

Appendix

Zugspitze Declaration on the Responsibility of Humanity for the Functioning of the Earth System

Faced by serious challenges to the Earth system, a group of scientists, politicians and business representatives met for four days in Wildbad Kreuth, Germany, at a workshop on “**Earth-System Engineering: The Art of Dealing Wisely with the Planet Earth**”. The participants agreed to the following declaration:

§1 Our global crisis

Global climate change threatens the life-enabling functions of the Earth system.

§2 We ought to learn from the past

We should be able to tackle climate change as effectively as the problems resulting from acid rain and stratospheric ozone depletion were mitigated. But we will need much more concerted action.

§3 Our deeds must follow our words

There is plenty of knowledge available to handle this global crisis. Let us get started!

§4 We must raise awareness of the problem

Behavioral changes will be necessary to solve the Earth system crisis.

§5 We need to protect our indispensable global commons

To regulate usage of the global commons, including the atmosphere and oceans, an enforceable international legal framework needs to be formulated, adopted and applied globally.

§6 Execution of deliberate climate modification requires authorization

Climate engineering should only be permitted after rigorous assessment and authorization by a process of international consensus to which all nations are supposed to contribute.

§7 Sustainability has to be our goal

Our global society must understand that human endeavors can only be tolerated when sustainability criteria are met.

§8 A global commons trust fund should assist in financing advanced research

A global commons trust should be made available to finance advanced research which is holistic and multi-disciplinary in nature.

§9 We need a United Nations authority responsible for preserving the functioning of the Earth system

A high-level United Nations body is to be established and authorized to enforce measures capable of preserving the life-enabling functions of the Earth system.

This declaration was signed by:

Dr. Padam Bhojvaid, Dr. Josef Bugl, Dr. Paul Josef Crutzen, Elena Davydova, Dr. Helmut Fluhrer, Dr. Martin Grambow, Dr. Michael von Hauff, Dr. Rafaela Hillerbrand, Dr. Eva Lang, Dr. Tim Lenton, Dr. Hamish McGowan, Dr. Wei Meng, Dr. Lee Miller, Dr. Rolf Müller, Dr. Deb Niemeier, Fred Pearce, Dr. Ulrike Potzel, Yuri Saveliev, Dr. Yong Hui Song, Dr. Akimasa Sumi, Dr. Naomi Vanghan, Dr. Raoul Weiler, Dr. Peter A. Wilderer, Dr. Stefan Wuertz

Explanations

§1 Our global crisis

Until recently, the biggest challenges to the survival of the increasing world population were the food and water deficits, pollution, loss of biodiversity, poverty, and inequality. Now, global climate change threatens to further exacerbate all these problems and compromise our efforts to deal with them.

§2 We ought to learn from the past

The world has recently shown the capacity and flexibility to quickly respond to short-term natural disasters. Moreover, environmental management has successfully addressed problems resulting from acid rain and stratospheric ozone depletion. The signatories of the declaration urge that similar capabilities be quickly mobilized to address the far more serious and longer term Earth-system crisis.

§3 Our deeds must follow our words

There is no excuse for delaying implementation of available state-of-the-art technologies. While there is need for innovation in certain areas, proven, established and sustainable responses already exist for handling large parts of the global crisis. The signatories of the workshop want to motivate those who have solutions, in order to share this knowledge with the global community so that implementation can begin now.

§4 We must raise awareness of the problem

Efforts to address the crisis require social empowerment to change behavior and deal wisely with the Earth system. This is the primary responsibility of the current generation.

§5 We need to protect our indispensable global commons

Utilization of the global commons, including the atmosphere and oceans, is currently only partially regulated, and degrading global commons carries few penalties. We recommend the formation of a binding international legal framework and a Global Commons Trust as proposed by Christopher D. Stone (in “Wege zum ökologischen Rechtsstaat“ (Path towards an ecological state under the rule of law), H. Baumeister (ed), E. Bottner Verlag, 1993). Most urgent is a globally

validated administration of a global cap and redistribution system for atmospheric carbon emission or climate protection credits.

§6 Execution of deliberate climate modification requires authorization

Climate engineering is the deliberate, planned, large-scale intervention in the climate system. Such initiatives with potential global effects need rigorous risk and legal assessment, and authorization by a process of international consensus to which all nations are supposed to participate. Climate engineering must never be seen as an alternative to the necessity to solve the global crisis at its roots.

§7 Sustainability has to be our goal

The purpose of the new frontier of Earth system engineering must be to promote improved management of the global commons. Our global society must find a relationship between the natural environment and human endeavors that ensures sustainability.

§8 The global commons trust fund should assist in financing advanced research

The global commons trust fund should support, among other important tasks, advanced research which is holistic and multi-disciplinary in nature.

§9 We need a United Nations authority responsible for preserving the functioning of the Earth system

A United Nations body is to be established and authorized to enforce measures capable of preserving the life-enabling functions of the Earth system. Decisions should be based on the advice of the IPCC, and on the recommendations of a second intergovernmental panel responsible for assessing and evaluating, within the context of sustainability, those technologies and methods proposed to preserve the life-enabling functions of the Earth system. This proposal goes beyond earlier suggestions to elevate the UN Environment Programme (UNEP) to the level of the WTO, because of the severity of the crises we now face.

Acknowledgement

The authors acknowledge the idealistic and financial support provided by the Bavarian State Ministry for Environment and Consumer Safety. Moreover, the authors are grateful for the support received from the Institute for Advanced Study of the Technische Universität München.

Index

A

Adaptive cycles, 64–68, 70
Agriculture, 7, 9, 13, 126–129, 140, 142–145,
147, 148, 160, 179, 184

B

Big data, 165–178, 187
Bioeconomics, 127, 129
Biosphere, 8, 11, 13, 84–90, 95, 96, 98, 102,
104, 127, 183
Biotic regulation, 88–95, 102

C

Centralization, 11, 17, 32, 47, 75–80, 82, 103,
127, 128, 131, 157, 179, 190
Chaos, 24, 25, 27, 28, 30, 31, 84, 87
City planning, 77
Civilization, 83–104, 111, 146, 166, 172, 186
Communication technologies, 60, 166, 182,
185, 186
Consumer, 2–6, 9, 10, 13, 21, 39, 40, 101, 129,
132, 134, 135, 143, 153, 160, 173, 174,
179, 186, 189, 190
Cultural evolution, 6, 8
Culture, 8, 49, 82, 98, 101, 107–112, 126, 153
Cyber physical systems, 17, 60, 63, 64, 172,
175, 178, 182, 186

D

Decentralization, 11, 17, 43, 47, 55–64, 76, 77,
84, 91–93, 103–107, 118, 119, 124–130,
136, 144, 149–152, 165, 179, 181, 182,
185, 189–191

Decision making, 31, 34, 37, 38, 77, 81–83,
110, 132, 141, 146, 148, 182, 185, 188
Duality of nature, 16
Dynamic systems, 12

E

Economic and societal crisis, 1, 190
Economy, 11–16, 66, 81, 102, 109, 112,
117–132, 134, 146, 161, 162, 168–170,
177, 178, 182, 187, 189–191
Ecosystem function and service, 1–10, 111,
135, 136, 140, 183
Ecosystems, 1–17, 46, 64, 66, 69, 83–104,
109–111, 120, 121, 135, 136, 140,
142, 145, 146, 148, 181, 183, 184,
189, 191
Education, 16–17, 33, 38, 107–110, 126, 127,
134, 135, 144, 166, 167, 169, 171, 172,
177, 189
Electrical energy, 32, 38
Energiewende, 35
Energy, 2, 3, 5, 6, 12, 14, 16, 22, 25, 26, 32, 33,
38, 40, 55–64, 67–71, 78, 79, 84–88, 93,
95, 96, 101–103, 122–124, 126–129,
133–135, 144, 147, 148, 155–161, 165,
166, 172–175, 185, 186, 190
Energy crisis, 146, 148
Environment, 1–4, 6–9, 11–14, 17, 28, 31,
34, 36, 37, 43, 46–48, 51, 52, 54, 63,
76, 80, 84, 85, 87–90, 92–95, 97–99,
101–112, 118–124, 126–134, 145,
148, 150–162, 179, 183, 184,
186, 190
Ethics, 11, 16–17, 22, 34–38, 41, 43, 110, 136,
172, 179, 183, 187

G

Global crisis, 14, 102
 Global warming, 112, 135, 141, 148
 Governance, 75–112, 130, 132, 133, 136,
 152, 165, 166, 177, 180–182, 184,
 185, 187, 188

H

Health risks, 149
 Human dimension, 7
 Human impacts, 14–16
 Hydrosphere, 3

I

Industrial parks, 122–123
 Informal cities, 77
 Information Technologies. *See*
 Communication technologies
 Internet of Things, 84, 101, 175–176, 178,
 179, 187

L

Land use management, 146
 Limited growth and Technology, 121

M

Man-made systems, 9, 13, 21–71, 181, 183
 Micro-pollutants, 151

N

Neoliberalism, 14

O

Organic farming, 17, 129

P

Paradigm of economy, 14
 Prosumer, 62, 63, 185

R

Regulation, 1–17, 26, 46–50, 52, 53, 66, 70,
 88–95, 102, 103, 134, 136, 166, 171,
 175, 183, 190

Renewable energy, 67–70, 102, 112, 124,
 133, 173, 190

Resilience, 12, 14, 32, 36, 42, 55, 66, 69,
 80–83, 85, 132, 146, 150, 181–184,
 191, 188, 190

Risks, 7, 66, 110, 111, 124, 126, 129–132,
 144, 148, 149, 166, 167, 170, 171,
 187, 190

S

Sanitation, 46, 47, 51, 77, 139, 144, 145
 Smart grids, 26, 32, 38–43, 58, 60–64, 166,
 172–175, 185, 186
 Sociotechnical systems, 165, 172
 Solid waste management, 152–162
 Stability, 12, 21, 23, 25, 32, 34–38, 40–42,
 55, 59, 64, 84, 90, 92, 95, 98, 101,
 132, 135, 136, 142, 146–148, 171,
 175, 181, 183, 185
 Subsidiarity principle, 50, 103
 Sustainability, 13, 14, 16, 25, 32, 34, 36,
 42, 64, 82, 83, 85, 93, 109–112, 118,
 120–123, 125, 128–132, 135, 140,
 147, 149, 150, 153, 181, 183, 191
 Sustainable economy, 117–125, 130–136, 178
 Sustainable trade, 129
 Systems science, 165–167, 169

T

Technology, 11–13, 16, 17, 35, 37, 38, 42, 56,
 60, 61, 65, 68, 69, 80, 101, 102, 104,
 107, 122, 124, 126, 128, 129, 131, 141,
 142, 144, 145, 147–149, 154, 165, 172,
 173, 175–179, 182, 185–187, 189–191
 Toxic materials, 151
 Trade, 13, 109, 126, 129–131, 133–135, 153,
 168, 187
 Transportation, 22, 24, 25, 32, 76, 100, 134,
 139, 142, 143, 156, 186

U

Urbanization, 76–80, 149, 150, 165

W

Waste management, 127, 150, 152–162
 Wastewater management, 149–150, 152
 Water and food crisis, 148
 Water reuse, 139, 143