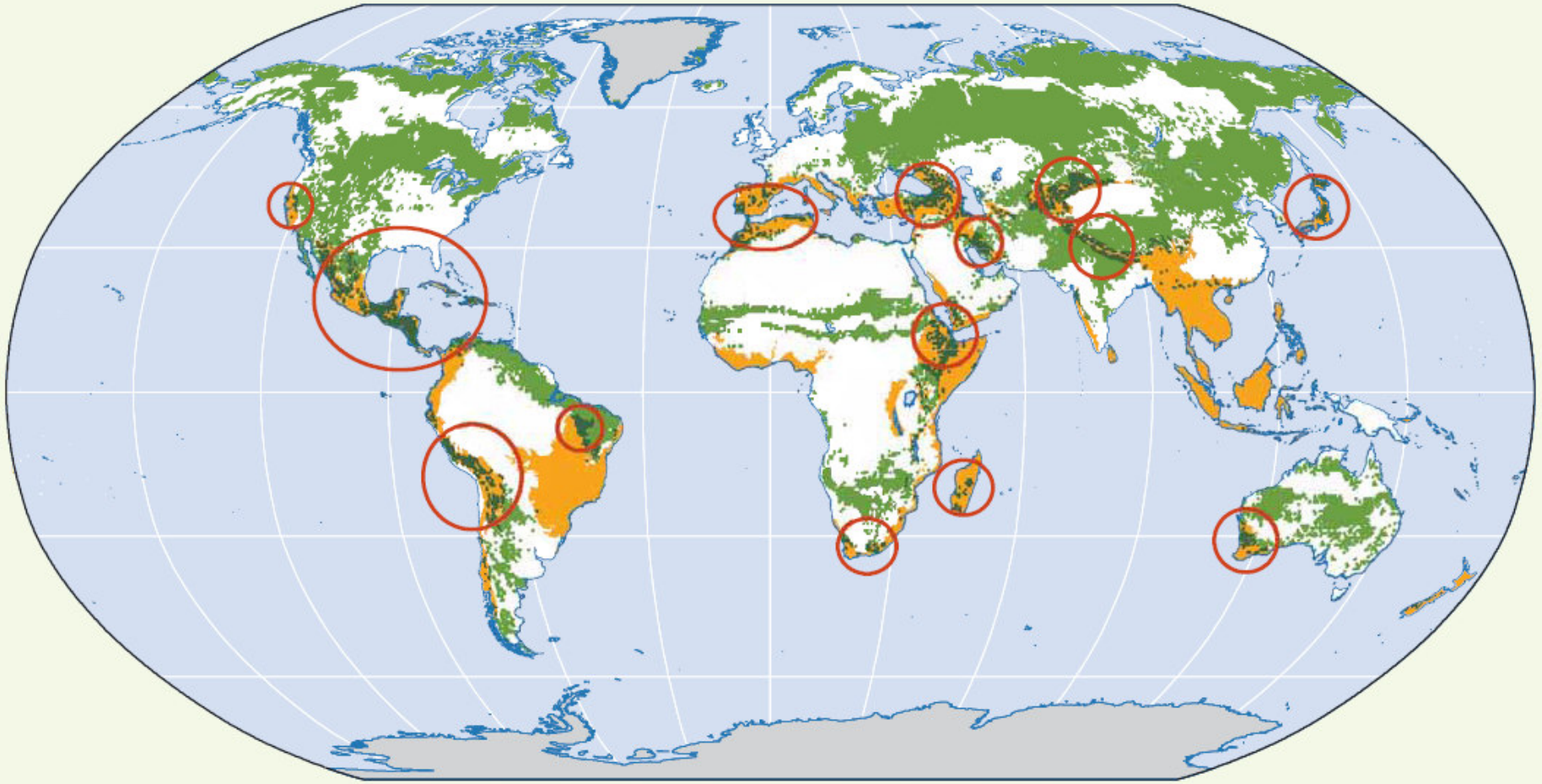
Table 1.1-2
Interaction of Global Environmental Changes. Red: cumulative intensifying effect; green: cumulative alleviating effect; black: neutral or unknown effect, or impact to be analysed individually.
Source: WBGU

SOURCE WBGU

Impact of / on	Climate change	Biodiversity loss	Freshwater scarcity and pollution	Soil degradation, desertification	Pollutants and nutrients
Climate change		CO_2 emissions through the loss of natural ecosystems (stocks and sinks); albedo change		Loss of CO_2 stock and sink function: albedo increase	Impact of aerosols: CFCs; ground-level ozone; stratospheric ozone
Biodiversity loss	Overtaxation of ecosystems' and species' ability to adapt (e.g. coral bleaching)		Degradation of limnic ecosystems; species loss	Ecosystem degradation; species loss	Accumulation of pollutants in natural ecosystems; eutrophication; species loss
Freshwater scarcity and pollution	Altered precipitation volumes and patterns	Altered local hydrological balances, e.g. through deforestation, increased sediment load in rivers		Increased pollutant and sediment burden	Contamination of water resources (e.g. through mercury, pesticides); sediment burden
Soil degradation, desertification	Desertification as a consequence of less precipitation in arid areas	Increased erosion through loss of plant cover	Salinisation		Soil burdening through heavy metals and organic substances
Pollutants and nutrients		Less air filtration; decelerated pollutant degradation	Decelerated pollutant degradation	More dust through wind erosion	

Deforestation in Amazonia, seen from satellite. The roads in the forest follow a typical "fishbone" pattern SOURCE, NASA, 20 September 2006

Map FB.1 While many of the projected ecosystem changes are in boreal or desert areas that are not biodiversity hotspots, there are still substantial areas of overlap and concern



SOURCE: Myers et al., 2000
Fischlin et al., 2007

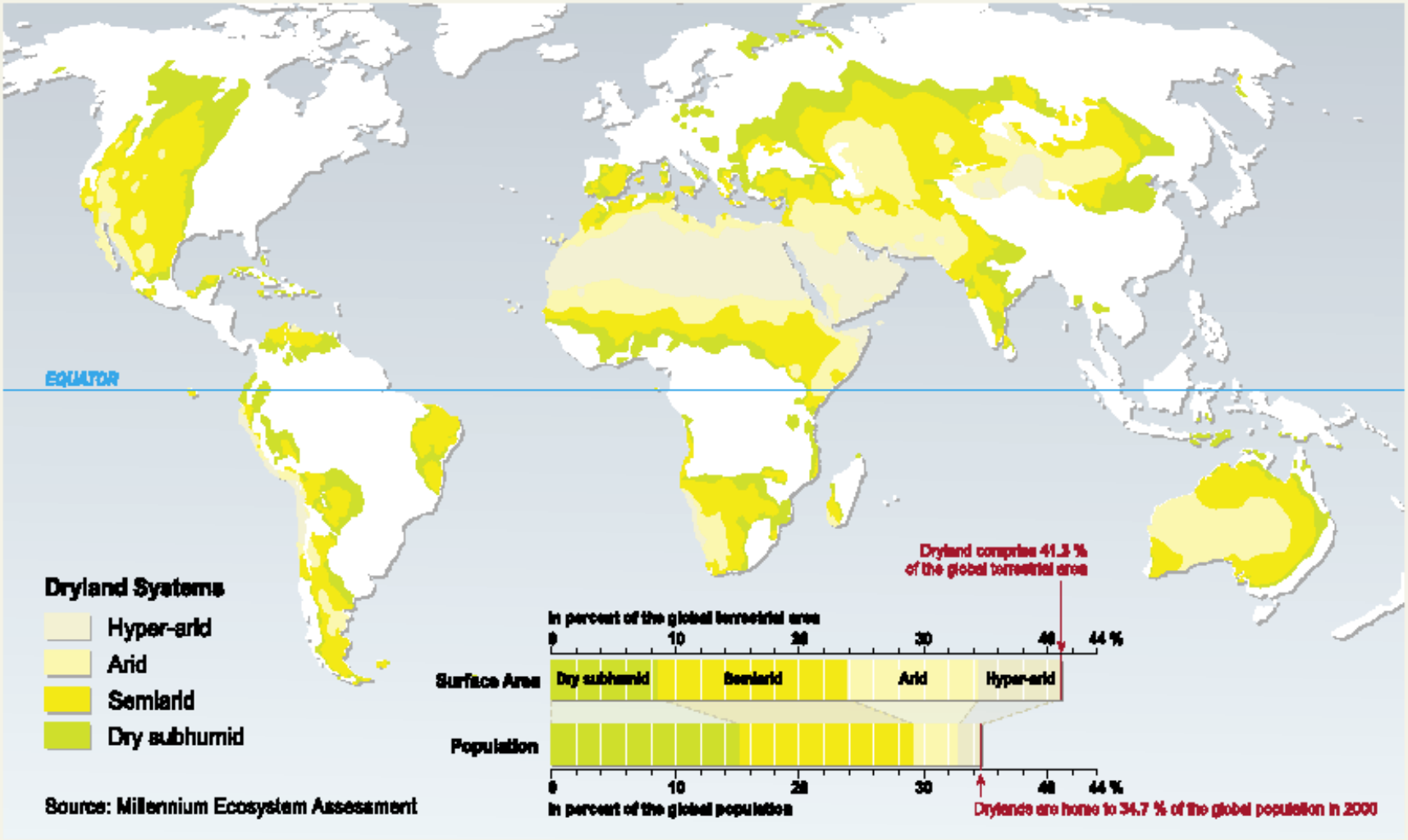
Source: WDR team based on Myers and others (2000) and Fischlin and others (2007).

Note: The figure shows the overlap between biodiversity hotspots (Conservation International and Myers and others 2000) and the projected changes in terrestrial ecosystems by 2100 relative to the year 2000, as presented by the Intergovernmental Panel on Climate Change in Fischlin and others (2007), figure 4.3 (a), p. 238. The changes should be taken as only indicative of the range of possible ecosystem changes and include gains or losses of forest cover, grassland, shrub- and woodland, herbaceous cover, and desert amelioration.

Present-day Drylands and Their Categories

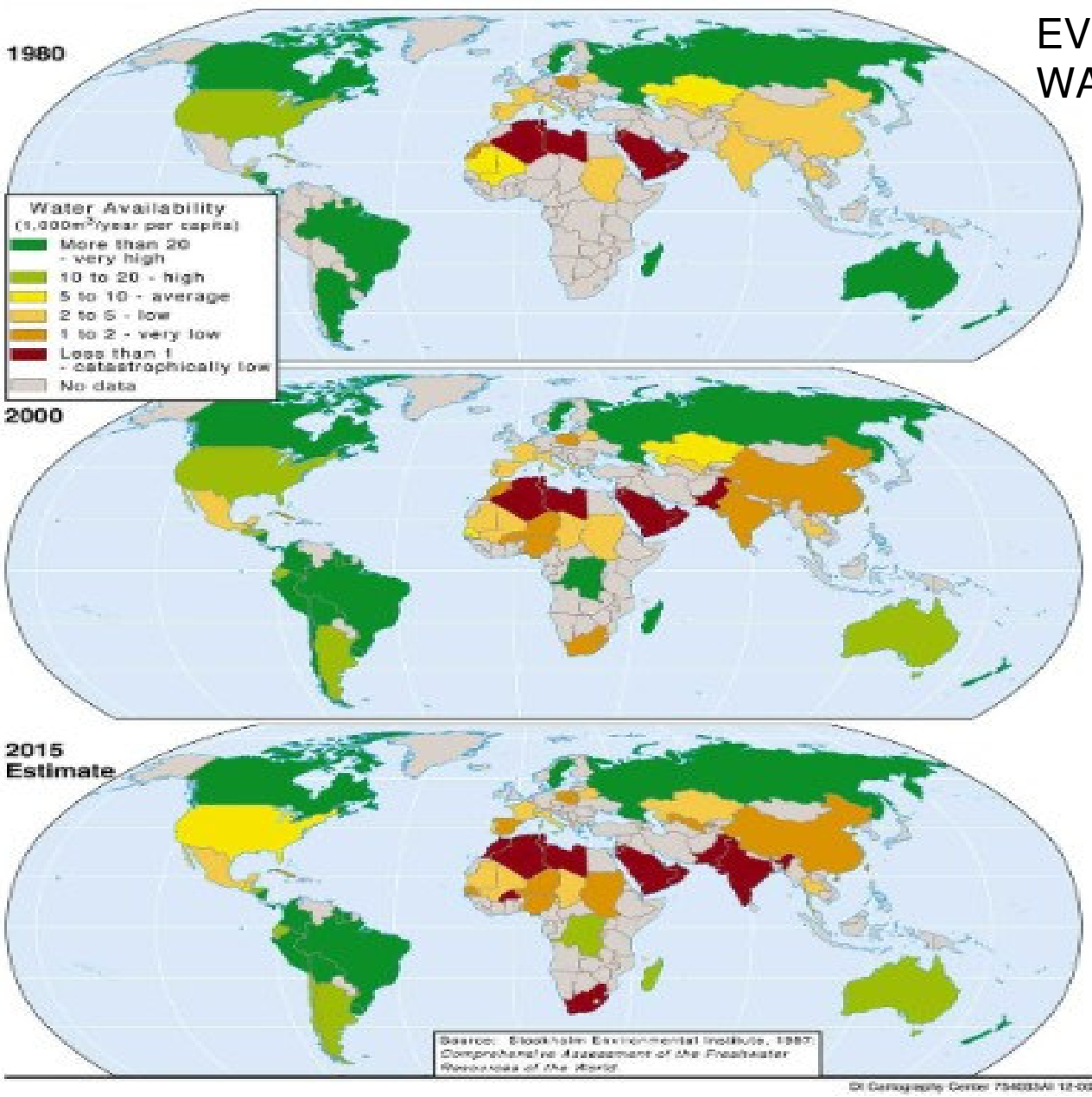
SOURCE: UNEP

Drylands include all terrestrial regions where the production of crops, forage, wood and other ecosystem services are limited by water. Formally, the definition encompasses all lands where the climate is classified as dry subhumid, semiarid, arid or hyper-arid. This classification is based on Aridity Index values†.



† The long-term mean of the ratio of an area's mean annual precipitation to its mean annual potential evapotranspiration is the Aridity Index (AI).

Notes: The map is based on data from UNEP Geo Data Portal (http://geodata.grid.unep.ch/). Global area based on Digital Chart of the World data (147,573,196.6 square km); Data presented in the graph are from the MA core database for the year 2000.

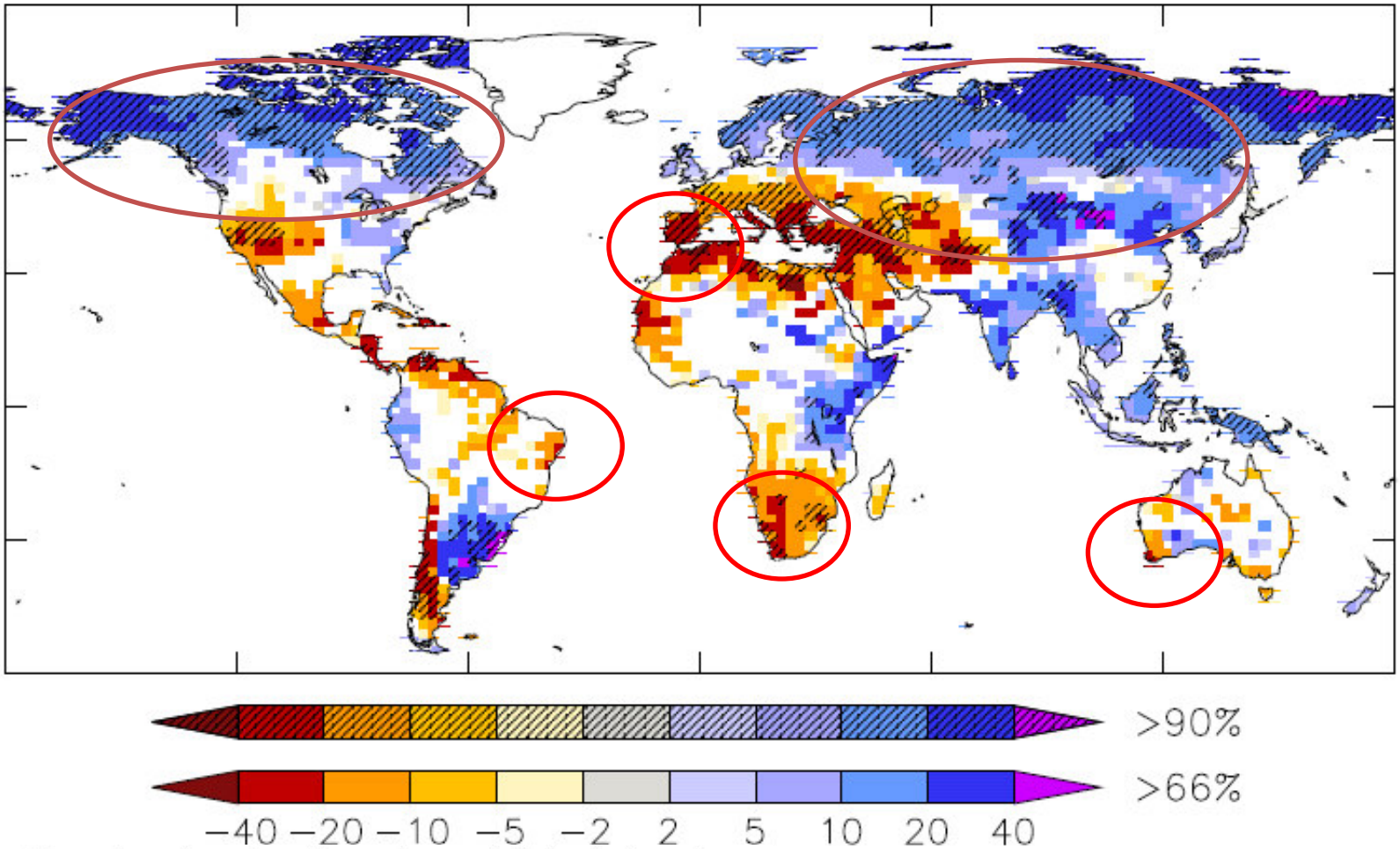


EVOLUTION OF WATER AVAILABILITY, From very high to very low

SOURCE: Stockholm Environmental Institute, 1997

National Intelligence Council, *Global Trends 2015*, Dec. 2000, p. 29 citing original source as Stockholm Environmental Institute, *1997: Comprehensive Assessment of the Freshwater Resources of the World*

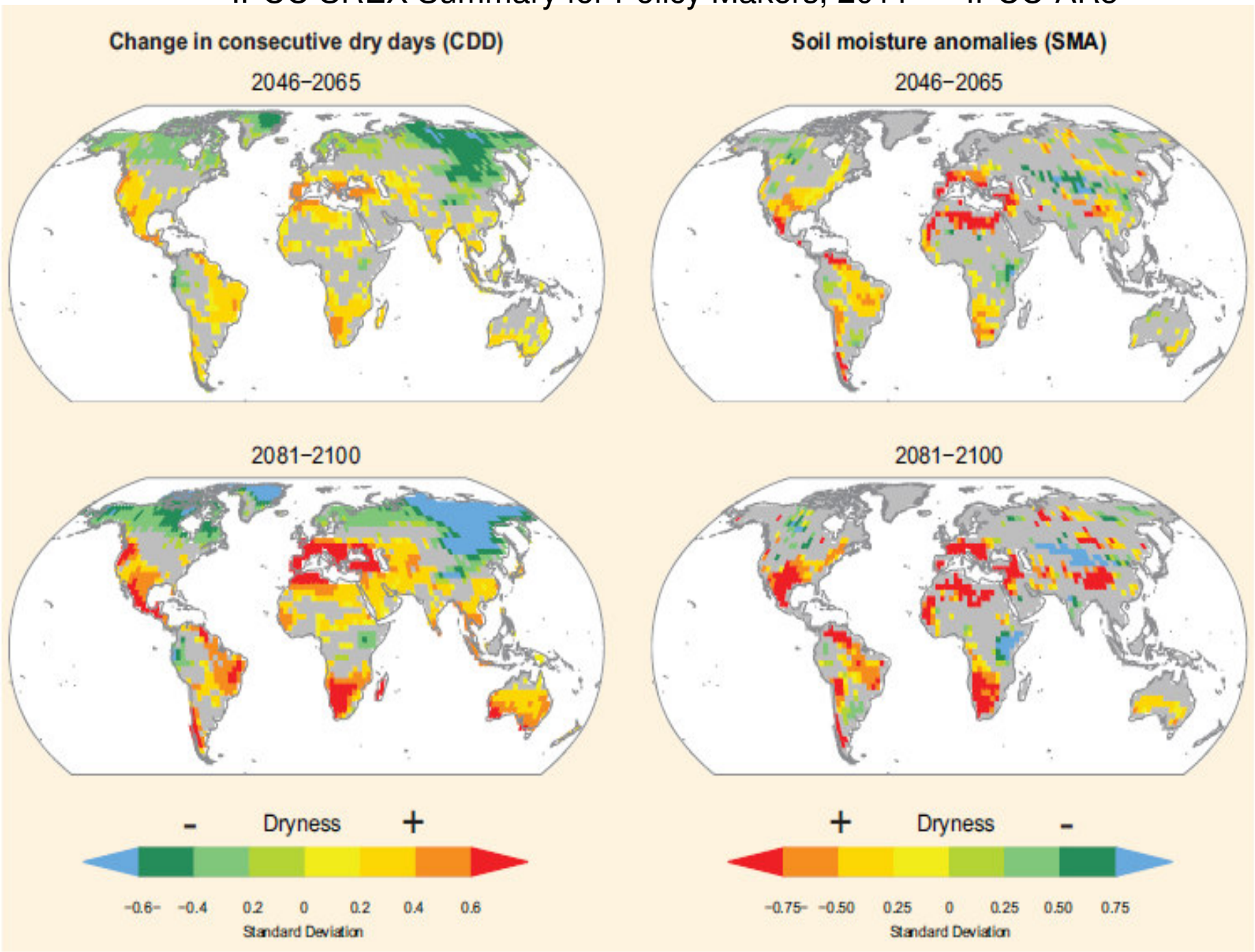
Expected change in annual runoff - 2060



Multimodel mean changes in annual runoff by 2060, in percent, indicating also degree of agreement between the 12 models used Scenario A1B, i.e. very rapid economic growth, convergence among regions and technological change in energy systems. Illustration from Milly et al 2005.

SOURCE: Milly et al., 2005

IPCC SREX Summary for Policy Makers, 2011 IPCC-AR5



SOURCE: OECD, 2010

Table 1.2-1

Concentration of cities in coastal zones. For various population figures, the proportion of cities along the coast is shown. Major cities are particularly often located in coastal regions.

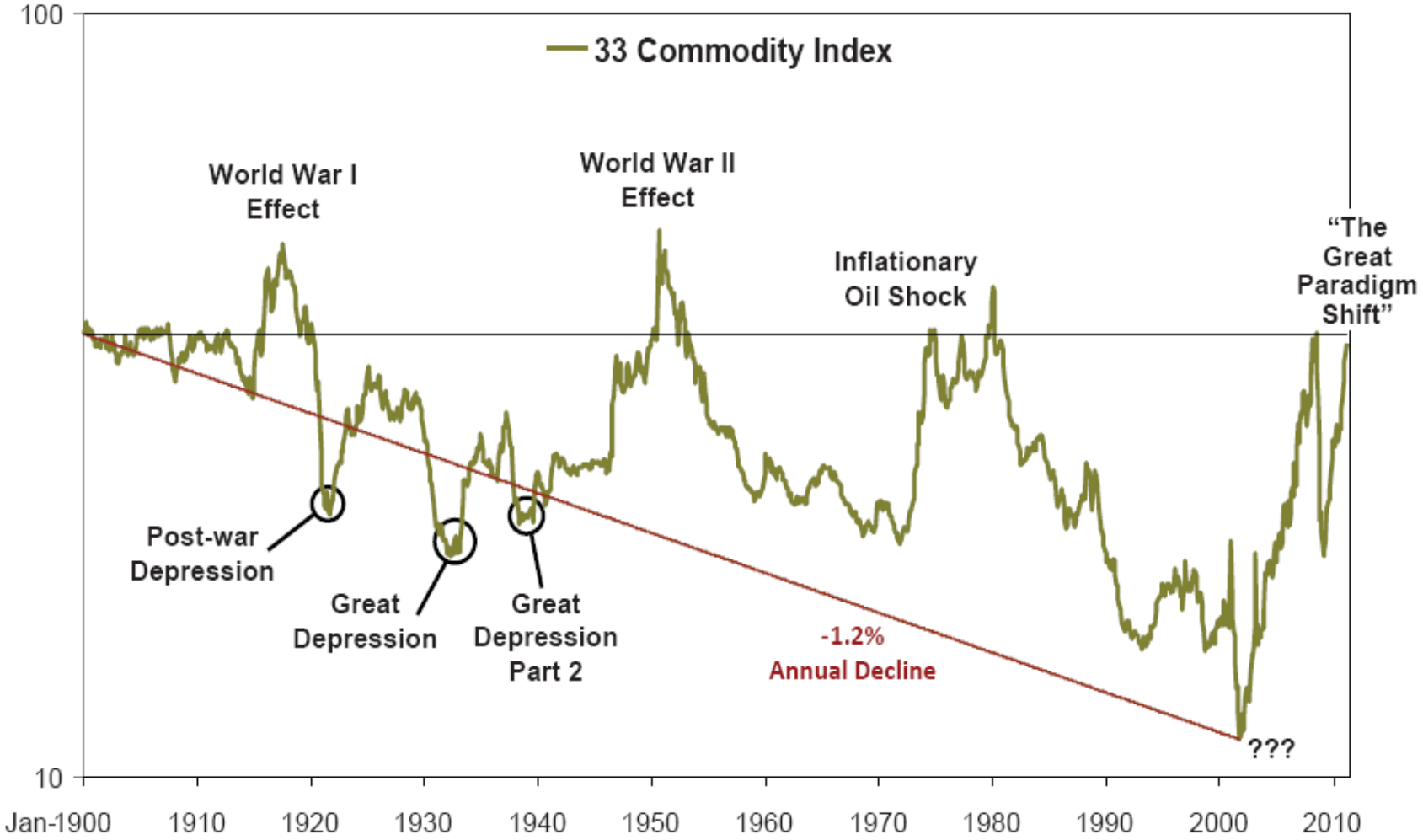
Source: OECD, 2010d

CONCENTRATION OF CITIES IN COASTAL ZONES

	Population figure				
Region	**<100,000 [%]**	**100,000–500,000 [%]**	**500,000–1 million [%]**	**1–5 million [%]**	**>5 million [%]**
Africa	9	23	39	50	40
Asia	12	24	37	45	70
Europe	17	22	37	41	58
Latin America	11	25	43	38	50
Australia and New Zealand	44	77	100	100	–
North America	9	19	29	25	80
Small island states	51	61	67	100	–
World	13	24	38	44	65

GMO Commodity Index: The Great Paradigm Shift

SOURCE GMO LLC



Note: The GMO commodity index is an index comprised of the following 33 commodities, equally weighted at initiation: aluminum, coal, coconut oil, coffee, copper, corn, cotton, diammonium phosphate, flaxseed, gold, iron ore, jute, lard, lead, natural gas, nickel, oil, palladium, palm oil, pepper, platinum, plywood, rubber, silver, sorghum, soybeans, sugar, tin, tobacco, uranium, wheat, wool, zinc.

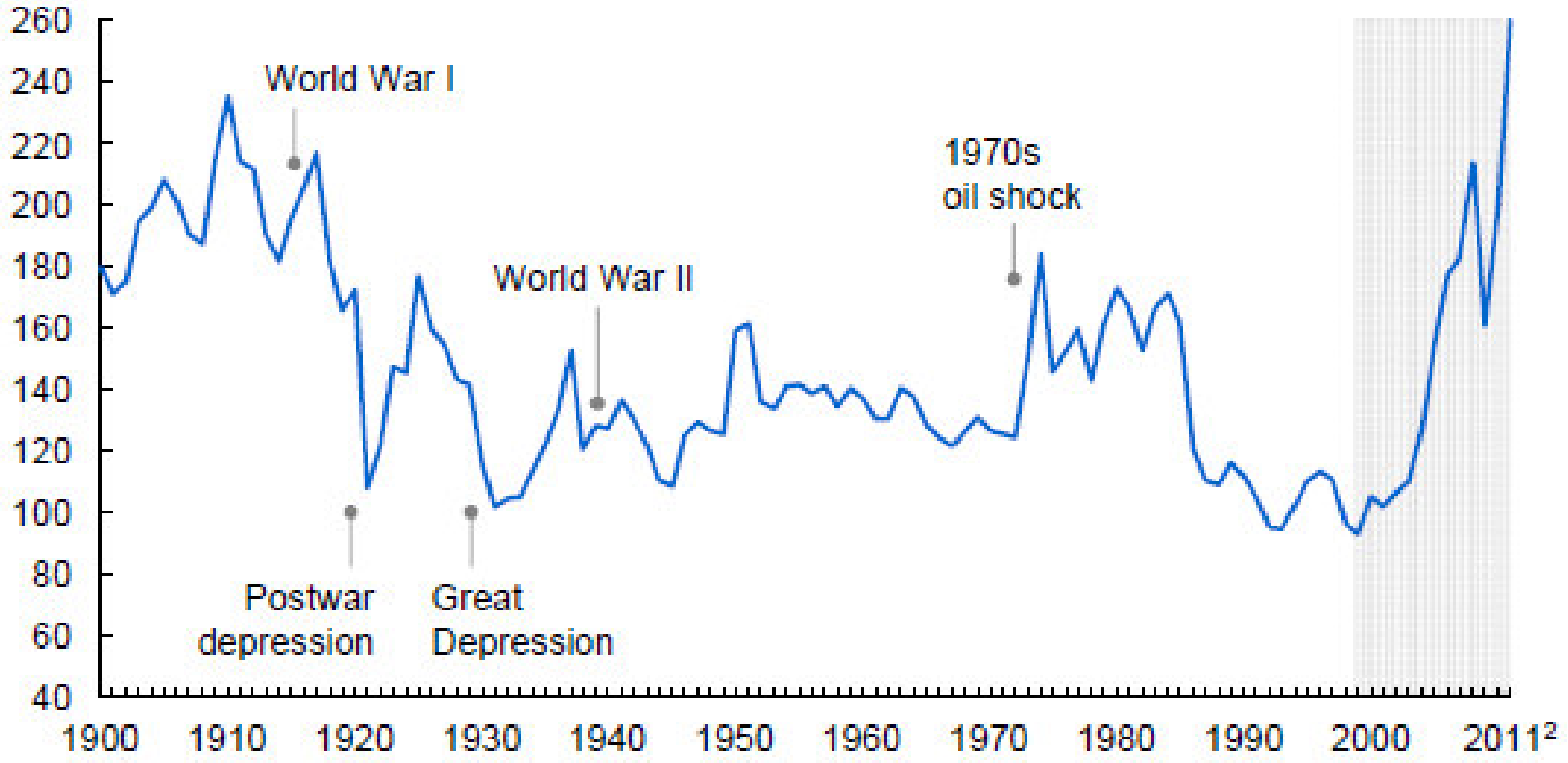
Source: GMO As of 2/28/11

SOURCE: World Bank, IMF, FAO, OECD, McKinsey

Exhibit E1

Commodity prices have increased sharply since 2000, erasing all the declines of the 20th century

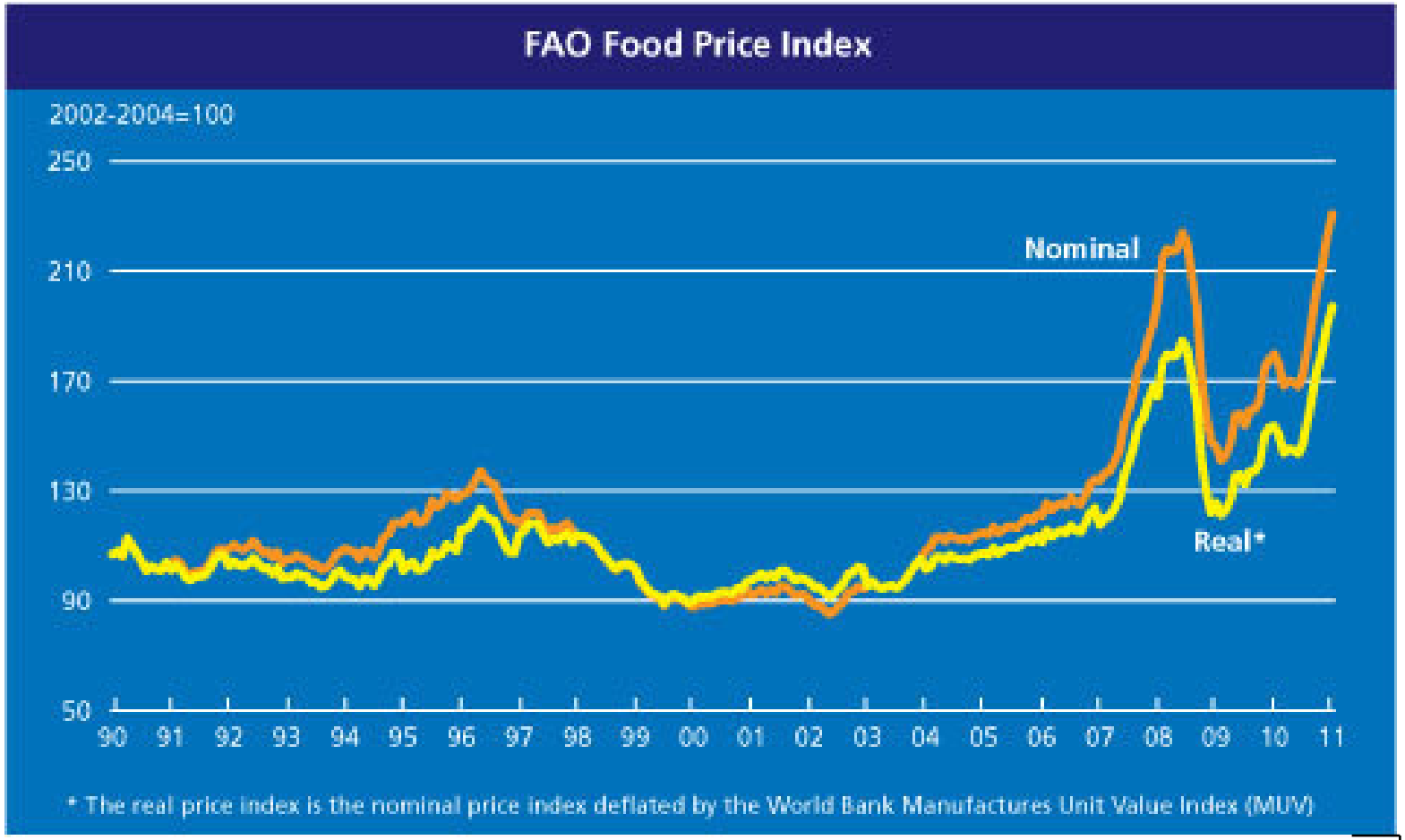
MGI Commodity Price Index (years 1999–2001 = 100)[1]



1 See the methodology appendix for details of the MGI Commodity Price Index.

2 2011 prices are based on average of the first eight months of 2011.

SOURCE: Grilli and Yang; Stephan Pfaffenzeller; World Bank; International Monetary Fund (IMF); Organisation for Economic Co-operation and Development (OECD); UN Food and Agriculture Organization (FAO); UN Comtrade; McKinsey analysis



World food prices reach new historic peak

03-02-2011

3.4 percent surge in January - FAO updates Food Price Index3 February 2011, Rome - World food prices surged to a new historic peak in January, for the seventh consecutive month, according to the http://www.fao.org/worldfoodsituation/FoodPricesIndex/en/ a commodity basket that regularly tracks monthly changes in global food prices.

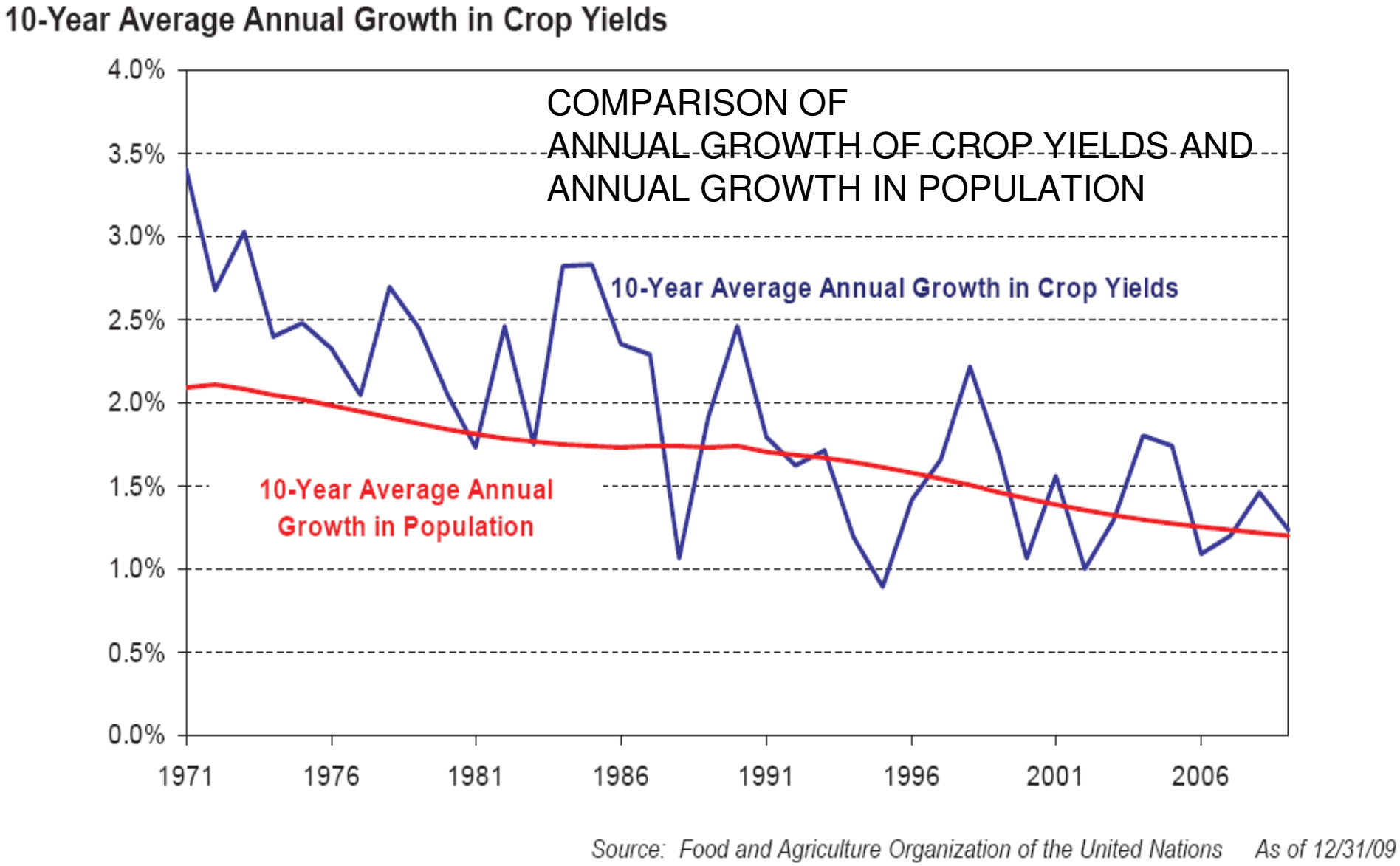
"The new figures clearly show that the upward pressure on world food prices is not abating," said FAO economist and grains expert Abdolreza Abbassian. "These high prices are likely to persist in the months to come. High food prices are of major concern especially for low-income food deficit countries that may face problems in financing food imports and for poor households which spend a large share of their income on food."

"The only encouraging factor so far stems from a number of countries, where - due to good harvests - domestic prices of some of the food staples remain low compared to world prices," Abbassian added.

SOURCE: FAO

Some reasons why food prices are rising

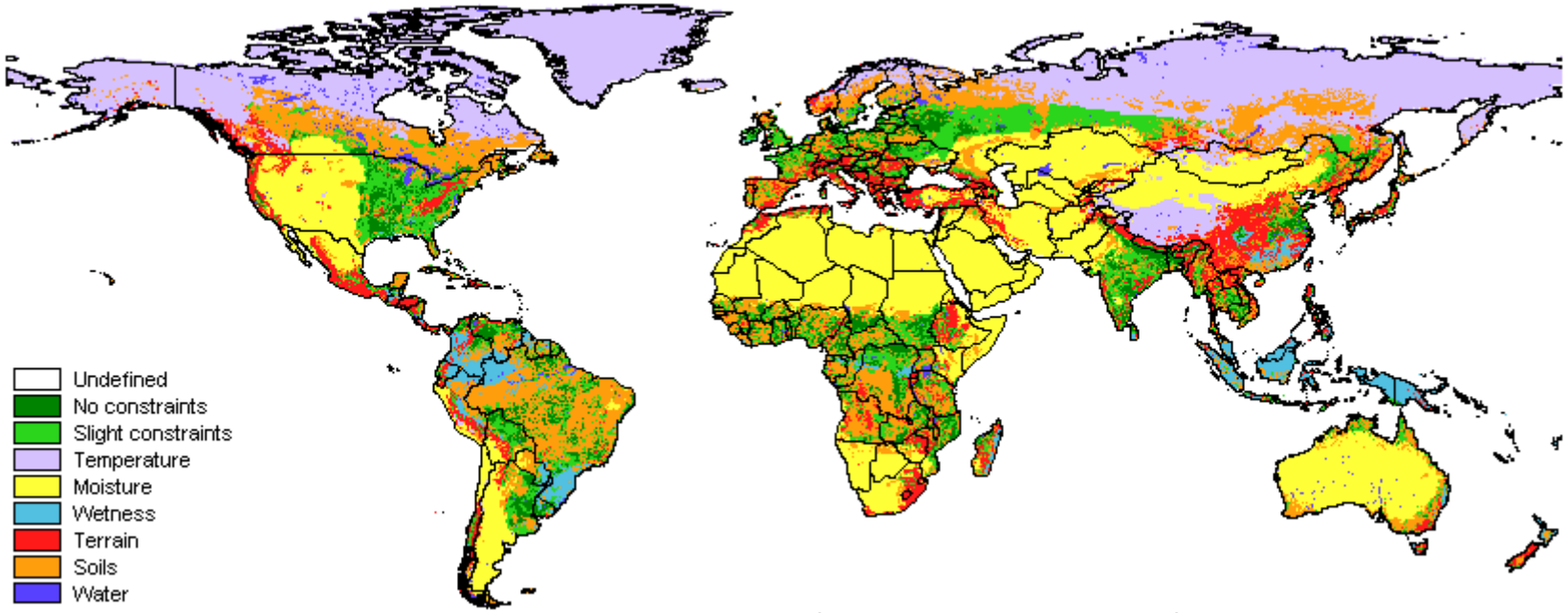
- Climate change, which leads to more intense droughts, floods and storm, and thus to crop failures;
- The cultivation of biofuels, which takes valuable farmland out of food production;
- The global population, which is growing too fast for agricultural production to keep up;
- The emerging economies, whose citizens are consuming greater quantities of higher quality food;
- The rising price of oil, which makes it more expensive to produce and ship food products;
- The rise in meat consumption, which means that more grain is needed for animal feed;
- Decades of neglecting agriculture, especially in hunger-prone regions.


10-Year Average Annual Growth in Crop Yields
COMPARISON OF
ANNUAL GROWTH OF CROP YIELDS AND
ANNUAL GROWTH IN POPULATION
10-Year Average Annual Growth in Crop Yields
10-Year Average Annual
Growth in Population
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
1971
1976
1981
1986
1991
1996
2001
2006
Source: Food and Agriculture Organization of the United Nations As of 12/31/09

SOURCE: FAO

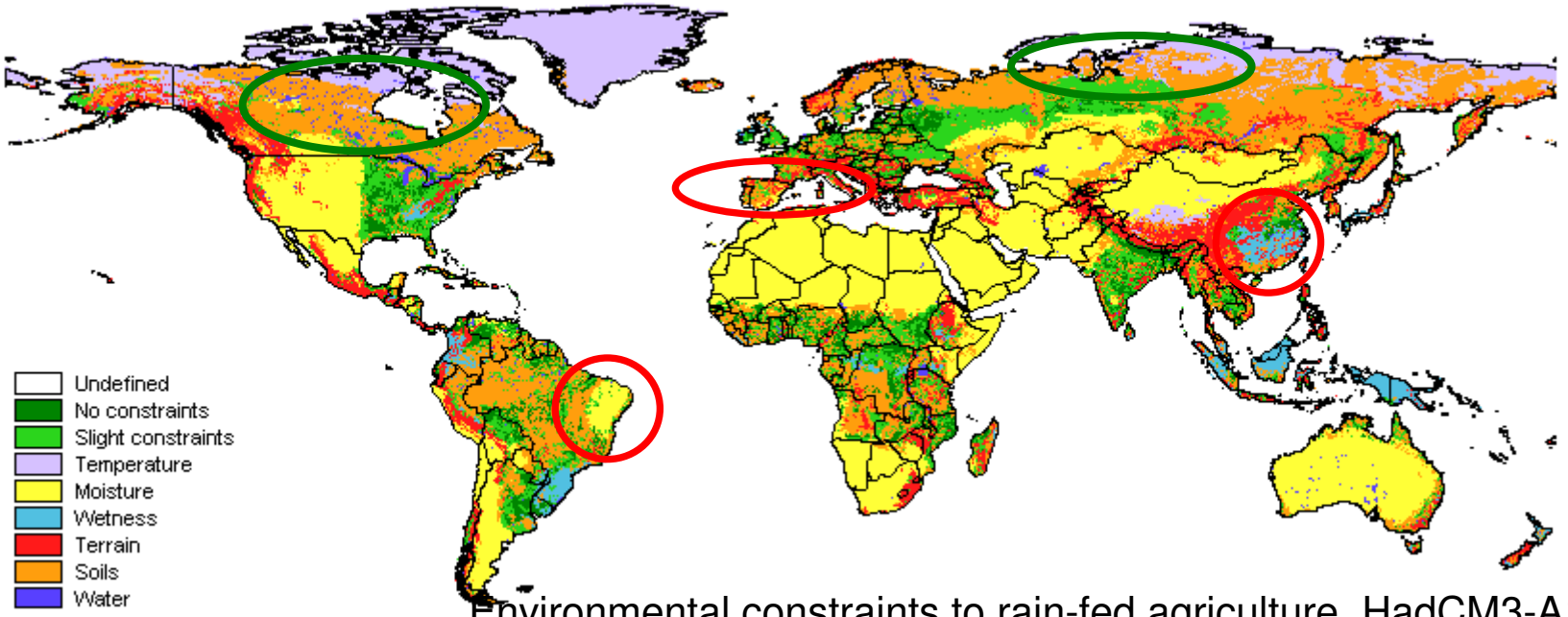
SOURCE: IIASA

IMPACTS OF CLIMATE CHANGE ON RAIN-FED AGRICULTURE



3.7

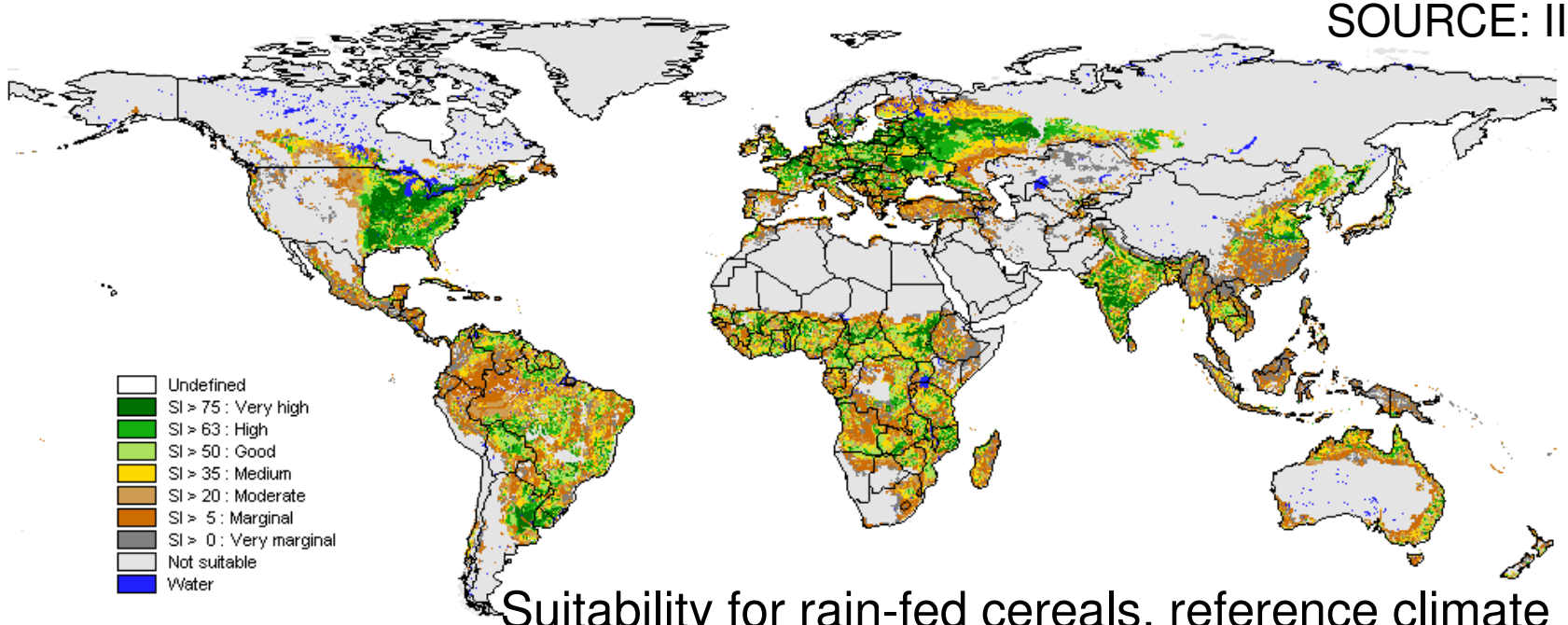
Environmental constraints to rain-fed agriculture, reference climate 1961-90



3.8

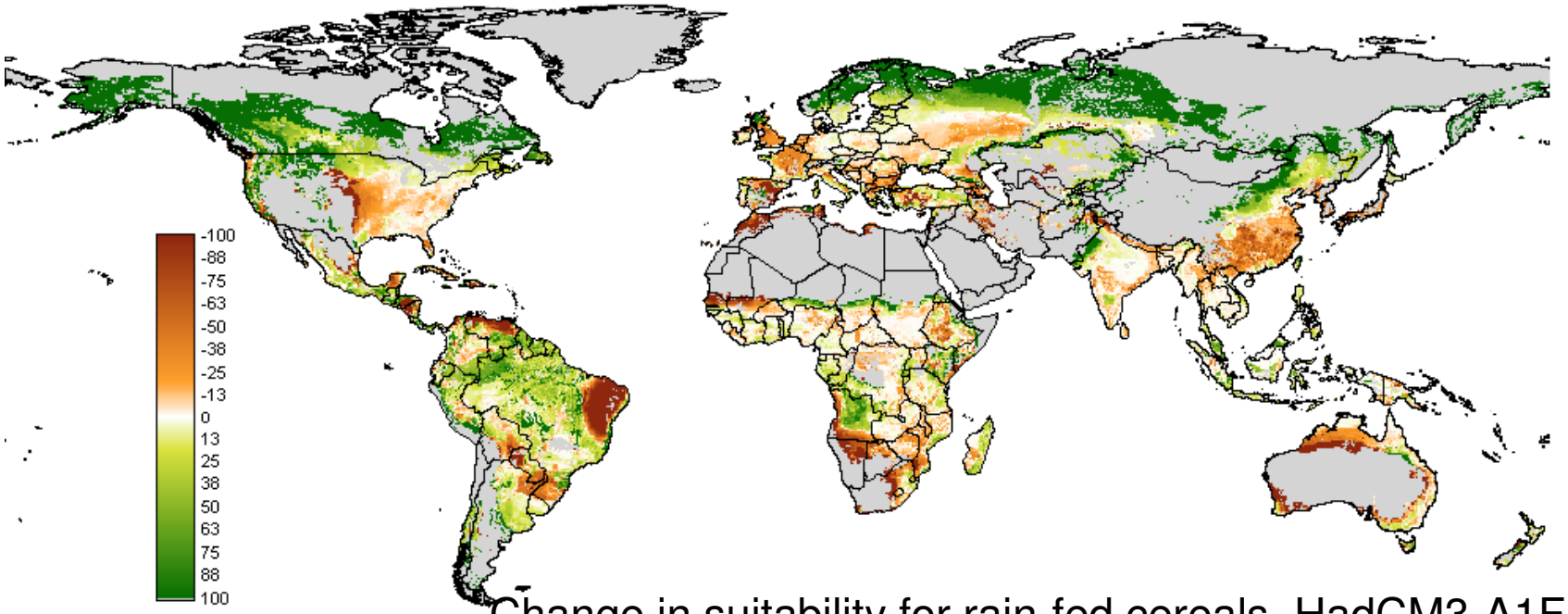
Environmental constraints to rain-fed agriculture, HadCM3-A1FI 2080s

SOURCE: IIASA



3.12a

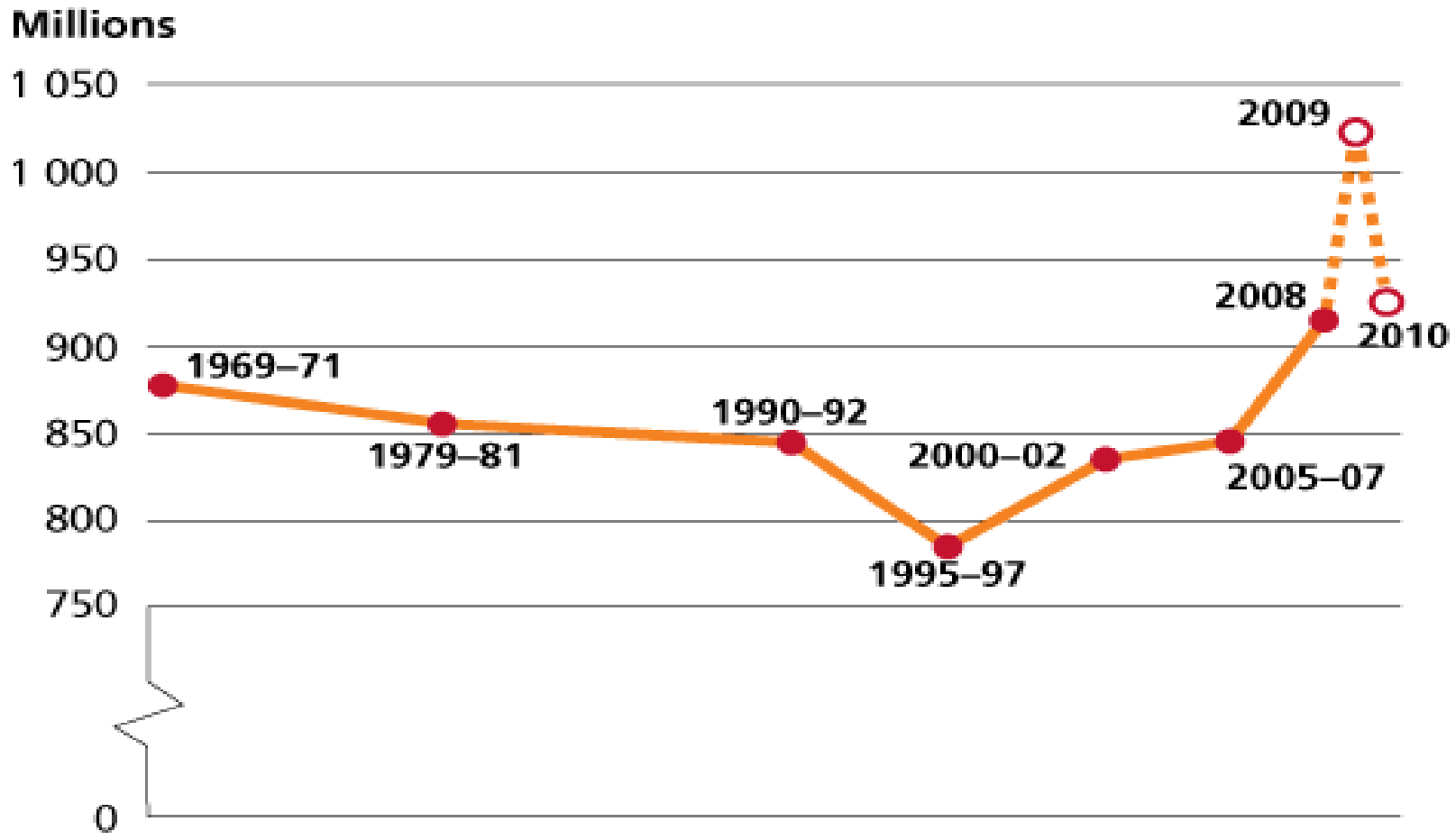
Suitability for rain-fed cereals, reference climate 1961-90.



3.12b

Change in suitability for rain-fed cereals, HadCM3-A1FI, 2080s

Estimated number of people with hunger in the world, FAO



Note: Figures for 2009 and 2010 are estimated by FAO with input from the United States Department of Agriculture, Economic Research Service. Full details of the methodology are provided in the technical background notes (available at www.fao.org/publication/sofi/en/).

Source: FAO.

Early Warning and Disaster Management

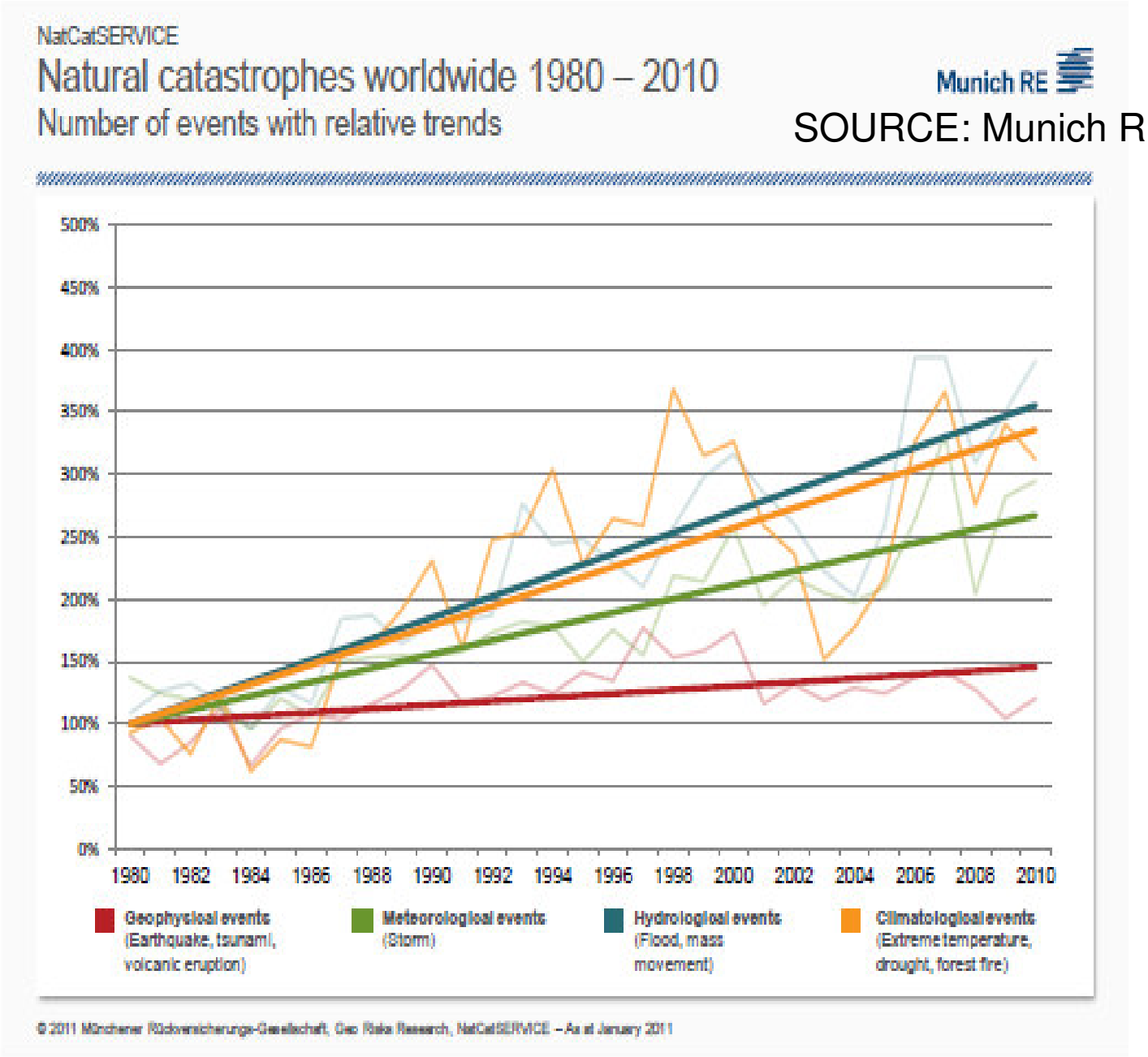
-GEOPHYSICAL EVENTS
Earthquakes, tsunamis, volcanic eruptions

Climate Related Events

-METEOROLOGICAL EVENTS
Tropical cyclones and storms

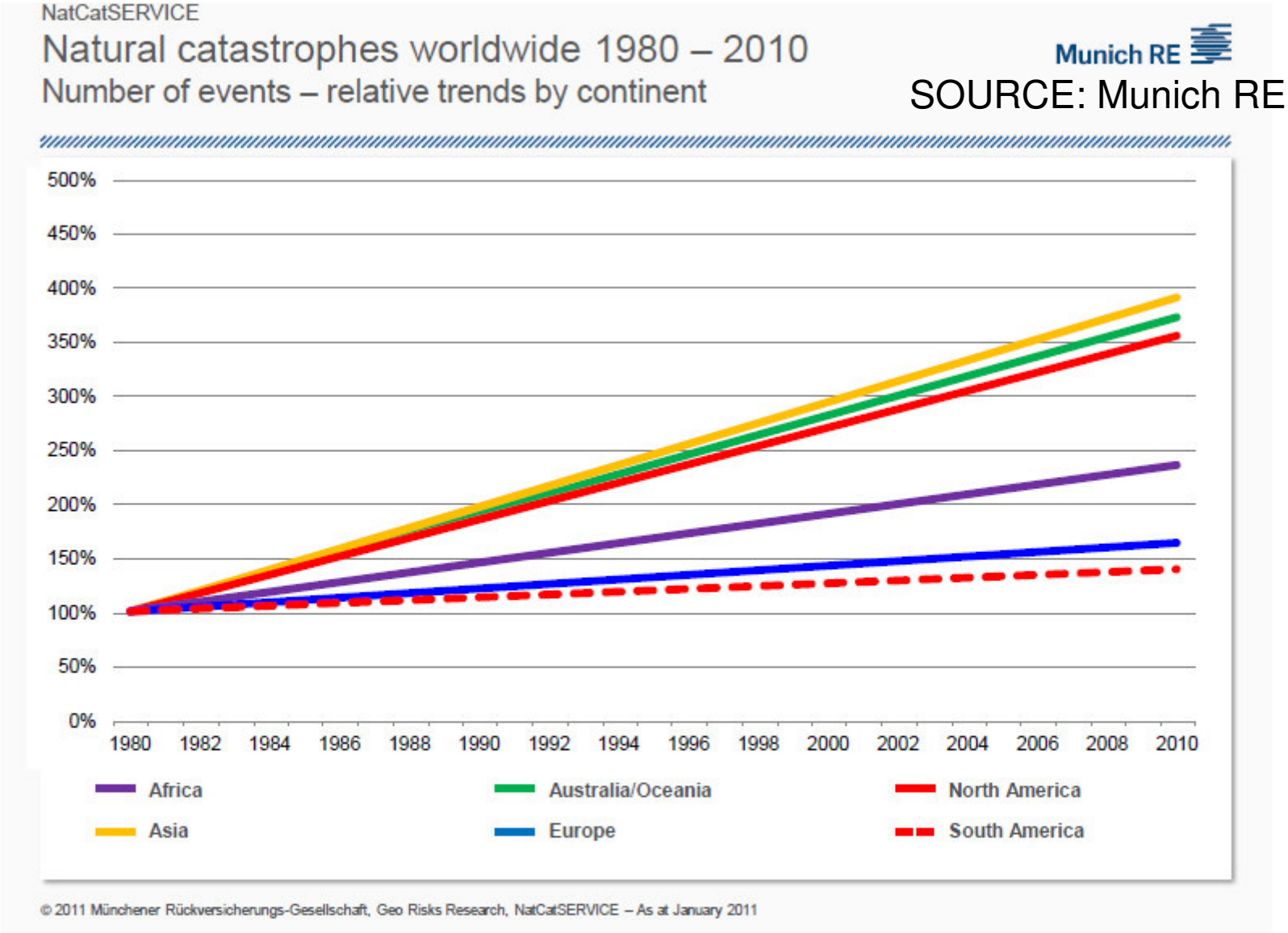
-HYDROLOGICAL EVENTS
Floods, mass movements

-CLIMATOLOGICAL EVENTS
Extreme temperatures, heat waves, droughts, forest fires



SOURCE: Munich RE, 2011

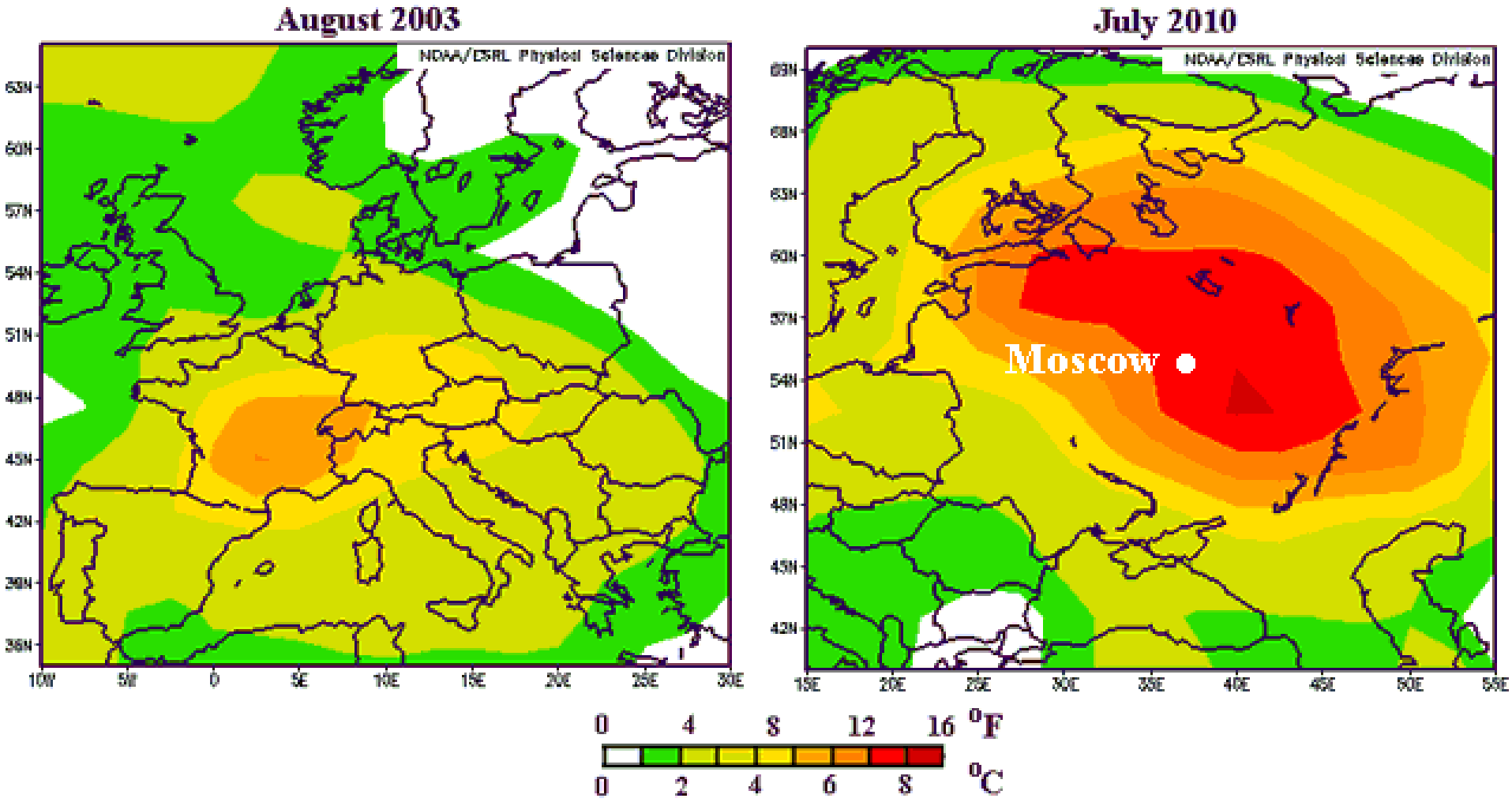
Fig. 1: Relative trends of loss relevant natural extreme events of the different perils



SOURCE: Munich RE, 2011

Relative trends of loss relevant natural extreme events in the different continents

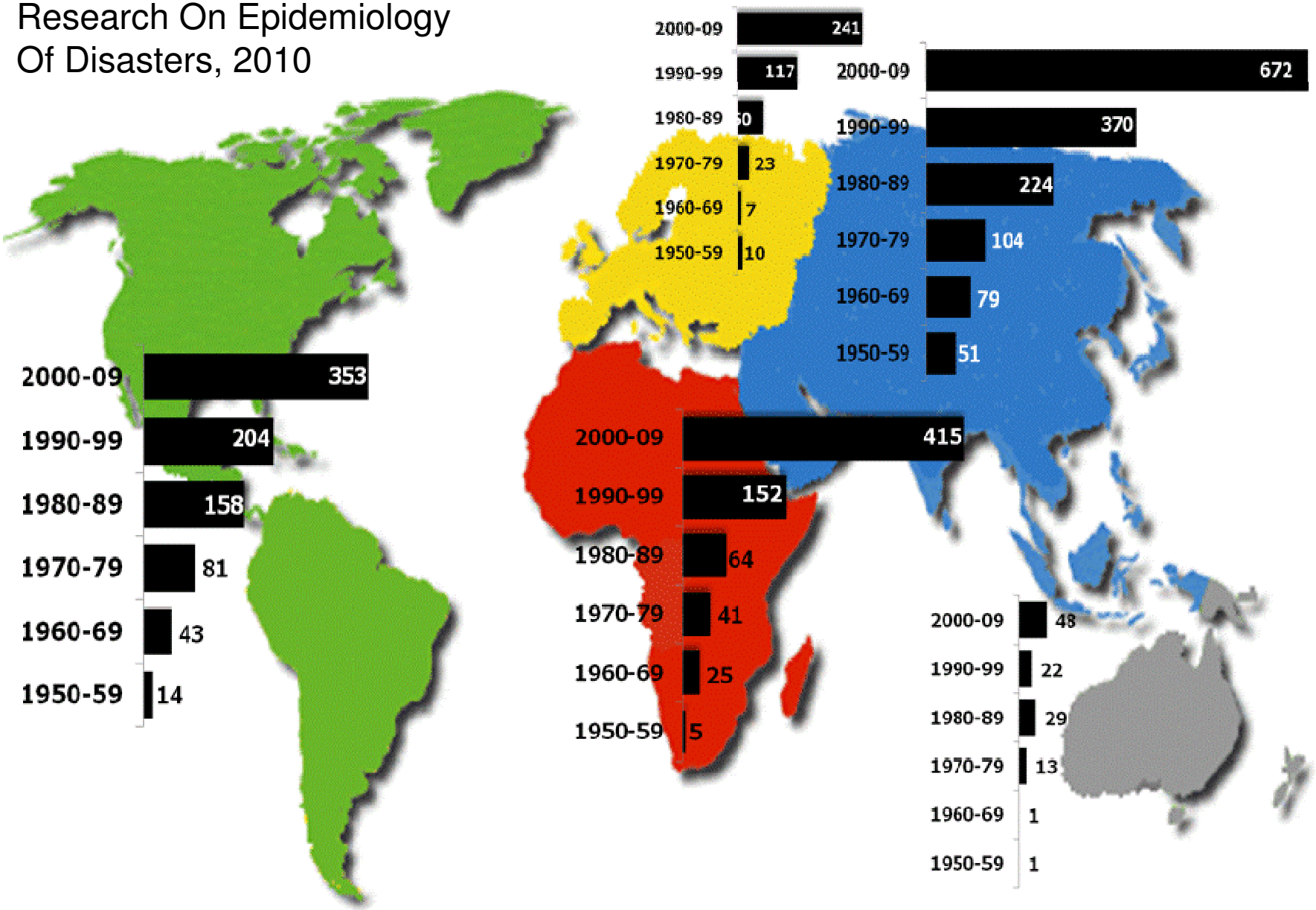
Departure of Temperature from Average for Two Great Heat Waves



SOURCE: NOAA – ESRL, Physical Sciences Division

Floods 1950-2009

SOURCE: Center for Research On Epidemiology Of Disasters, 2010



Fuente: The international disaster data base. Center for Research on Epidemiology of Disasters. 2010.

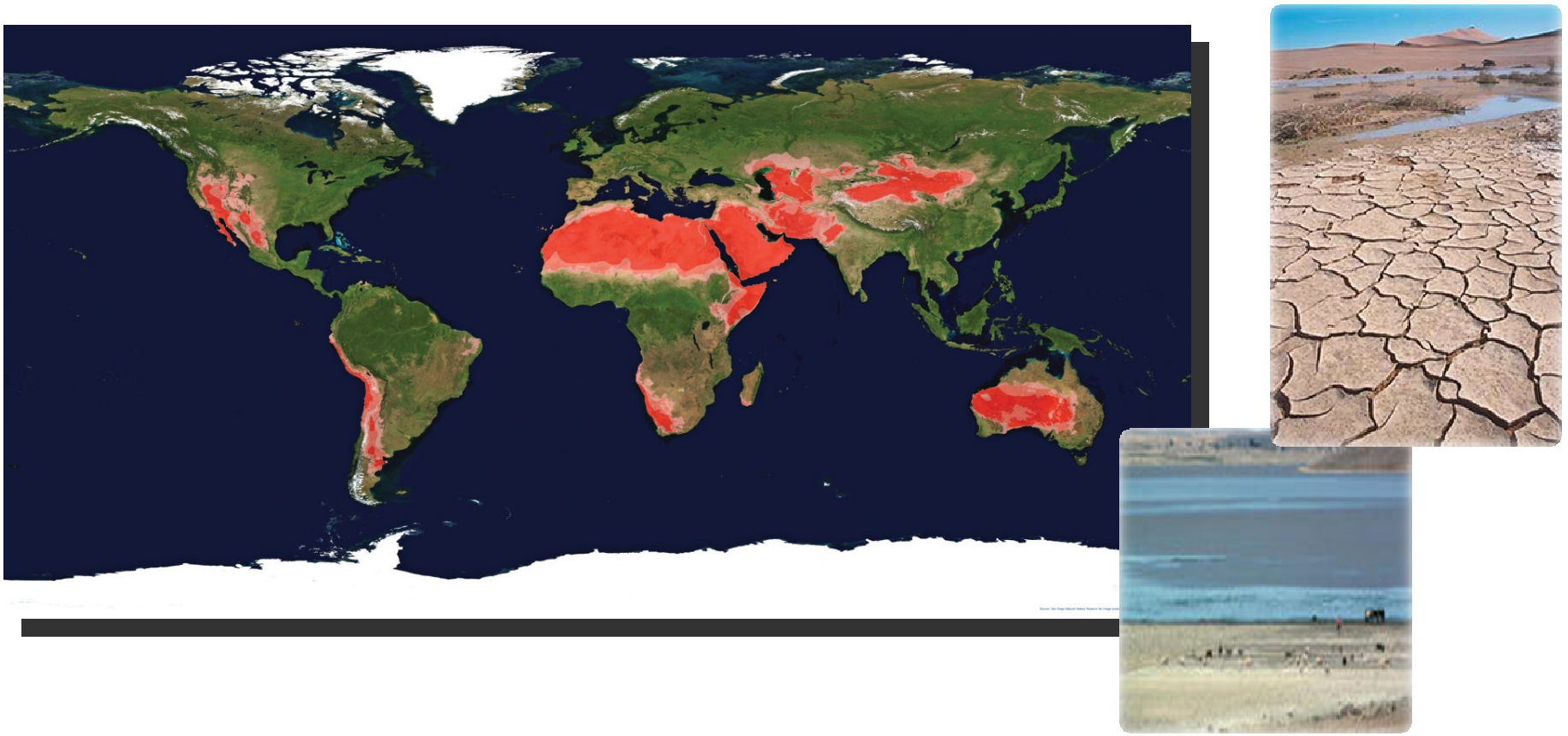
Droughts

About 400,000,000 people live under extreme drought conditions

Land considered “very dry” at global level:

15% em 1970

38% em2010



Examples of Earth observation applications for sustainable development

- Tele-health
-Tele-education
-Institutional and public awareness of space applications for sustainable development

-Sustainable agricultural management and development
-Crop system analysis
-Integrated agricultural drought assessment and management
-Assessment of land productivity, land degradation and soil carbon dynamics

-Monitoring water resources
-Water resource development plans

-Sustainable development of forests
- Monitoring and analysis of biodiversity changes

-Mineral and mining exploration

-Monitoring the Earth system
-Monitoring climate change and its impacts, including climate system tipping points
-Monitoring carbon stocks and greenhouse gas emissions

Examples of Earth observation applications for disaster management and humanitarian relief

-Management of disasters related with geophysical, meteorological, hydrological and climate events
-Vulnerability and risk analyses
-Rapidly mapping and assessing local emergency situations
-Reconstruction activities

Examples related to the equitable access to the limited resources of outer space

-Access to the geostationary orbit
-Access to the radio frequencies in which satellites operate

- Clustering of topics in order to allow more efficient consideration of related matters by the EGs. Cross-cutting topics and issues

- Prioritization of the topics in terms of the need for action

GUIDELINES

Preparation of an appropriate set of voluntary best-practice guidelines focused on practical and prudent measures that could be implemented in a timely manner to enhance the long-term sustainability of outer space activities, concerning specifically sustainable development and disaster management.

FINAL REPORT OF THE EGA

Process methodology and scheduling.

Preparation of Working Papers for the 4 topics of the EGA until the end of May 2012 to be discussed at the EGA meeting during the COPUOS June Session

Consolidate the Working Papers in the form of a Final Report until the end of September 2012 to be Discussed possibly at a EGA meeting during the IAC in October

Thank you for your attention