Future Earth Observation needs

Mario Hernandez

Future Earth Scientific Engagement Committee

**(International Society for Photogrammetry and Remote Sensing
Regional Rep. for Latin America- ISPRS)**


futurearth
To build and connect global knowledge
to intensify the impact of research
and find new ways
to accelerate sustainable development

About IGFA & the Belmont Forum

- The International Group of Funding Agencies for Global Change Research (IGFA) is a forum for national scientific funding agencies to collaborate in addressing the challenges and opportunities of global environmental change.

- The Belmont Forum, a group of high-level representatives from major funding agencies across the globe, is the Council of Principals for IGFA.

The Science & Technology Alliance for Global Sustainability

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ICSU
International Council for Science

ISSC
international social science council

BELMONT FORUM

IGFA
International Group of Funding Agencies for Global Change Research

UNEP

UNITED NATIONS UNIVERSITY

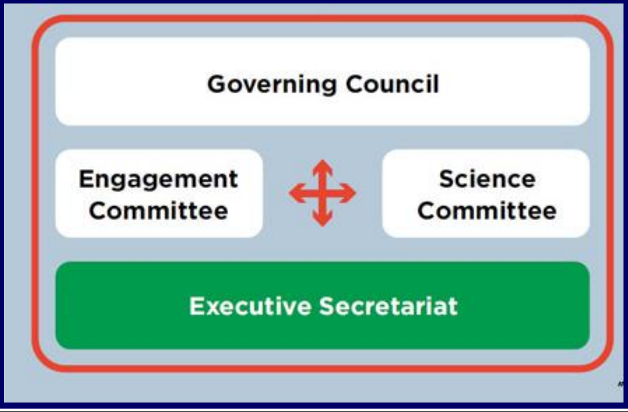
World Meteorological Organization
Weather · Climate · Water

UNESCO

Future Earth structure

International Group of Funding Agencies for Global Change Research + Un agencies

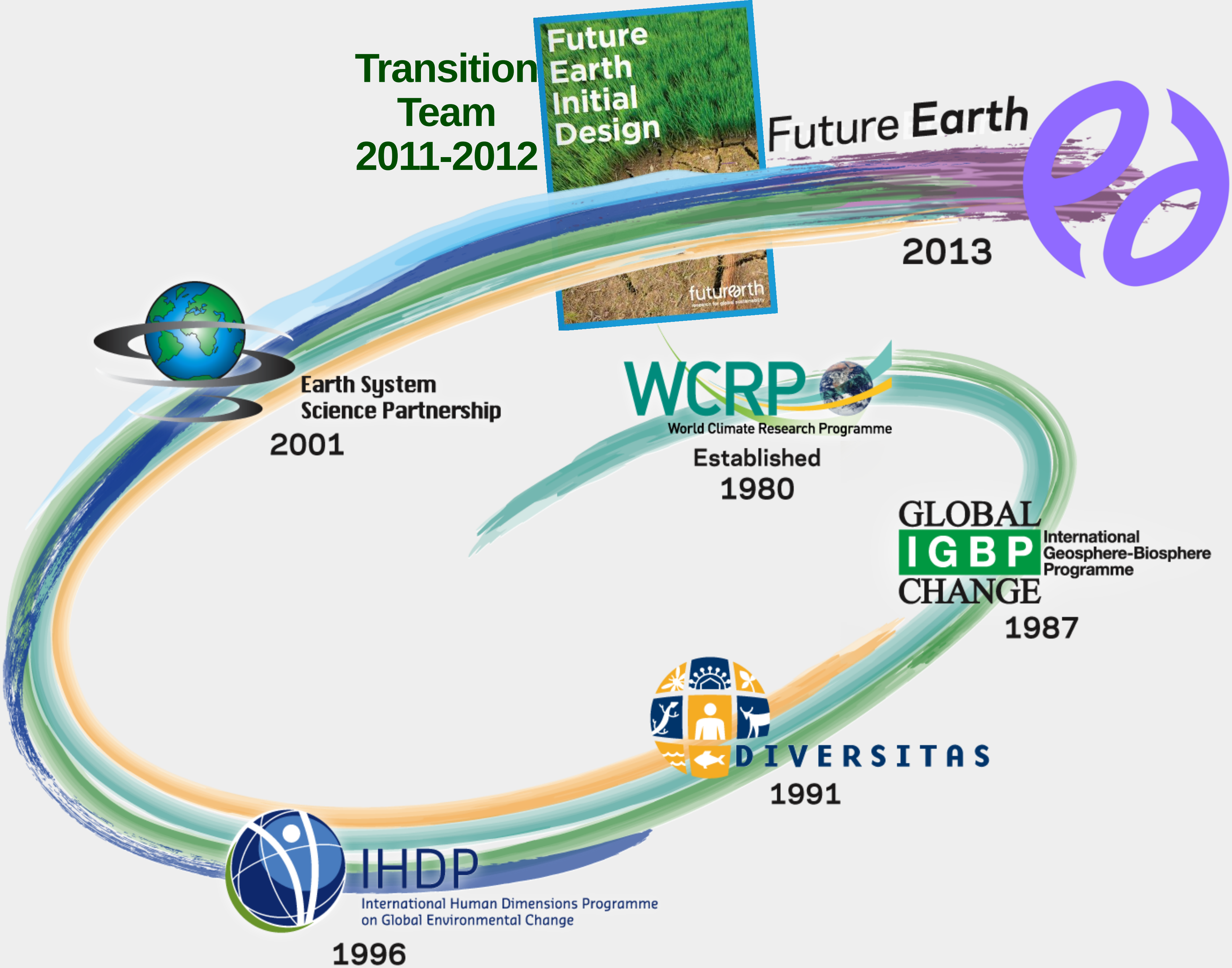
International Council for Science
Implementing Agency



Future Earth Governing Bodies

Future Earth Scientific Engagement Committee – Nov 2014

Chair: Jairam Ramesh



Transition Team 2011-2012
Future Earth Initial Design
futurearth
research for global sustainability
Future Earth
2013
Earth System Science Partnership
2001
WCRP
World Climate Research Programme
Established 1980
GLOBAL IGBP CHANGE
International Geosphere-Biosphere Programme
1987
DIVERSITAS
1991
IHDP
International Human Dimensions Programme on Global Environmental Change
1996

What is Future Earth?

- A global platform for international research collaboration on global environmental change and sustainable development
  - Providing integrated research on major global change challenges and transformations to sustainability
  - Strengthening partnerships between researchers, funders and users of research through co-design of research
  - Solutions-oriented, aiming to generate knowledge that contributes to new more sustainable ways of doing things
  - Communicating science to society and society to science

Future Earth Research Themes

Transformation towards Sustainability

Global Development

Dynamic Planet

And cross-cutting issues: Observing systems, models, theory development, data management, research infrastructures

Current Regional Hub Partners

Regional members are critical

In establishing Region Hub guidelines

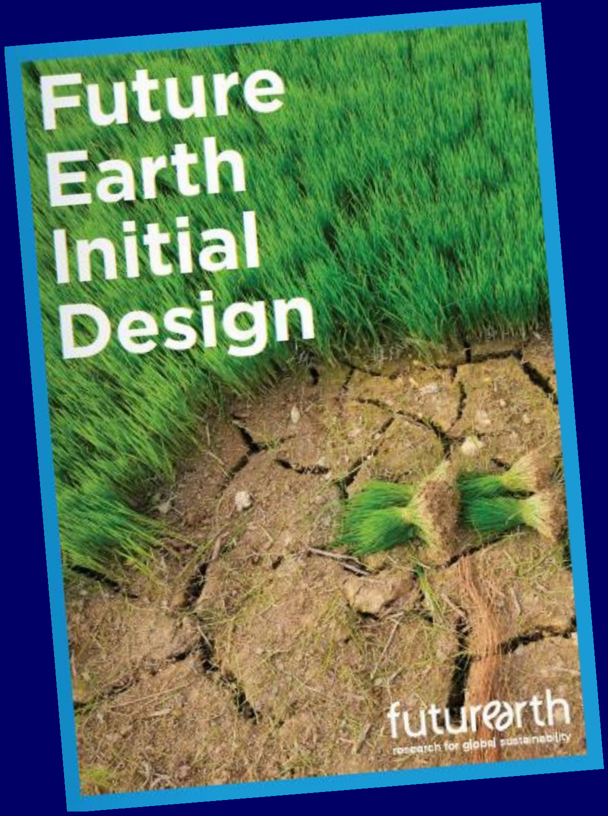
To help us establish hubs for broader regional reach

Inter-American Institute for Global Change Research (IAI), Montevideo, Uruguay with IAI-FAPESP(Brazil) –CONACYT (Mexico) -CONICET (Argentina) consortium, and be coordinated by IAI.

Tyndall Centre for Climate Change Research, University of East Anglia, UK.

The Cyprus Institute (CyI), Nicosia, Cyprus to cover the Middle East and North Africa (MENA) including the Eastern Mediterranean and Gulf States

Research Institute for Humanity and Nature (RIHN), Kyoto, Japan CSIRO Ecosystem Sciences in Australia and The Chinese Committee for Future Earth



- **2025 Vision: Success Factors for Future Earth**

  Publish Q4-2014

- **Strategic Research Agenda 2014: Agenda-setting for funders**

  Launch Q4-2014

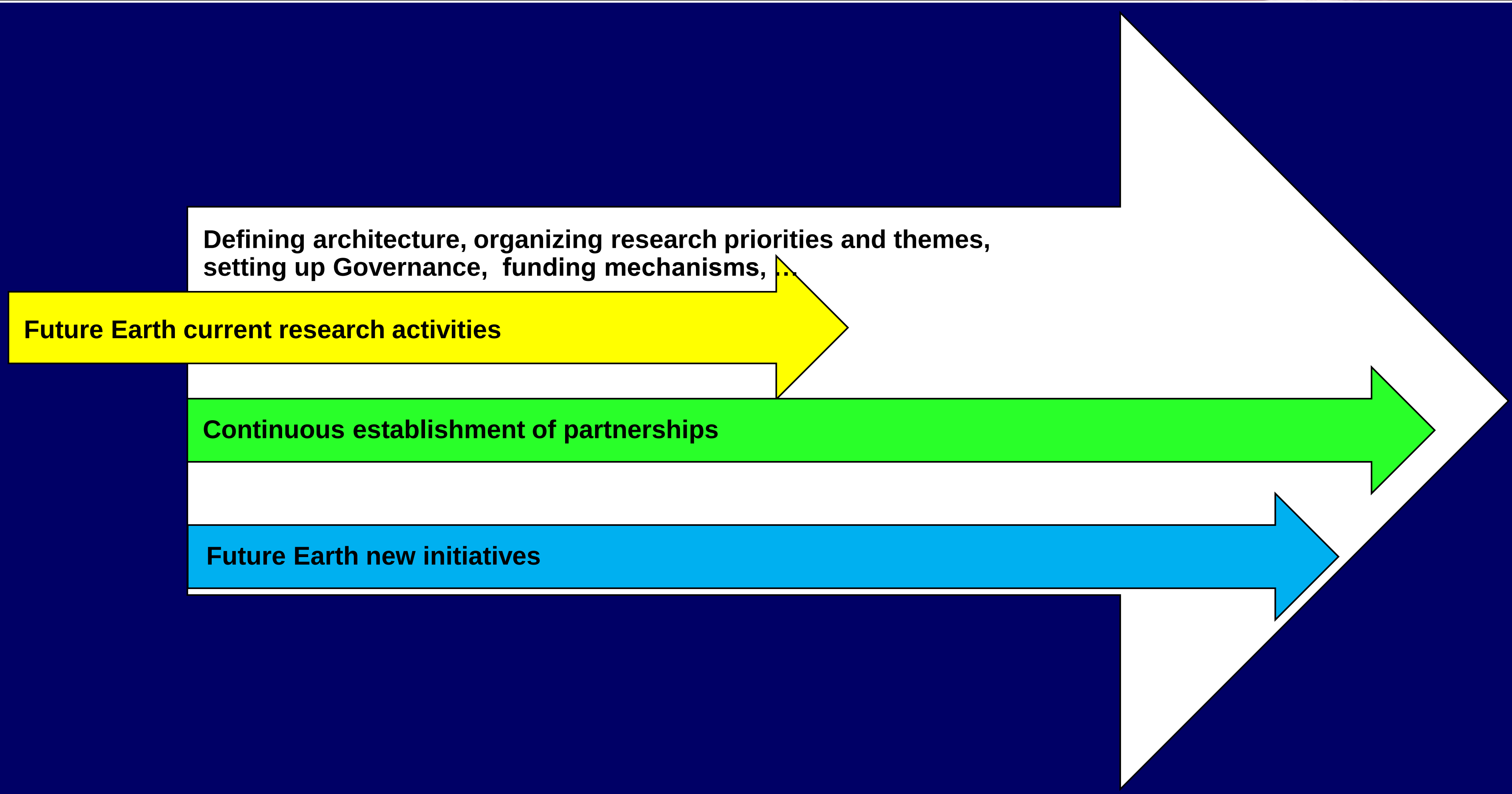
- **Short-term initiatives: Fast track initiatives and cluster activities**

  Launch Q2-2014

Criteria for Future Earth Research

- Encourages Earth system research for global sustainability
- Answer s complex questions that require international collaboration
- Regional to global scale
- Integrates natural, economic, engineering, arts, humanities and social sciences
- Co-design and co-production of knowledge

Future Earth first 10 years



… in relation with CLIMATE

Future Earth current research activities

CCAFS — Climate Change, Agriculture and Food Security	GMBA — Global Mountain Biodiversity Assessment	LOICZ — Land-Ocean Interactions in the Coastal Zone
EcoHealth and GECHH — Global Environmental Change and Human Health (2006 - 2014)	GWSP — Global Water System Project	UGEC — Urbanization and Global Environmental Change
EcoServices and GLP — Global Land Project	IGAC - International Global Atmospheric Chemistry	MAIRS — Monsoon Asia Integrated Regional Study
Global Carbon	iLEAPS — Integrated Land Ecosystem-Atmosphere Processes Study	

Future Earth Observation needs

GCOS has a tremendous experience in collecting data for the GLOBAL CLIMATE key variables

Future Earth is relatively new

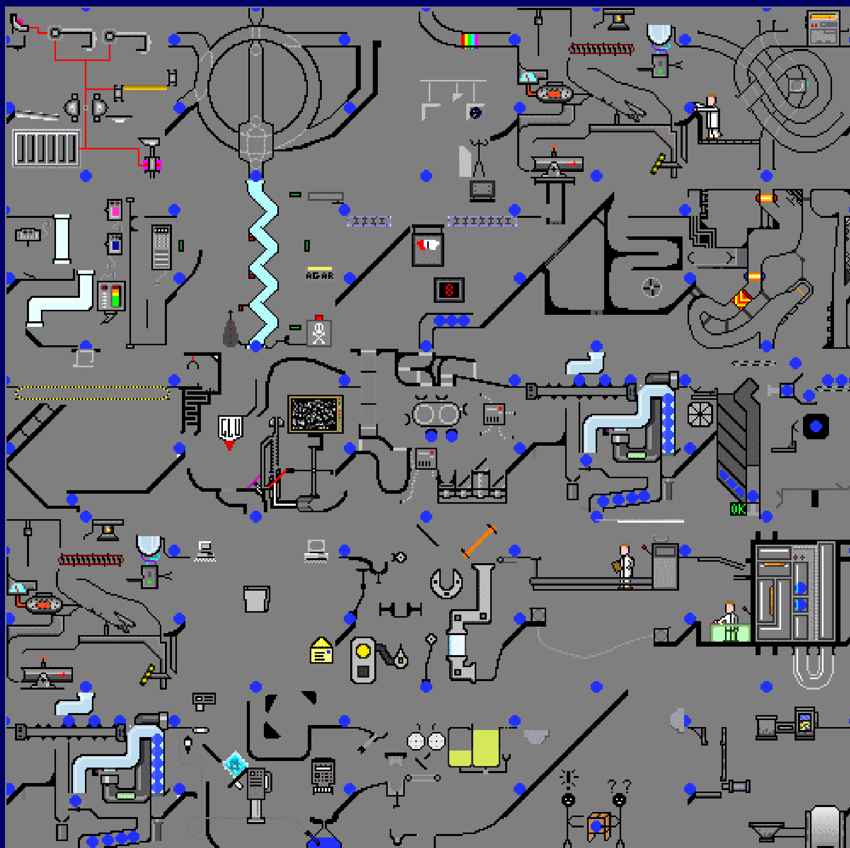
Future Earth Data Needs

However we can start talking about, not additional data, but how Future Earth requires data

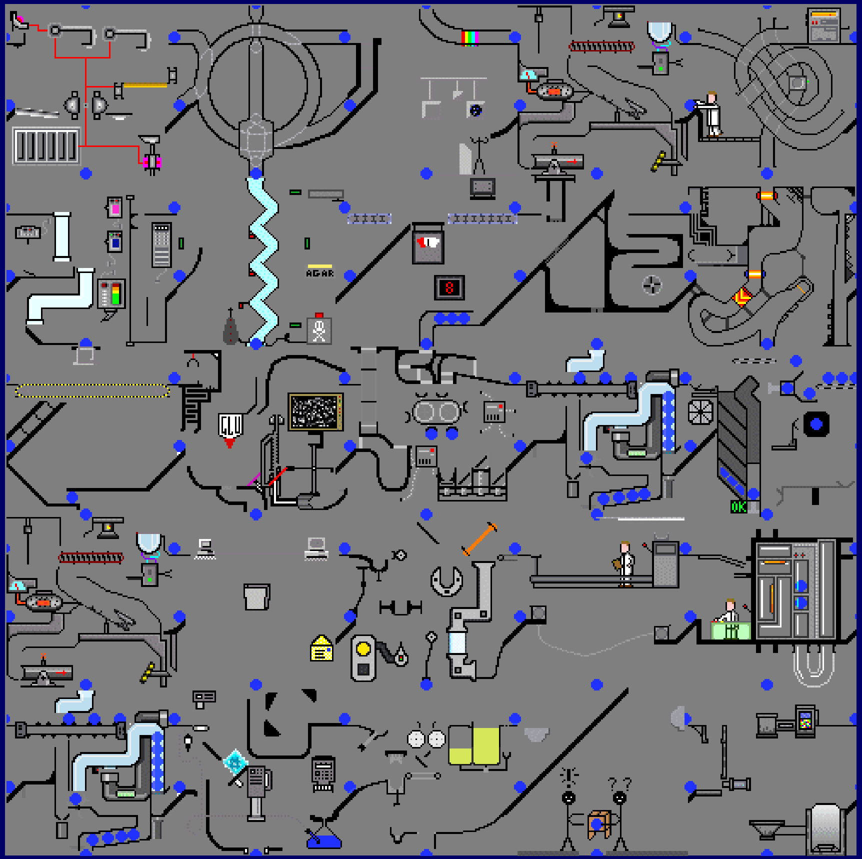
GCOS Essential Climate Variables

Domain	Essential Climate Variables	
Atmospheric (over land, sea and ice)	**Surface:**	Air temperature, Precipitation, Air pressure, Surface radiation budget, Wind speed and direction, Water vapour.
	Upper-air:	Earth radiation budget (including solar irradiance), Upper-air temperature, Wind speed and direction, Water vapour, Cloud properties.
	Composition:	Carbon dioxide, Methane, Ozone, Other long-lived greenhouse gases, Aerosol properties.
Oceanic	**Surface:**	Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea Ice, Current, Ocean colour (for biological activity), Carbon dioxide partial pressure.
	Sub-surface:	Temperature, Salinity, Current, Nutrients, Carbon, Ocean tracers, Phytoplankton.
Terrestrial	River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Biomass, Fire disturbance, Soil moisture.	

A perfect scientific and technological data collection

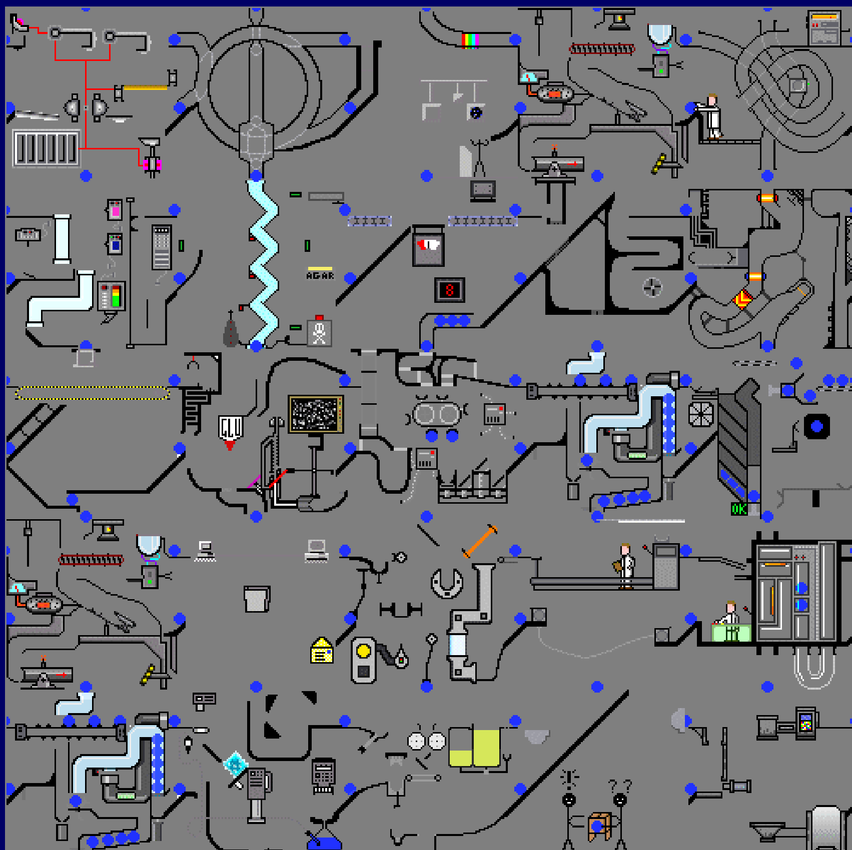


A perfect scientific and technological data collection



- **Specialized scientists (peers)understand components of the 'mechanism'**
- **Social and economical sciences find it extremely complex**
- **Decision makers …**
- **Society, in general …**

Future Earth main challenge



How can we do joint research in order to use all this extremely useful data, but by 'adding value' converting data into information usable by:

- **Other scientific disciplines**
- **Decision makers**
- **For society to understand the required transformations**

e-infrastructure and data management

Type of data and information required

Future Earth e-infrastructure and data management

…the need to address global environmental challenges requires a more coordinated approach to the planning, implementation, and management of data, analytics and e-Infrastructures through international collaboration.

Belmont Forum, New Delhi, February 2013

Belmont e-infrastructure and data management

- **STEERING COMMITTEE**

Arizona Geological Survey (USA)

University of Reading (UK)

University of São Paulo (Brazil)

University of Tokyo (Japan)

European Space Agency (International)

International Council for Science (ICSU) (International)

University of Cape Town (South Africa)

GEO / GEOSS (International)

Australian National Data Service (Australia)

Institut de Physique du Globe de Paris (France)

GEOMAR (Germany)

University of Bremen (Germany)

e-infrastructure and data management

- Let us make use of existing efforts (e.g. GEO)
- Assess what is necessary to make it also beneficial to other scientific disciplines,

Future Earth

- We require partnerships to participate in activities to convert data into information
  - Such information to be integrated with all types of data including socio-economic data
  - To be used in interdisciplinary scientific activities involving decision makers
- We need partnerships to progress the e-infrastructure and data management
  - Using your existing efforts and associated results
- We could consider joint activities
  - Involving multiple scientific disciplines
  - Regional to Global (good local example o.k.)
  - To support with science the decision making process
  - To assess the necessary social transformations

During ISRSE-Berlin 2015 (May 2015)

Launch an initiative of Earth Observation partners supporting Future Earth

A proposal for discussion

Earth Observation partners in support of Future Earth

Earth Observation partners assisting in converting selected data into information usable for other scientific disciplines, decision makers and the society

Development of useful examples that will then motivate others to further make use of your data

Sharing with Future Earth your data infrastructure so that data can be made accessible to other scientific disciplines

Adaptation: needs assessment? (involving decision makers and other scientific disciplines)

September 2015

MDGs will change into SDGs

Would be extremely useful to have SPACE SCIENCE and TECHNOLOGY ,GEO, GCOS, Future Earth ….

Sea level rise

Biodiversity and eco-system services

Extreme typhoons

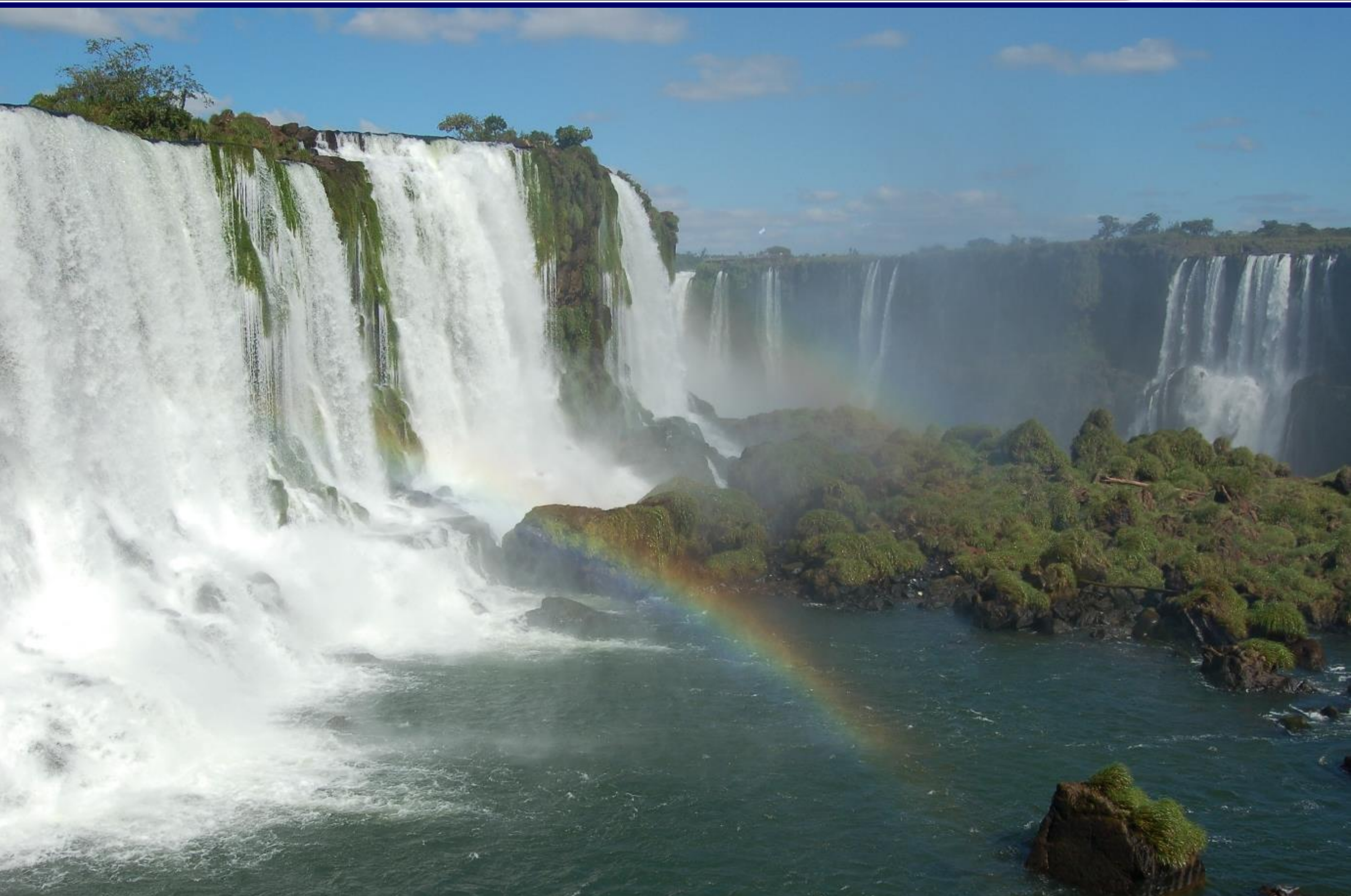
Displacement of local communities

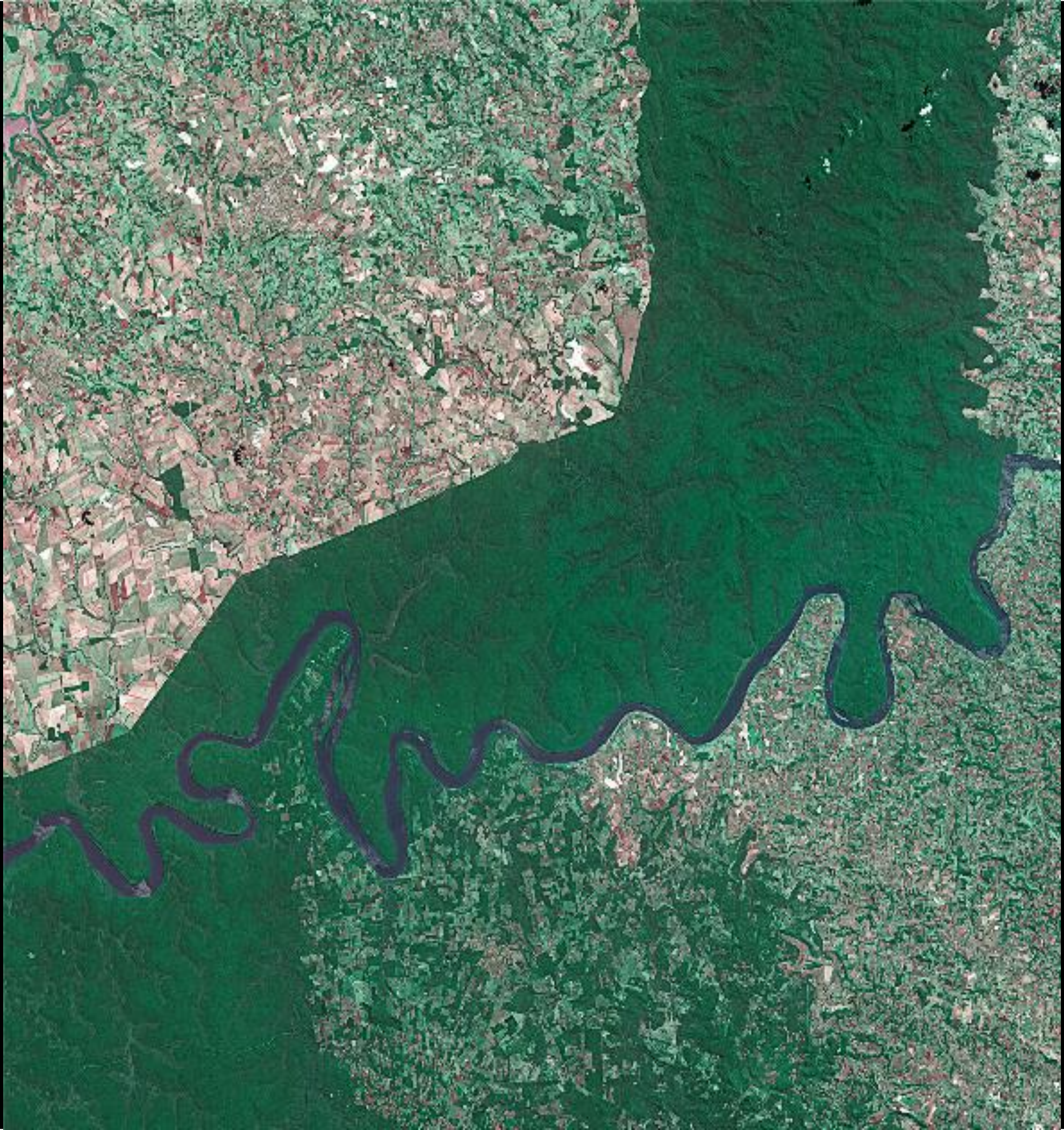
Socio-economical consequences

New policies

Societal transformation
Etc.

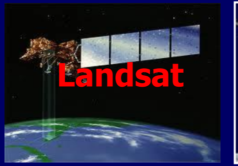
Future Earth – type of data and information

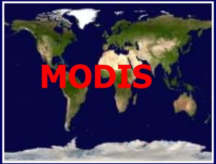


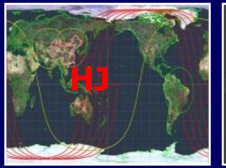



Is it economically better?
What alternatives can be offered to the local communities?
Which societal transformations are required to ensure sustainability?
What type of policies and rules to be issued?

China's National Geomatics Center, Prof. Jun Chen







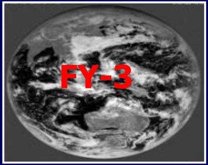


Image Processing

30m Imagery (2000)

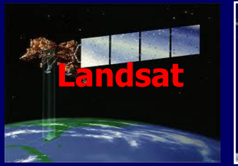
30m Imagery (2010)

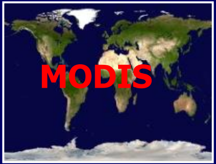
Land Cover Data (2000/2010)

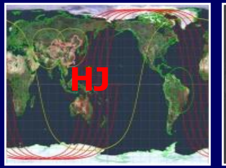
Land Cover Change
30m resolution & 10 classes

From 2000 to 2010

China's National Geomatics Center, Prof. Jun Chen







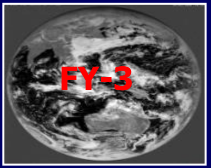


Image Processing

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Land Cover Change
30m resolution & 10 classes

From 2000 to 2010

Data processing

Added value information

10 Classes

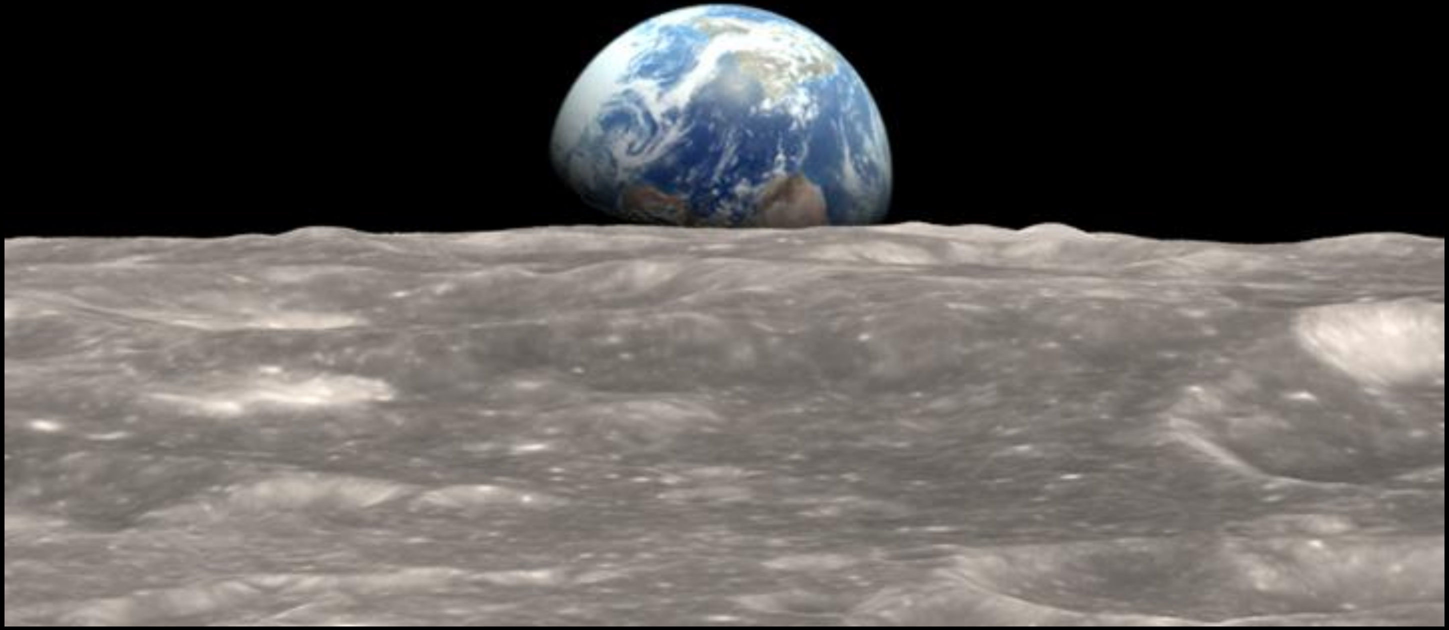
10	Arable land (Cropland)	dry land, paddy field, Land for greenhouses, vegetable field, Artificial Tame Pastures, economic cropland which is planted shrub crop or herbaceous crop, abandoned by the land reclamation of arable land
20	Forest	broadleaved deciduous forest, evergreen broad-leaf forest, deciduous coniferous forest, evergreen coniferous forest, mixed broadleaf-conifer forest
30	Grassland	typical grassland, meadow grassland, alpine grasslanddesert grassland, grass
40	Shrubland	desert scrub, mountain scrub, deciduous and evergreen shrubs
50	Wetland	lake swamp, river flooding wetlands, seamarsh, shrub/forest wetlands, mangrove forest, tidal flats/salt marshes
60	Open Water	lake, reservoir/fishpond, river
70	Tundra	brush tundra , poaceae tundra, wet tundra , bare tundra , mixed tundra
80	Artificial Cover	settlement place, industrial and mining area , traffic facilities
90	Bare Land	saline-alkali land , sand, gravel, rock , microbiotic crust
100	Perm.snow & Glac.	permanent snow, ice sheet and glacier

Statistics of Urban and Rural Resident Land Change in Ten Countries, 2000-2010

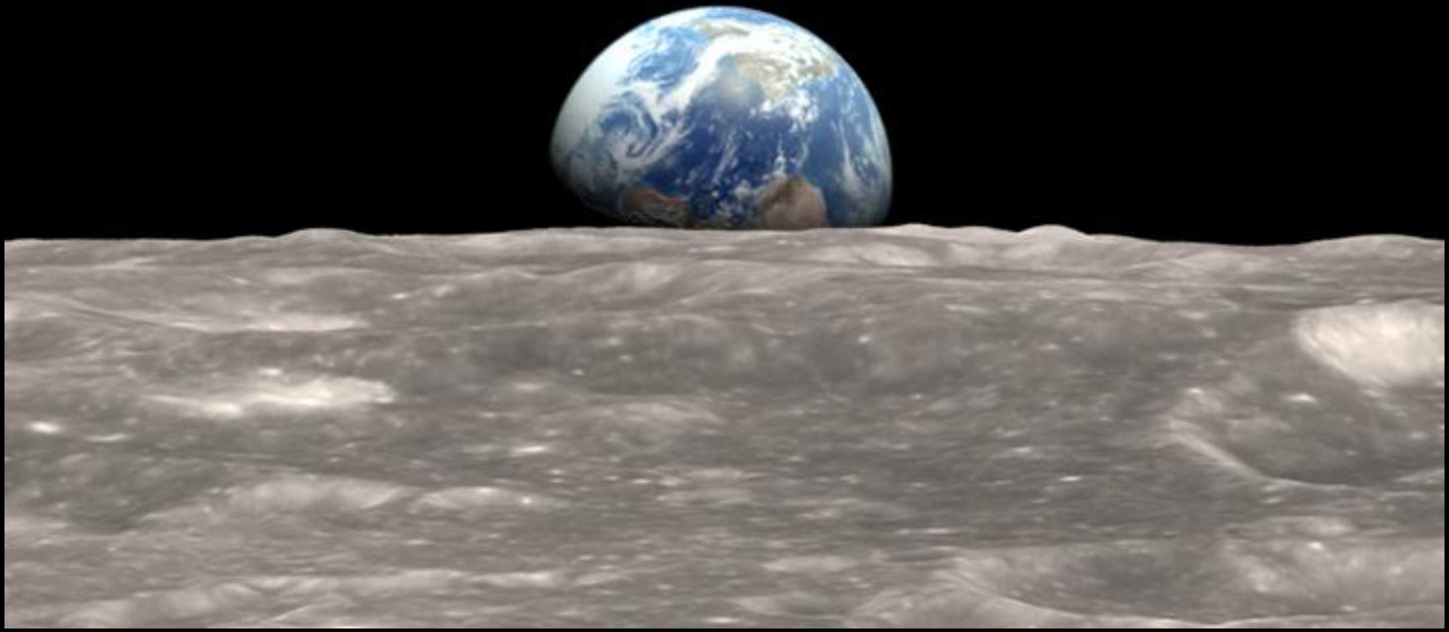
Country/ Region	Area in 2000 (10,000 km2)	Area in 2010 (10,000 km2)	Variation Rate （%）	Increase Proportion （%）
China	14.49	16.10	11.17	28.17
U.S.A	22.38	23.56	5.26	20.48
Russia	9.50	9.83	3.46	5.73
Mexico	2.32	2.50	7.87	3.18
India	4.90	4.99	1.79	1.53
Brazil	3.18	3.24	1.83	1.01
Japan	2.50	2.54	1.55	0.67
France	2.86	2.90	1.29	0.64
Germany	3.02	3.02	0.03	0.01
Ukraine	4.09	4.09	<0.01	<0.01

Sources for Increased Urban and Rural Resident Land in Each Continent

		Asia	Europe	Africa	North America	South America	Oceania	Global
Arable land	Area(km^2)	17968.43	3457.04	2525.80	4074.99	666.82	179.34	28872.41
	Proportion (%)	**72.01**	60.43	29.47	27.26	27.91	20.86	50.26
Forest land	Area(km^2)	1756.84	416.31	1134.09	3859.18	376.62	185.92	7728.96
	Proportion (%)	7.04	7.28	13.23	25.82	15.76	21.62	13.46
Grassland	Area(km^2)	3749.71	643.80	3479.60	3093.45	755.19	344.52	12066.26
	Proportion (%)	**15.03**	11.25	40.59	20.69	31.61	40.07	21.01
Shrub	Area(km^2)	158.09	284.31	517.68	2563.72	306.59	82.71	3913.11
	Proportion (%)	0.63	4.97	6.04	17.15	12.83	9.62	6.81
Wet land	Area(km^2)	33.68	127.33	27.54	743.92	17.93	20.46	970.87
	Proportion (%)	0.13	2.23	0.32	4.98	0.75	2.38	1.69
Waters	Area(km^2)	2.21	609.83	39.98	241.20	26.11	24.19	943.52
	Proportion (%)	0.01	10.66	0.47	1.61	1.09	2.81	1.64
Bare land	Area(km^2)	1282.04	182.18	849.38	372.80	240.00	22.83	2949.24
	Proportion (%)	5.14	3.18	9.91	2.49	10.04	2.66	5.13
Sub-total	Area(km^2)	24951.00	5720.80	8574.07	14949.26	2389.26	859.97	57444.37
	Proportion (%)	43.44	9.96	14.93	26.02	4.16	1.50	100.00



Writing the manual of our spaceship EARTH



Further information

www.futureearth.org

www.futureearth.org/blog

www.facebook.com/futureearth.org

@FutureEarth

Question: **Large amount of data is available. Who is going to keep this 'Earth's library' available forever: data custodian?**

Challenge: **Additional efforts are necessary in order to make all this data available in the form of information to:**

all scientific disciplines,

decision makers

and society