# Strategy of the Antrhopocene Priority Research Area (PRA) in the years 2020-25

### ANTHROPOCENE or in search of sustainable development\*

The Anthropocene is a vastly comprehensive term, typically understood as "the era of humans," in which the anthroposphere, alongside the biosphere and geosphere, has become a main component of the Earth system. In the Anthropocene, humans have possessed the powers normally associated with natural processes that shape the Earth system. The Anthropocene is thus viewed as a unique epoch in the Earth's history, in which the geological time, an ahistorical entity (deep time), has drawn level with historical time, since the rate of changes in the Earth system has greatly accelerated, unprecedented by anything that had come before. In light of the satellite photographs from the past several decades, which register global changes of the environment on the planet, we may go as far as to declare that we are participating in one of the fastest moving catastrophes that the Earth has seen over its entire history. The Anthropocene, however, is different from the other geological epochs in that humans, in contrast to nature, act also in the sphere of morality, and what they do is subject to moral judgement (human responsibility). Hence the postulates, by e.g. the environmental humanities, pointing to the need for a social transformation and building a participatory and inclusive "ecological democracy," emphasizing the significance of complementary knowledge, which combines humanities and social sciences with natural sciences and traditional ecological knowledge.

Humanity has never faced challenges of such a sweeping scale. The tragedy of the commons (*The Tragedy of the Commons*, Hardin 1968), afflicting in the past rural communities, has become a problem for the global village. To the classic challenges the humanity is facing named by Hardin, such as natural resource depletion or pollution, we may add today climate and environmental changes as well as cultural and social changes within the globalizing, ever more digital-technologies-dependent society. Half a century ago Hardin wrote: *"The population problem has no technical solution; it requires a fundamental extension in morality.* [...] *the world available to the terrestrial human population is finite. 'Space' is no escape."* And yet, since that time world's population has doubled, we all use the world wide web, plan bases on Mars: *the world is still infinite.* Should we put the report *"The Limits to Growth,"* commissioned by the Club of Rome, out to pasture too?

Only a cursory analysis of global problems such as climate and environmental change, desertification, deforestation, biodiversity loss, the spread of invasive species, epidemics, limited access to water, population migrations, dwindling natural resources, armed conflicts, progressive digitisation, causing addiction to technology dehumanising relations, shows that this is not necessarily the case. The problems exacerbate, while the Earth's buffer capacity is running thin. The situation from 50 years ago is different merely in terms of quantity, not quality (IPCC). At the same time, a reflection on the tragedy of commons has sparked research on governing the commons, as evidenced by, among others, a theory of commons by Elinor Ostrom, a 2009 Nobel Prize laureate.

The interdisciplinary Earth System science (ESS) research team has even put forward a demand for the geologic time scale to include a seprate unit: the Anthropocene. The formal boundary of the Anthropocene would be the pronounced isotopic fingerprint originating in the decay of radiogenic nuclides (an effect of the nuclear tests in the 1950s) and the accumulation of industrial waste, including plastic and particles, in the deposits. Unlike Hardin's generation, then, we are deeply aware of the vast, quantitative and qualitative environmental changes caused by the human impact: we are both the parents and the children of the Anthropocene.

The changes sweeping over the world often form a complex chain of cause and effect, the understanding of which requires cooperation of researchers from a number of fields. As an example of such a chain of changes may serve the great migrations known from history, which brought about deep transformations in social and cultural structures (e.g. armed conflicts, falls of civilisations), the

background of which was the climate or unsustainable management of natural resources. Butzer writes: "*Historical collapse of ancient states poses intriguing social-ecological questions, as well as potential applications to global change and contemporary strategies for sustainability.*" What is more, migrations are often accompanied by pandemics of contagious diseases.

The current COVID-19 pandemic brings home with a vengeance the fragility of the modern tenets on which the anthroposphere is organised. Two months were enough for most countries to experience an unprecedented economic recession, whose aftermath will in all likelihood have to be tackled for years to come. The solutions put forward seem to be just local, makeshift steps, which do not take into account the complexity of the Earth system. It is, in essence, an attempt at continuation of the policy of economic growth at all cost, supported by technological development, often carried out at the expense of increasing economic disparities. This generates further social tensions and conflicts, and adds to the cumulation of unresolved problems. Given the technological development, the exploitation of the Earth's natural resources and the dwindling thereof, and the curiosity innate to humans, we are facing a new chapter in human history, which is the exploration of the outer space and the humans' transgression of the Earth system. This brings about another range of economic, social or legal (space law) dilemmas.

Perhaps the overarching challenge of modern science is the consolidation of the highly specialist knowledge from different disciplines, which – as as the turnout of academic publications dramatically accelerates – become ever more hermetic scientific fields, the cultivation of which narrows the perspective on a larger dimension of the problem at hand.

On 20 April 2020 we celebrated the 50th anniversary of the Earth Day, an occasion at which emphasis was put on the fundamental role of science in paving the way for humanity to materialise the idea of sustainable growth. As was observed, it will be possible only thanks to a broad cooperation transcending research domains, but also the involvement of lawyers, economists and politicians. This manifesto is a continuation to a call to common action bringing together the idea of sustainability and Earth System science, formulated a decade ago in the paper *Earth system science for global sustainability: grand challenges* (Reid et al., 2010), whose authors aptly noted: *"The disciplinary- dominated structure of academia runs counter to the need to address interdisciplinary aspects of these grand challenges."* 

The Anthropocene PRA aims to do away with this disciplinary-dominated structure of academia and to take a holistic look, one that integrates the research community, at the causes, course, and results of the changes unfolding in our world today, the natural ones (including climate) as well as social and technological ones (social, economical and technological). The world in which we live, the world of Anthropocene, is an outcome of a number of factors that are active throughout: from extra-terrestrial (solar energy, UV radiation), to terrestrial (geosphere, hydrosphere, atmosphere, biosphere), to human activity (anthroposphere) and the related social world, the world of ethics, law, religion or technology (industry). Our task is to find and suggest methods and ways for the Earth in the Anthropocene not to share the fate with the commons.

\*) The 2030 Agenda for Sustainable Development (UN Resolution A/RES/70/1

### Defining strong and weak points of the JU and PRA in the research area

A strength of the PRA and the JU is certainly the competence of their academic staff, represented at the Anthropocene PRA by eight faculties, including three of the university's A+ category faculties. Among the chief assets of the PRA is also its addressing of topics in line with the worldwide trends, particularly significant for the socio-economic environment, which expects researchers not only to take a stance on the Anthropocene's problems, but also to draw guidelines for political or social decisions.

It merits a note that at the JU a complementary project of sustainable development is carried out within the UNA Europa network, which strengthens the PRA and settles it in a network of eight leading European universities, enabling it to develop relations and collaboration. Thematic scope of the Anthropocene PRA is broad enough for two JU Doctoral Schools to participate in the implementation of its educational mission; they take actions aimed at launching a new international Anthropocene study programme. A similar study programme is being planned also for students of the first or second study cycle. The educational initiatives develop as a result are sure to be innovative and seeking to meet social expectations.

Because of its hyperinterdisciplinarity, the implementation of the Anthropocene PRA will require the breaking of many systemic biases, but also of mental biases within the academic community. This may be understood as a certain weakness and a threat to the implementation of the PRA mission.

### Objectives and directions in development of the PRA

The Antrhopocene's uniqueness thus requires integrated measures aimed at grasping the ongoing changes in the anthroposphere, biosphere, geosphere and the Earth system. Without a proper diagnosis, without knowing the reasons and potential effects, it is impossible to come up with successful solutions. A policy of sustainable development, adaptation and protection, which requires the involvement of technologically advanced solutions, must be carried out by responsible experts who are aware of the causal link between the anthropo-, bio- and geosphere.

The Anthropocene PRA thus seeks to do away with boundaries between disciplines or research domains, in order to form, within the University, a group of scholars expert in topics related to responsible policies with regard to climate, environment, energy or society, taking into account the complexity of the works of the Earth system.

Another mission of the PRA is a transfer of knowledge to society and the economic environment, so as to inform the awareness of the impact exerted by decisions taken on different levels with the understanding of the Anthropocene's threats. This mission will be carried out by means of, among others, educating students and doctoral students in hyperinterdisciplinary new study programmes concerned with the Anthropocene studies.

A wide-ranging information campaign is also planned for the non-academic community, including schoolchildren and local authorities. We also plan to cooperate with non-governmental organisations (NGOs), with a view to provide them with expertise.

The Anthropocene PRA should create space for innovative social practices and implementation programmes, which seek to address the urgent problems of communities both local and global.

The Anthropocene PRA is thus a real answer on part of the research community to the global problems affecting each of us individually. In that it implements most fully the 4\*I principle.

## PRA priorities: definition of priority domains / research problems and measures to be taken within the PRA aimed at achieving world-class research in the area

In view of the strategy outlined above, the development directions and the specific nature of the Anthropocene PRA, three functional research domains have been identified. These domains, like the entire PRA, do not focus on splitting the research problems into ever more minute fields. On the contrary, they reflect the methodology of studying the Anthropocene as a whole. This disciplinary comprehensiveness of the Anthropocene requires that part of the actions, mostly educational, be carried out across the entire PRA (EduPrograms for the Future).

The first domain, Earth System science (ESS), comprises actions that allow for learning and understanding the interactions between the anthroposphere, biosphere and geosphere: it is, therefore, a diagnosis of the Earth system.

The second domain, Adaptation, Sustainability, Advancement, Protection (ASAP), deals with actions which, drawing on the diagnosis provided by the ESS, search for solutions that include the Goals of the2030 Agenda for Sustainable Development, including in particular environmental protection, but also adaptation to the changing environment. The ASAP domain will also comprise research extending the anthroposphere beyond the Earth system.

The Emerging Fields domain deals, on the other hand, with all random and unexpected events that affect the Earth system and require a correction of the once developed solutions, e.g. adaptive solutions. This domain, given its indeterminacy, seems to best reflect the nature of the Anthropocene.

### Name of the research domain: EARTH SYSTEM SCIENCE (ESS)

Scope of the research domain: social sciences, exact sciences, life sciences

Examples of research topics within the research domain:

- 1. Learning the mechanisms of and comparing the changes in environmental conditions in the past (biogeoarchives), the ones happening at the moment, and modelling their future directions.
- 2. Climate, atmosphere: climate change modelling, computational modelling of atmospheric processes.
- 3. Factors shaping the water cycle (hydrological cycle) and the circulation of elements in nature.
- 4. Critical zone of the Earth and other celestial objects (soils, clay minerals).
- 5. Water and soil pollution, including heavy metals, organic compounds, biologically active substances, plastics.
- 6. Air pollution, including solid (nano)particles, volatile organic compounds, toxic gaseous substances.
- 7. Environment monitoring.
- 8. The impact of the past environmental change on the rise and decline of human cultures.
- 9. Dynamics and directions of contemporary environmental change.
- 10. The social and economic impact of environmental change (including climate change).
- 11. The impact of land use change on the environment.
- 12. The impact of legal regulations on the Earth system.
- 13. The impact of space factors on the Earth system.
- 14. Comparative planetary science with a focus on Earth-like objects (e.g. Mars)

<u>Measures planned to be implemented within the research domain</u>: New Blood, Incentives program, R2R, Strategic research infrastructure #1, Open access, Jagiellonian Fellowship Program, Conferences & Seminars, Young Labs Program, Outgoing Fund, Talent management, Skills, Individual Development Program, R2B, R2S.

#### Name of the research domain: ADAPTATION, SUSTAINABILITY, ADVANCEMENT, PROTECTION (ASAP)

Scope of the research domain: social sciences, exact sciences, life sciences

Examples of research topics within the research domain:

- 1. Rational use of raw materials and energy in accordance with the principles of sustainable development and circular economy (closed circuit), law and circular economy.
- 2. Waste in raw materials policy and implementation of circular economy.
- 3. Raw materials, materials and technologies of the future (including extraction of raw materials occurring in space), law of new technologies.
- 4. Management of space as a non-renewable resource and the protection and shaping of the landscape.
- 5. The impact of legal regulations on the formation of relations between humans and the environment in various areas, legal aspects of sustainable development (environmental democracy, ecological safety).
- 6. Threats to biodiversity: challenges and chances of combating (e.g. legal protection).
- 7. Environmental pollution and human health (e.g. availability and quality of drinking water, air purity, noise pollution).
- 8. Migration flows at a time of global change, legal aspects of migration and asylum-seeking.
- 9. Astrobiology and space medicine.
- 10. Legal regulations of the use of the outer space and its resources.
- 11. Climate change and adaptation to climate change, including the reduction of greenhouse gas emissions, food security and the pro-climate social practices of organisations, institutions and social movements.
- 12. Globalisation and Europeanisation, including international trade and investment, global health and safety threats: international health regulations, law harmonisation processes.
- 13. Law and advancement of science, transfer of knowledge and know-how.

<u>Measures planned to be implemented within the research domain:</u> New Blood, Incentives program, R2R, Open access, Jagiellonian Fellowship Program, Conferences & Seminars, Young Labs Program, Outgoing Fund, Talent management, Skills, Individual Development Program, R2B, R2S.

### Name of the research domain: EMERGING FIELDS

Scope of the research domain: social sciences, exact sciences, life sciences

Examples of research topics within the research domain:

- 1. political, social, migration crises, armed conflicts
- 2. pandemics
- 3. ecological catastrophes
- 4. natural catastrophes

<u>Measures planned to be implemented within the research domain:</u> Incentives program, R2R, Open access, Jagiellonian Fellowship Program, Conferences & Seminars, Young Labs Program, Outgoing Fund, Talent management, Skills, Individual Development Program, R2B, R2S.