Environmental Change and Food Safety

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The Great Acceleration

<table>
<thead>
<tr>
<th>Trend</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Carbon dioxide emissions</td>
</tr>
<tr>
<td>Real GDP</td>
<td>Nitrous oxide emissions</td>
</tr>
<tr>
<td>Food</td>
<td>Methane emissions</td>
</tr>
<tr>
<td>Energy</td>
<td>Oxygen levels</td>
</tr>
<tr>
<td>Water use</td>
<td>Ocean acidity</td>
</tr>
</tbody>
</table>

*Steffen, Broadgate, Deutsch, Gaffney, Ludwig (January 2015) Anthropocene Review*

Future Scenarios

"Limits to Growth: The 30-Year Update", Donella Meadows, Jorgen Randers and Dennis Meadows, 2004

The Fifth Assessment Report (AR5) of the United Nations Intergovernmental Panel on Climate Change (IPCC)
Two of four compared Representative Concentration Pathways (RCPs) of Radiative Forcing
Planetary Boundaries:

- Climate Change
- Novel Entities
- Stratospheric Ozone depletion
- Atmospheric aerosol loading
- Ocean acidification
- Biogeochemical Flows
- Freshwater use
- Land-system change
- Biosphere Integrity

From Steffen and others, 16 January 2015, Science, F. Pharand-Deschenes /Globala

Then, how will future food production and food safety be?

Feeding the planet doesn’t require further deforestation

- 500 scenarios for food production to 2050 for 9 billion people
- 289 scenarios don’t require deforestation
- Dietary choice is critical
- Low meat, vegetarian or vegan diets give highest likelihood of success


Foodborne illnesses and death estimated by WHO FERG – future changes?

<table>
<thead>
<tr>
<th>HAZARD</th>
<th>FOODBORNE ILLNESSES</th>
<th>FOODBORNE DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>600 652 361</td>
<td>418 608</td>
</tr>
<tr>
<td></td>
<td>(417 646 804–962 834 044)</td>
<td>(305 128–598 419)</td>
</tr>
<tr>
<td>Diarrhoeal disease agents</td>
<td>548 595 679</td>
<td>230 111</td>
</tr>
<tr>
<td></td>
<td>(369 976 912–888 528 014)</td>
<td>(160 039–322 359)</td>
</tr>
<tr>
<td>Viruses</td>
<td>124 803 946</td>
<td>34 929</td>
</tr>
<tr>
<td></td>
<td>(70 311 254–251 352 877)</td>
<td>(15 916–79 620)</td>
</tr>
<tr>
<td>Bacteria</td>
<td>349 405 380</td>
<td>187 285</td>
</tr>
<tr>
<td></td>
<td>(223 127 469–590 002 559)</td>
<td>(131 742–254 037)</td>
</tr>
</tbody>
</table>

Median global number of foodborne illnesses and deaths, with 95% uncertainty intervals, 2010. (WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015..World Health Organization)
Inter-related factors

- Many factors are related to each other and have impacts on human health and FOOD SAFETY.
- Some have correlation, others have trade-off.
- We need to address to multiple challenges all together.

Future Earth Core Projects

Birth of Future Earth

Serious reflection

- Excellent scientific products have been achieved.
  - With good quality
  - Referred in IPCC reports, etc.

However,

- Has science changed (improved) the real world?
  - Stopping global environmental change? – no
  - Supporting people to have better life? – yes and no

Somethings has been lacking…

- Lack of collaboration with other disciplines within science – e.g. social and natural sciences
- Science only cannot solve societal problems – need collaboration with stakeholders in the society and wisdom in the society
Two key aims of Future Earth

- Scientific integration across natural and social sciences and humanity: Interdisciplinary approach
- Co-creation of knowledge with stakeholders in the society: Transdisciplinary approach, stakeholder engagement
  - Co-design: research planning (incl. theme, methods)
  - Co-production: research conduct
  - Co-delivery: application of the research products in the society

What Future Earth would like to provide

- Understanding interaction between diverse factors that were not considered previously as related – e.g. climate change and poverty eradication and gender equity, with synergies and tradeoff – and synthesizing knowledge
  - by interdisciplinary and multi-academic collaboration, especially with social sciences
- Promoting research with stakeholders (private sectors, citizens, local politicians, educators, etc)
  - by understanding their recognitions/ interest/ desire/ wisdom
- Global network

Knowledge-Action Networks

Practical platform to facilitate information exchange, highly integrative sustainability research, aiming to generate the multifaceted knowledge, together with Future Earth projects, external projects and stakeholders in the society

- Water, energy, food nexus
- Decarbonise & adapt
- Natural assets
- Cities
- Rural landscapes
- Health
- Consumption & production
- Emergent risk

SDGs

- Oceans
- Transformations
- Finance & Economics
Knowledge-Action Network: Water-Energy-Food Nexus

How can resource management help to deliver food AND water AND energy for all in sustainable ways?

Considering synergies and tradeoffs

Knowledge-Action Network: Health

The report by Rockefeller Foundation–Lancet Commission on planetary health was the powerful engine to formulate the ideas and purposes of the Health KAN.

Knowledge-Action Network: Finance & Economics

Challenge: To support strategies for linking economic prosperity with social justice and a healthy planet

How can we achieve physical, mental and societal health, with good QOL and Wellbeing AND Planetary health?

Can we reduce demand and make profits? Super-smart society?

How can we deliver food AND water AND energy for all in sustainable ways?

How to achieve goals/targets? How to assess?

Need to change our lifestyle? How?

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Mechanisms by which the harmful effects of ecosystem change can affect human 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

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

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Science -> Technology -> Innovation Opportunities for Business

Economic, Social, Technological Actions
Regional and Local Translation

“Our Common Future Under Climate Change”
International Scientific Conference 7-10 July, 2015
Paris, France

Business Opportunities

Science -> Technology
Innovative products
Eco Markets
Ecological Efficiencies

Social Innovation ->
Business Opportunity

Yunus – “Every social problem is a business opportunity”

Asia: both frontier of global issues and advantages for solutions supported by sound sciences and good wills

- Rich in diversity in the nature and in human society
- Affected by various natural disasters and social problems – all global challenges
- Growing population, economics – development: opportunities? sustainable?
- Opportunities by collaboration among scientific communities
  - Future Earth Regional Center (Kyoto) and Regional Advisory Committee
  - South Asia Regional Office (Bangalore, India)
  - Future Earth National Committees
  - ICSU Regional Office for Asia and the Pacific
  - National Science Academies, Regional academic organizations, e.g. SCA, AASSA, PSA
  - UNU campuses (Tokyo, Kuala Lumpur), etc.

Sustainable Development Goals (SDGs) and Future Earth challenges related to food and health

The Global Goals
For Sustainable Development

The Regional Centre for Future Earth in Asia builds networks among research communities and stakeholders in the region and promotes the Future Earth initiative in Asia to enhance global sustainability.

Future Earth embraces a strong regional engagement for its global agenda to adequately address regional science priorities and end user needs. To achieve this, the Regional Centres provides the five core functions (i.e., coordination, research enabling, communication, capacity building and synthesis and foresight) of the Executive Secretariat within regions. The Asia Centre will facilitate the implementation and development of the Future Earth.
Main Theme: Future Earth: Research for Global Sustainability and a Holistic Understanding of Sustainable Development in Asia

How to get involved in Future Earth? – via Open Network

Speakers from Japan, Malaysia, Japan, Taiwan and Korea (from left)

What ICMSF would consider for future

Relative proportion of sample units in a lot

No concern  m  Some concern  M  Decisive concern

Mean log count
What ICMSF would consider for future

\[ H_0 - \Sigma R + \Sigma I \leq FSO \]

- FSO = food safety objective
- \( H_0 \) = initial level of the hazard
- \( \Sigma I \) = total increase (growth or recontamination)
- \( \Sigma R \) = total reduction (inactivation or removal)

Complicated Ecosystem

- Understanding interaction between diverse factors in the complicated ecosystem using systems thinking
- Considering food stability, food quality and food safety together

Transdisciplinary approach, stakeholder engagement has been our tradition/culture in food safety
What food safety specialists can do may includes to

- Keep our eyes widely open to identify new trends and affecting factors
  - monitoring, systematic review
  - can be new threats
  - but business opportunity – as well
- Develop new research and technology
  - new food technologies
  - systems thinking
  - flexibilities and rooms to address emerging issues in risk models
- Work with other scientific disciplines and other partners

- For human health, One Health, and Planetary Health, through food stability/quality/safety

Thank you very much!