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FNP Association of the Foundation for Polish Science Scholars

Uniwersytet Wrocławski

RESEARCH UNIVERSITY EXCELLENCE INITIATIVE

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Organizers

Uniwersytet Wrocławski

At the **University of Wrocław** – under the watchful eye of 2 thousand academic teachers, including more than 450 professors, also from abroad – knowledge is being acquired by 25 thousand students, doctoral students and post-graduate students. Every year, 8,000 graduates leave the university. Many of them had an opportunity to gain experience also outside Poland. Thanks to the University of Wrocław's membership in global student exchange programmes and networks (including Erasmus+ and ISEP), our students can pursue education, among others, in the United States, Germany, Great Britain, Austria, France, Spain and Belgium.
Our students can gain not only theoretical knowledge, but also the practical skills needed to start a professional career. We do this with the help of businesses and potential employers of our students and graduates,cooperating with the University of Wrocław.
At the University of Wrocław, which is also a prestigious research centre, several thousand scientific publications are published every year, we also run several hundred projects. A lot of the research programmes are carried out in cooperation with foreign partners. The results of our research are regularly published in prestigious magazines, including "Nature". For people with broad interests, exceeding the traditional division into academic disciplines, we have prepared Individual Interdisciplinary Studies, for which the curriculum is each time prepared according to the interests of a given student. Bearing in mind the needs of secondary-school graduates and the changing labour market, every year we introduce new courses and specializations.
The University of Wrocław is one of the leading Polish universities chosen by foreign students, and from year to year their number is increasing. There are currently almost 1500 foreigners studying with us. The most numerous groups come from India, Ukraine, Turkey, Azerbaijan and Uzbekistan. Our foreign students represent in total more than a hundred nationalities and very different cultural backgrounds. They successfully integrate with other students through joint activities. They gladly volunteer and take part in various projects (among them, an international orchestra and a football team operating at the university).
The University of Wrocław consists of more than 50 buildings, most of which are located in the city centre and concentrated around five campuses. They include both historic buildings, located on the tourist routes of Wrocław (such as the main building and the buildings on the square and in Nankiera Street), as well as modern buildings, with extensive equipment, meeting global standards and perfectly adapted to scientific and educational needs (e.g. educational and research Biotechnology complex, new seat of the University Library).
The University of Wrocław also includes:

- Botanical Garden in Wrocław and Arboretum in Wojsławice
- The Stanislaw Baranowski Polar Station in Spitsbergen
- Astronomical Observatory in Białystok
- Meteorology and Climatology Observatory in Wrocław
- "Storczyk" Environmental Station in Karpacz
- Ornithological Station in Ruda Milicka

The history of the university and the accomplishments of its researchers over the years are on display in five museums, in the University Archives and the University Library, one of the largest libraries of its type in Poland (we have 4 million volumes, the third largest collection of old prints pressed between 1456-1800 in Europe, as well as the first prints of Mozart's works and Beethoven's manuscript).
The Confucius Institute operates at the University of Warsaw, organizing Chinese language courses and meetings with Chinese culture and tradition. It's one of only four such centres in Poland. An interesting interdepartmental, interdisciplinary facility is the Centre for German and European Studies named after Willy Brandt, which is part of a network of institutions supported by DAAD (German Academic Exchange Centres). There are also many laboratories, clinics and language schools operating at our university, providing services to external companies, institutions and organisations. We regularly hold lectures in the scope of popular science, demonstrative classes and courses for secondary-school students, we are a co-organiser of the Lower Silesian Science Festival. We've been open to seniors for a long time. With them in mind, back in 1976 we established the University of the Third Age, which continues to be extremely popular.

AMU
Akademia Młodych Uczonych
POLSKA AKADEMIA NAUK

The Polish Young Academy (PYA) was constituted under the Polish Academy of Sciences (PAS) Parliamentary Act of April 30, 2010. It is a part of the PAS corporation and was established thanks to the effort of the PAS authorities inspired by the activity of similar bodies in other countries.One of the PYA's tasks is to promote the activation of the young scientific community, in particular:

- participating in the formation of science policy
- promoting scientific excellence
- disseminating scientific results.

Selection procedure of the PYA members is based on the election procedures for the PAS members, main criterion being the candidate's outstanding scientific achievements. PYA members are nominated for 5 years, without a possibility of re-election. Each PYA member can contribute to the work of the PAS by participating in the work of divisions, branches, scientific committees and task force committees. PYA is formed by leaders in respective scientific domains – scientists that have typically already been honoured with other prestigious awards and distinctions, including recipients of the European Research Council grants, the Ministry of Science and Higher Education Scholarships or the Foundation for Polish Science programmes. Despite their young age, many of them have already been appointed or awarded a professor title. PYA is actively involved in consultations regarding science and higher education policy, including "Law 2.0". PYA was represented in the Council of the National Congress of Science (NCS) and participated in the NCS conferences. Members of PYA were also involved in consultations conducted by the Policy Support Facility, a group assigned by the Ministry of Science and Higher Education with a peer review of Poland's higher education and science system, and in consultations regarding programmes supporting internationalization of Polish science, proposed by the newly founded National Agency for Academic Exchange. In an effort to promote scientific excellence, PYA supports the mobility of Polish scientists. This activity is illustrated e.g. by the report on national and foreign mobility of scientists, published in 2015 in cooperation with "Nauka Ludzka Rzecz" Initiative. Cooperation and mobility of scientists was also the main topic of the 1st edition of Polish Scientific Networks conference

(PSN, Warsaw, June 16 -18 2015), organized, as well as the next editions, in cooperation with the Ministry of Science and Higher Education and the Association of the Foundation for Polish Science Scholars. PYA also cares about building competence of young scientists. For that purpose, PYA organizes annually summer schools Forge of Young Talents (Kuźnia Młodych Talentów) addressed to PhD students specializing in life and exact sciences and developing so called soft skills. In order to encourage new generations to practice science, PYA actively supports its popularization. For many years, PYA members have been taking part in Science Festivals in different Polish cities, in Warsaw Science Picnic, in European Researchers' Night in Olsztyn, etc. PYA has also initiated Flying Scientific Cafes (Latające Kawiarenki Naukowe), popular science meetings that are mainly addressed to children and school youth. Since January 2022, PYA counts 35 members. More information: http://www.amu.pan.pl/

FNP Association of the Foundation for Polish Science Scholars

ASSOCIATION OF THE FOUNDATION FOR POLISH SCIENCE (FPS) SCHOLARS unifies laureates of postdoctoral scholarship programmes of the Foundation for Polish Science. Among the Association's aims are the interdisciplinary and intergenerational integration of FPS Scholars, actions aimed at supporting science and popularizing the ethos of a scientist and teacher, promoting of good scientific practice and improving qualifications, as well as supporting scholars in critical situations.

The Association, initially named Association of the Foundation for Polish Science Foreign Scholars, was founded in 2000, during a meeting organized by the Foundation for Polish Science attended by laureates of the Foundation postdoctoral scholarship programme KOLUMB. Initially, the Association was established as an informal group of young scientists, whose postdoctoral training in foreign research centres was financed by the Foundation. In April 2003, the Association was officially registered as an association. In December 2009 the Association, following the establishment of different postdoctoral scholarship programmes of FPS, was joined by laureates of several other Foundation programmes, such as Homing (later replaced by Homing-Plus), Focus, Ideas, Team, Master, Welcome, and – in May 2014 – by the laureates of the programme Bridge, who have completed at least 6 months long fellowship in a foreign research centre. Since May 2016, laureates of all types of TEAM programmes are also welcomed among FPS scholars. At the same time, in 2009, the association was renamed as the Association of FPS scholars.The Association's activity manifests mainly in the organization of meetings and conferences, both informal and formal, that support scientific cooperation – interdisciplinary, international and intersectorial, including the series of Polish Interdisciplinary Symposia Inter-Mix and the Polish Scientific Networks conference, that addresses scholars interested in applying research in practice. Every year, in May members of the Association meet during the Annual Alumni Congress, organized in different academic centres in Poland. The Congresses are an excellent occasion for the presentation of most recent research results, scientific discussions, as well as to maintain contacts and friendships. Additionally, members of the Association have been engaged in the debate about the reorganization of science in Poland for many years, as part of advisory bodies or as experts in panels and conferences dedicated to this issue. The history of the Association has been marked with a painful event – a tragic death of dr Artur Rojszczak, founder and animator of the Association. In his memory, the Association has established an award named after dr Rojszczak. The award is granted to young doctors who stand out not only with prominent scientific achievements, but also with a humanistic attitude towards

the world, broad horizons and the ability to break down barriers and to surpass the framework of narrow scientific specializations. The awarding ceremony of Artur Rojszczak Award takes place every year during the Annual Congress of the Association.
klub-fnp.pl

Strategic Partners

PAN
POLISH ACADEMY OF SCIENCES

Polish Academy of Sciences (PAS), as the leading scientific institution in Poland, carries out comprehensive research activity aimed at the development, promotion, integration and popularization of science and the development of education, and also the enrichment of national culture. The Academy achieves these goals by carrying out advanced research of strategic importance for the development of science and economy, by organizing interdisciplinary research teams involved in the concentration of modern research apparatus, integrating Polish scientific community, educating academic staff, and by innovatively utilizing the results of scientific research, also in cooperation with economic entities, and by organizing scientific conferences and participating in science popularization events.
Structure of PAS unites traditional functions of autonomic scientific corporation with an academia that directly realizes research goals. This combination provides the possibility to create science by personal research involvement of PAS members affiliated in different research facilities. The corporation of scholars of the Academy includes:
• scientific committees, that on the grounds of their composition constitute the most representative scientific circle in the given discipline;
• task force committees, that are appropriately selected groups of experts, established to accomplish certain research tasks
• national committees, established in order to maintain and develop the cooperation with international scientific organizations,
• divisions, participating in the performance of tasks of the Academy within the scientific fields included in its scope, by the involvement of its members in the works of branches of the Academy, scientific committees, task force committees, and the boards of experts of the research institutions,
• territorial branches, established in order to perform the tasks of the Academy in a particular region of Poland, that above all integrate the academic life in the region of Poland in question,
• Scientific institutes, that are the basic organizational units of the corporation. Gathered around departments, the institutes conduce international and internal research, both basic and applied, organize conferences, symposia and scientific lectures, provide financial services and perform the transfer of technology.
Recently, Polish Young Academy functions in the structure of PAS. Its tasks are centred around the activity for the activation of the young scientific community, by, among others, presentation of opinions and programmes related to the scientific issues, the organization of debates, discussions and scientific conferences, and the dissemination of scientific results.
Polish Academy of Sciences is also engaged in the publishing and expertise, provides access to the library, museum and archival stocks, organizes conferences, exhibitions and popular science

lectures.
As the publishing activity, PAS ensures the continuity in the publishing of the scientific publications and journals most important in given specializations, a part of which are available in open access on the Academy's web page. Science popularization activity involves, above all, open popular science lectures "Wszechnica", participation in picnics and science festivals, nights of museums or book fairs; concerts and exhibitions are also organized periodically. PAS research units are actively involved in the preservation and restoration of material culture heritage and natural resources in Poland and abroad. The Academy's institutions possess in their collections, among others, printed literary treasures, dating back to 15th century, that include early editions of Hevelius' and Copernicus' works and Marie Skłodowska Curie's or Albert Einsteins' letters. Biological collections, comprising unique plants and seed banks, are also not without significance.
For outstanding achievements, the Polish Academy of Sciences grants: Medal of the Polish Academy of Sciences, Nikolas Copernicus Medal, Stefan Banach Medal of the Polish Academy of Sciences and the Polish Academy of Sciences Statuette.
More information at: pan.pl

FNP Foundation for Polish Science

Foundation for Polish Science (FNP) has been in operation since 1991. It is a non-governmental, non-political, non-profit institution and the largest source of science funding in Poland outside of the state budget. Foundation's mission is to support outstanding scholars and research groups and to back innovative projects and the commercialization of research results. The Foundation is offering prizes, scholarships and subsidies for scientists of any age, at all career stages, irrespective of the represented field of science.

Operating rules of FNP:

• to offer support directly to scholars and research groups

• all subventions, prizes and scholarships are awarded on the basis of a competition

• scientific excellence is the most important criterion in awarding of support

• assessment of the achievements of participants in the Foundation's competitions is made by Polish and foreign scientists recognized in their field (peer-review method)

• the support is awarded according to the "Hard money" principle (strict accounting procedures for funding awarded)

The Foundation actively supports and promotes scientific mobility and international research cooperation, and many FNP laureates achieve international success. FNP collaborates with over 45 foreign scientific institutions and organizations. We are a member of European Foundation Centre (EFC) and Science Europe.

Foundation's statutory activities are funded from its own resources, including donations of 1% of income taxes, private donations and European funds. In 2008, the Foundation began the realization of programmes founded by the European Regional Development Fund under the Operational Programme Innovative Economy, and in 2011 it started the SKILLS project, financed from the Operational Programme Human Capital funds. Both ended in 2015. At the end of 2015 and at the beginning of 2016, the Foundation launched new projects financed from the Operational Programme Smart Growth: International Research Agendas, TEAM, TEAM-NET, TEAM-TECH, FIRST TEAM, HOMING and POWROTY.

Detailed information can be found on www.fnp.org.pl

Partners

Wrocław University of Science and Technology

Wrocław University of Science and Technology was established in 1945, mainly as a result of the involvement of the academic staff of the now-defunct Technical University of Lviv and the Jan Kazimierz University in Lviv, who adapted the destroyed buildings of the German School of Technology – Technische Hochschule.

Today we continue the tradition of these prominent Polish universities and develop in close cooperation with the leading companies of Lower Silesia. We are one of the largest and best technical universities in the country, one regularly ranked among the best in the national rankings.

The first rector of the then merged University of Technology and University of Wrocław was Professor Stanisław Kulczyński (1945-1951). Since then, the university has already seen as many as fourteen successors of the eminent academic. Currently, the tertiary institution is governed by Professor Arkadiusz Wójs, whose term of office will last until the end of August 2024.

Institute of Molecular Physics Polish Academy of Sciences

The Institute history goes back to 1953, when the PAS Institute of Physics in Warsaw established a branch in Poznań - the Ferromagnetics and Ferroelectrics Department led by Szczepan Szczeniowski. In 1956, the previous department separated and additionally a new Dielectrics Department was established under the direction of Arkadiusz Piekara. The next step forward came in 1966, with the establishment of the Radiospectroscopy Deparment led by Jan Stankowski. Finally, the current Institute of Molecular Physics in Poznań was inaugurated in 1975, as an autonomous division of the Polish Academy of Sciences. Its first director was Jan Stankowski (1975-1985), who was succeeded in the post by Andrzej Graja (1985), Janusz Morkowski (1985-1991), Bogdan Bułka (1992-1998), Narcyz Piślewski (1998-2006), Andrzej Jezierski (2006-2014) and Bogdan Idzikowski (2014-2018). Since 2018, the post of director has been held by Prof. Dr. Zbigniew Trybuła.

At present, the Institute employs a staff of 110 members, including 67 people of research personnel (10 professors, 14 associate professors, and 43 doctors), 17 engineers, and 26 administrative and technical support employees. The Institute's research work chiefly involves fundamental investigations in condensed matter physics, with 14 research laboratories applying both experimental and theoretical methods.

In 2002-2005, the Institute hosted the EU Centre of Excellence for Magnetic and Molecular Materials for Future Electronics (MMMFE). Its main objective was to uncover new avenues of research and to integrate the top research institutions in Europe. The Institute was also coordinating a national research network on New Materials for Magnetoelectronics (MAG-EL-MAT), whose activities are largely related to spintronics.

The Institute devotes much attention to the education of both university students and secondary school pupils. There are, presently, 19 students preparing PhD dissertations on condensed matter physics under the Institute's doctorate program. Every year, more than a dozen students from Poznań University of Technology carry out their master's theses research at the Institute, many of them subsequently going on to participate in our doctorate program. Additionally, the Institute annually hosts a "Summer with Helium" event at its branch department in Odolanów, addressed to university students and gifted secondary school students interested in physics.

Poznan University of Technology

The mission of the University is to educate students of all cycles of higher education and students of lifelong learning mode in close connection with scientific work as well as research and development projects carried out by the University in cooperation with prospective employers of PUT's graduates and in continuous contact with society. Our visionary goal is transformation of PUT into the country's leading technical university, known and acknowledged in Europe, an important and sought after partner of educational establishments of the world, a university that can offer high quality education and the world-class scientific work and research and development projects.

About

The **5th edition of the Polish Scientific Networks** conference entitled **Climate Change: Science & Society (September 28-30, 2022 in Wroclaw, Poland)** is devoted to the causes and impacts of climatic changes. It will bring together leading Polish climate change researchers and experts from around the world to better understand climate impacts on world environments and societies – and how to respond to them.
Climatic changes are one of the biggest challenges we face today and play a major role in the functioning of the modern world. Changes in the climate system have already had observable effects on the worlds' environment. Glaciers have retreated, sea-ice is disappearing earlier, plant and animal ranges have shifted, and trees are flowering sooner. Warmer oceans are becoming more acidic, affecting marine life. Rising sea levels due to thermal expansion and melting land ice sheets and glaciers put coastal areas at greater risk of erosion and storm surges. Intense heatwaves are observed all around the globe. Things that we depend upon and value – water, energy, transportation, wildlife, agriculture, ecosystems – are experiencing the effects of a changing climate. The changing environment is expected to cause more heat stress, an increase in waterborne diseases, poor air quality, and diseases transmitted by insects and rodents. Extreme weather events can compound many of these health threats and facilitate the spread of pandemics. Climate change also affects our art and culture, modifies our lifestyles and political agendas.

The conference will:

- Highlight the latest information on climate change is transforming worlds landscapes, environments and societies, what is at risk and how to respond;
- Identify key knowledge gaps;
- Promote collaborations between national and international teams and
- Stimulate the next generation of science and actions.

Plenary Session

Climate change disbelievers online

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Climate change is, arguably, one of the most agreed-upon topics among the specialists, and one of the most contested among the general public. It exemplifies the exacerbating problem of anti-intellectualism and anti-science, visible also e.g. in the antivaxxer movements, as well as closely connected to misinformation and fake news.

In this presentation, we are going to show how the general public changed the way climate change is described, as well as discuss the social networks of climate change denialists. We are also going to cover the way scientific misinformation and misunderstanding permeats the public discource, with consequences visible not only public discussions, but even in neuro studies.

Keywords: climate change denialism; misinformation; fake news; disinformation

Dariusz Jemielniak's participation was possible thanks to a grant no. 2019/35/B/HS6/01056 from Polish National Science Centre.

Silent extinction? Climate change and tree reproduction

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Forest resilience to worldwide increases in tree mortality will require sufficient reproduction to ensure regeneration, but the response of tree reproduction to climate change remains poorly understood. Understanding plant reproductive responses to changing climate is complicated by masting, the annually variable seed production synchronized within populations. Predicting trends in masting is crucial, because masting impacts seed predation and pollination enough to override simple trends in mean seed production. I will show how important masting is for forest functioning, review the mechanisms that create the annually variable, synchronized reproduction, discuss how climate change can impact these mechanisms, and finally, show the results of our 40-year-long observations of European beech reproduction. Warming in that species broke down mast seeding, leading to dramatic increases in seed predation and pollen limitation that threatens that tree future.

Keywords: forest ecology, food webs, mast seeding, plant reproduction,

This work has been funded by numerous grants from (Polish) National Science Centre, most recently 2019/35/D/NZ8/00050. Other funding comes from Polish National Agency for Academic Exchange Bekker Fellowship PPN/BEK/2020/1/00009/U/00001.

Reconstruction of Violent Tornado Environments in Europe

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Violent tornadoes produce large societal impacts and considerable damage. Approximately 1–3 such events hit Europe each decade. In this study, we reconstruct the environmental conditions using the Weather Research and Forecasting model for 12 violent tornadoes in Europe from 1957 to 2021. We use metrics providing information about atmospheric instability and wind variability to analyze conditions under which these tornadoes formed. This helps to study events that occurred before the radar and satellite era when only limited information is available about them. In 8 out of 12 cases, the model successfully simulated storm tracks in a favorable tornado environment close to the location of the actual tornado report. Our results indicate the importance of performing high-resolution simulations in reconstructing tornado events, and they offer promising results in improving operational forecasting of tornadoes across Europe.

Keywords: severe weather, tornado, numerical modeling

Funding was provided by the Polish National Science Centre (2019/33/N/ST10/00403 and 2020/39/D/ST10/00768), and the Polish National Agency for Academic Exchange—the Iwanowska Programme (PPN/IWA/2019/1/00148). The WRF simulations were carried out using resources provided by the Wroclaw Centre for Networking and Supercomput-ing (http://wcss.pl), Grant No. 170.

Session I. Climate Change sculpting landscapes and transforming landsystems

Session Chair: Matt C. Strzelecki (Institute of Geography and Regional Development, University of Wroclaw)

Climate permits, inhibits, retards, or enhances certain geomorphic responses and is one of the key controls of landscape evolution. During this session, we will evaluate changes in the climate character and their impact on geomorphological processes over the Holocene, compare that to that observed during the Anthropocene and, debate on the role of predicted changes in climate systems on the functioning of landforms, landsystems, and landscapes. Contributions focused on the interaction between shifts in climate and extreme geomorphic processes and geohazards are particularly welcomed.

Relationships between small Arctic catchments and glacial lakes and coastal lagoons using the case study of Nepebreen and Knivseggbreen foreshore (NW Spitsbergen, Rekvedbukta)

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As climate change continues, we observe significant landscape transformation in the polar regions and high mountains. The place where these changes are among the most intense in the world is Svalbard Archipelago, which is related to the climate there as well as the geomorphological conditions [1,2].
One of the key and more visible result of climate change is the retreat of glaciers. The retreat of these large ice masses up in the catchments, exposes new and often unexplored areas. Intermediate forms, linked to changes in the extent of glaciers and also to fluctuations in sea level, are: coastal lagoons [3] located near the shoreline and glacial lakes [4] located in the proglacial zone.

The relationships between these described water bodies and glaciers are directly regulated within small Arctic catchments, as the glacial geomorphological system react to climate change [5] are rapidly visible in a small scale.

Using Nepebreen and Knivseggbreen foreland (NW Spitsbergen, Rekvedbukta) as an example, we would like to indicate what processes are taking place within the boundaries of a small Arctic catchment and relate them to direct landscape changes that have been taking place since the end of the Little Ice Age, which occurred in the Svalbard archipelago at the turn of the 20th century.

Keywords: Small catchments, Coastal lagoons, Glacial lakes, Arctic

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Research funded by Svalbard Science Forum by Arctic Field Grant entitled "Climate Change drives fluctuations of glacier lakes in Svalbard – Crammerbreane case study" no. 333199 and the Polish National Science Centre grant 'ASPIRE - Arctic storm impacts recorded in beach-ridges and lake archives: scenarios for less icy future' No. UMO-2020/37/B/ST10/03074.

Multidecadal analysis of paraglacial landscape changes in foreland of Gåsbreen - Sørkapp Land, Svalbard.

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The change in the structure of the polar landscape since the termination of the Little Ice Age (ca. 1900) is expressed by widespread retreat of glaciers, progressive exposure of glacial landforms at ice margins and opening ice marginal zones to increasing paraglacial and periglacial processes operating synchronously in adjacent areas. This study provides insights into the rate of post-LIA deglaciation and associated paraglacial transformation in foreland of Gåsbreen, a glacier situated in north-western Sørkapp Land, region characterized by one of fastest deglaciation rates in the entire Svalbard Archipelago. During the investigated period, 1938-2020, Gåsbreen was in a recession that accelerated after 1990 and as a result the area of its marginal zone almost tripled from 2.2 km² to 5.8 km². This process had a significant impact on the development of the relief in glacier foreland. The dynamics of landscape transformation in the glacier marginal zone manifested in degradation in the surface of ice-cored moraines and the forms that are underlain by dead-ice. Mass movements and debris flow on ice-cored moraines and fluvioglacial processes had a great influence on this transformation. Larger volume of proglacial waters intensified denudation, transport and accumulation of sediments, which resulted, in: an increase in the surface of sandurs and proglacial riverbeds, an increase in the area of lakes, extending and changing of the course of rivers in marginal zone.

Keywords: glacier retreat, glacial lakes, glacial landforms, Svalbard

This study is the contribution to the National Science Centre project 'GLAVE' (Award No. UMO-2020/38/E/ST10/00042)awarded to MCS. IW work on glacial lakes contributes to the Arctic Field Grant project no. 333199 (RIS ID: 11620).
Michał Węgrzyn is thanked for providing unique field images of Gasbreen foreland. Wiesław Ziaja is acknowledged for introduction to the field site and inspiring expeditions to Sorkapp Land over the years.

GLAVE - Paraglacial coasts transformed by tsunami waves – past, present and warmer future: project goals

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Over the last century, rapid retreat of glaciers exposed vast areas of new land, particularly steep and unstable slopes along numerous Arctic and subarctic fjords and coasts. Recent observations from Greenland and Alaska showed that landslides may trigger massive tsunamis. In contrast to tropical and mid-latitude tsunamis, the effects of cold region events remain on the landscape for long periods. Interestingly, there is no information on tsunami impact in regions deglaciated over the Holocene (last 10k yrs) which experienced rapid paraglacial transformation destabilizing, not only terrestrial environments but also submarine landscapes of fjords. Together this creates the impression that either: a) occurrence of tsunamis in Arctic and subarctic regions accelerated over the last century as a result of unprecedented climate warming, or, b) the potential archives of palaeotsunamis in paraglacial landscapes are still not fully explored.

Through GLAVE project, I will lead a step-change advance in our understanding of the effects of tsunamis on present paraglacial coasts, decipher their past record, and predict which communities living along threatened coasts are most vulnerable to their impacts in a warmer future.

Specifically, I will:

1. determine the response and recovery time of paraglacial coasts to tsunami impacts by state of art geomorphological mapping, sedimentological investigations and remote sensing analyses;

2. provide first-ever insight into the past frequency and magnitude of tsunamis in paraglacial environments through the Holocene;

3. evaluate future tsunami threat for the state of paraglacial coasts and safety of coastal communities posed by tsunamis.

These ambitious objectives will result in a state-of-the-art study of the extreme processes shaping cold region coasts, which in addition to progress of coastal science and paraglacial geomorphology will deliver new knowledge to help indigenous communities reduce the growing geohazard risk

Keywords: paraglacial coasts, deglaciation, tsunami waves, cold region geohazards

This study is the contribution to the National Science Centre project 'GLAVE' (Award No. UMO-2020/38/E/ST10/00042) awarded to MCS.

Research project: Climate conditions as a driver of settlement in Ostrowite since Neolithic to Middle Ages

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The complex of archaeological sites in Ostrowite (Pomorskie Voivodeship) is one of the largest early medieval settlement complexes in Eastern Pomerania. The results of the archaeological research conducted so far show that the first human groups penetrated the area in the Late Paleolithic and Mesolithic. Ostrowite is therefore a key study site for research on the neolithisation of northern Poland.

The area of the Ostrowite Lake shore was attractive for developing multifunctional settlement centres associated with the use of various natural resources.

The geological exploration documents two palaeolakes in the immediate vicinity of the archaeological site. Two cores of biogenic sediments with a thickness up to 6 m were subjected to palaeoecological studies: palynological, plant macrofossils, malacological, chironomid, cladoceran, geochemical, and sedimentological. The Allerød to the Northgrippian (ca. 14-6 ka cal BP) age of the sediments has been determined with a series of radiocarbon AMS datings.

The main goal of the palaeoecological research undertaken is the reconstruction of the climatic and hydrological changes in the late Weichselian and the Holocene, and their influence on prehistoric and early-historic communities. Pollen, chironomids and cladocerans will be used as proxies for quantitative summer and winter temperature reconstructions.

Palynological studies reveal similar changes in vegetation in the two analysed palaeolakes, while in the Neolithic one of them functioned as a wetland, the other as a shallow lake.The project will contribute to the discussion on global and local climate changes as a driver of neolithisation processes in Northern Poland, and the conditions of settlement functioning in the Roman period and later Medieval times.

Keywords: temperature reconstruction, Late Weichselian, Holocene, neolithization

Research is financed under the IDUB UŁ project "Human-environment relations in Ostrowite based on the results of palaeoecological study" granted for experienced researchers - 2nd edition 2021, contract No. 56/2021.

100 years of research and exploration of Lodowa w Ciemniaku cave (Western Tatras, Poland) - melting archive of the climate crisis

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In 1922, brothers Tadeusz and Stefan Zwoliński rediscovered the entrance to the long-sought ice cave in Ciemniak (Western Tatras) [1]. It was the first and for decades the biggest ice cave in Polish Tatras. Since then the most intensive and multifaceted research in Polish caves has begun. Geology, ice history and its structure, troglofauna, bats, air circulation and conditions, ice mass balance, heavy metal accumulation in ice, etc were the topic of the investigations within the cave throughout the century. Since 1933 the disaapperance of cave ice has also been observed [2-4]. Throuout the 100 yeras of research the volume of ice reduced dramaticaly. According to calculations from 1988 the block of ice has become thinner by 3.8 to 6 meters in comparison to its state in 1922. Recent observations suggests that the process has speeded up; benchmarks marked on the cave wall in the 90ties are now up to 4 metres above the cave floor.

The same phenomenna is observed also in other ice caves on northen hemisphere. The decay rate of ice suggest that in near future ecosystems like this in Lodowa w Ciemniaku cave may disappear in the coming years.

Keywords: speleology, ice cave, climate crisis, Tatra Mountains

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Session II. Extreme Events under Climate Change

Session Chair: Bartosz Czernecki (Department of Climatology, Adam Mickiewicz University, Poznań)

Many atmospheric extreme weather and climate events may become more common and simultaneously more severe under different climate change scenarios. The increasing exposure to climate change is visible almost in every aspect of our life. However, our understanding of how climate change will affect extreme events varies between investigated phenomena and geographic regions of the world.

During this session we plan to focus on the most recent and future extreme weather and climate events, changes in its long-term trends, frequency, and severity, as if as mitigating risk and implementing adaptation strategies. The presentation on the effects of heatwaves, drought, atmospheric convection phenomena, and other devastating atmospheric xtremes bringing socioeconomic losses will be the main topic of this session.

KEYNOTE LECTURE:

Severe Convective Storms in Europe: Past, Present and Future

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Severe convective storms represent a hazard to life and property. Lightning, hail, severe convective wind gusts, flash flooding and tornadoes are responsible for fatalities, injuries, and large economic losses across most of the globe. Europe is no exception: only in 2021, 25016 severe weather reports were entered into the European Severe Storms Database (ESWD, Dotzek et al. 2009) [1]. These include a violent (IF4 rated) tornado in Czechia, giant hail (13.5 cm large) in Poland, extremely severe convective wind gusts in North-Central Europe and a major flooding event in Northern Germany. In total, 430 fatalities and 680 severe weather-related injuries occurred in 2021. Different convective hazards lead to different socio-economic impacts: while hail is mostly linked to large economic losses with single hailstorms causing up to 1-billion-dollar in damage, flash flooding causes the largest number of fatalities. Severe weather databases such as the ESWD are of crucial importance for severe weather research, not just for evaluating convective hazards' impacts. When used in conjunction with atmospheric reanalysis or proximity soundings, they allow to study the atmospheric conditions associated with these events. The talk will introduce the basic approach to convective storms forecasting while explaining the physical mechanisms behind their formation. Recent advances and future perspectives in severe convective storms forecasting will also be mentioned in the context of the ESSL Testbed activities. Beside improving forecasting of these events, severe weather research has focused on mapping the frequency of convective hazards while, at the same time, trying to detect the relation of severe weather with climate change. Atmospheric proxies reflective of the environmental conditions for storm (and severe weather) occurrence, have been used to objectively assess the frequency of such events. Using atmospheric reanalysis, several studies [2,3,4] have managed to objectively reconstruct the occurrence and the long-term trends of convective hazards for much longer timeseries than what would be possible using severe weather reports only. These attempts suggest that the frequency of severe convective storms has increased across most of Europe in recent decades. Furthermore, according to climate simulations, their occurrence and their associated socio-economic risks are expected to increase further in the future. The presentation will include an overview of these efforts and will focus on recent advances from ESSL regarding the development of lightning and (very) large hail models for use in climate and medium-range forecasting.

Keywords: Severe Convective Storms, Severe Weather, Climatologies, Forecasting

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Challenges and limitations in assessing climate trends of severe convective storms

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Globally, thunderstorms present a significant hazard to communities, agriculture, and infrastructure. Each year, thousands of lightning, large hail, damaging wind, tornado, and flash flood events lead to heavy damage and considerable social impacts including fatalities. As a result of convective events, around 300 billion USD in damage has been reported over the last decade across Europe and North America. Thunderstorms are also responsible for a significant fraction of rainfall, thus their absence in certain regions may lead to droughts. Increasing threat of extreme convective events is often linked to the warming climate but how the changing climate is affecting the frequency of local-scale phenomena such as tornadoes, large hail or flash floods is currently not fully understood. This uncertainty is driven mainly by the complex nature of convective storms where very small environmental details may lead to markedly different outcomes. As lightning-detection records lengthen and the efficiency of severe weather reporting increases, more accurate regional climatologies of convective hazards can be constructed. However, since such datasets still cover relatively short timeframes and feature strong spatial biases, a typical approach in the climate research has been to identify key environmental ingredients necessary to storm formation, which allow to study much longer timeframes on the global scale. These proxies are used by climate scientists to assess frequency, intensity and long-term trends of convective hazards using reanalyses and climate projections. While such analyses are valuable, applying an ingredient-based approach in climate research is associated with certain challenges and limitations, which will be discussed in this presentation. Author will also explain how small environmental properties related to storm development and its organization may change the expected outcome from life threatening situation to a fair weather.

Towards observing and forecasting river stages at ungauged sites: the use of satellite Sentinel-3A data and unmanned aerial vehicles

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A wealth of water-related data is required to predict hydrological extreme events. River stages are monitored in situ by automatic gauges, the number and distribution of which is often unsatisfactory to capture floods. Since the number of in situ hydrological measurements is decreasing [1], there is a growing need to complement and densify gauge-based data with remotely-sensed observations. Such a densification of measurements can be attained by the use of the synthetic aperture radar mounted onboard altimetric satellites, such as Sentinel-3A. At places where ground tracks of a satellite pass a river, known as virtual stations, water levels can be measured remotely, complementing in situ data.

There is a considerable number of studies which focus on the usability of altimetric measurements over rivers [e.g. 2,3], however the accuracy of satellite altimetry over Polish rivers has not been thoroughly scrutinized. Halicki and Niedzielski [4] investigated stages of six Polish rivers (Vistula, Odra, Warta, Bug, Narew and San) recorded between 2016 and 2019 by Sentinel-3A at 34 virtual stations. Based on the comparison between the satellite and in situ data, it has been found that root mean square errors were of 0.12–0.44 m (0.22 m on average), whereas the Nash-Sutcliffe efficiency was of 0.40–0.98 (0.84 on average).

A step forward in evaluating the performance of the Sentinel-3A measurements of water levels in rivers is being made during a long-term field experiment with the use of unmanned aerial vehicles, commonly known as drones. Its aim is to measure water levels at a few virtual stations of Sentinel-3A located along the Odra river in western Poland at times when the satellite passes the virtual sites. The drone-mounted cameras and light detection and ranging (LiDAR) sensor are employed to delineate water-land interface and compute water level. The initial studies on the detection of waterline based on RGB images in the Odra river reveal the following skills: best detection rate of 78.57% (false hit rate 15.38%) and worst detection rate of 42.42% (false hit rate of 39.13%).

For the virtual stations of the Odra river the hydrologic prediction system is being elaborated. Its objective is to forecast water levels at these ungauged sites. The system predicts river stages at in situ gauges using the vector autoregressive model, and transfers them to virtual stations using the up-to-date two-gauge relationship. The solution will provide predictions and warnings against hydrological hazards at places where monitoring is unavailable.

Keywords: Sentinel-3A, Polish rivers, observation, prediction

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Climate projections in Poland in XXI century

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Regional climate projections are necessary to assess possible changes in the exposure and risk to plan adaptation strategies. Climate projections were prepared for Poland in the scope of the KLIMADA2.0 project. Climate models' results from the EuroCordex repository were used for the domain covering central Europe with a resolution of 0.11 ° (approx. 12.5 km). A novelty of the method was afforded by creating a downscaled ensemble based on various historical gridded datasets. The ensemble spread analyses were undertaken to assess the projection uncertainty. We prepared projections for the RCP4.5 and RCP8.5 scenarios.

The projected increase in the annual average temperature is due to the rise in the number of hot days and the reduction of the number of frost days. Most pronounced changes in the frequency and the amount of precipitation occur in the northeast part of Poland. The increase in the annual rainfall is due to the higher number of days with extreme precipitation. Solar radiation in the future climate shows a slight downward trend. Projections of average wind speed showed an increase in the winter and a decrease in the summer months without significant changes in the annual average. Snow depth in the future climate shows a downward trend, especially for the RCP8.5 scenario. No trend was detected for the relative humidity and the total cloud cover. Climate projections for Poland are available via the interactive climate web portal

https://klimada2.ios.gov.pl/klimat-scenariusze-portal/

Keywords: climate projections for Poland, regional climate change, climatic trends in XXI

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Future droughts in Central Europe – what is the state of the art?

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Central Europe has recently experienced several extensive and severe droughts (e.g., 2015, 2018, 2019) that affected a wide range of sectors, such as agriculture, energy production and water management. These drought events were broadly attributed to climate change, but often without, or with only limited, scientific assessment. There is a common belief that warmer climate and more frequent heat waves are likely to lead to more frequent and severe droughts in the future. This conviction is at least partly a result of a simple extrapolation of existing trends, but the climate impact on freshwater cycle is too complex to be persuadingly mimicked by extrapolation. In this talk we will present state of the art in drought projections over Central Europe with a focus on hydrological droughts. The findings are based on a recent systematic review comparing the evidence on historical trends in observed data with changes in model-based projections for the future. Analysing 155 individual evidence items extracted from 68 identified, relevant articles, we found that trends detected in observation records have more frequently downward (i.e. meaning decreased low flows or increased drought hazard) than upward direction (53% vs. 11%). However, the frequency of evidence reporting decreases in future low flows is lower for future projections than for historical trends (43% vs. 53%), and even more convincingly, nearly three times more evidence items point out at upward trends in the future (31% vs. 11%). This shows that there is a low coherence between observed and projected indices of hydrological droughts in Central Europe. We will discuss potential reasons for this discrepancy, such as climate model and hydrological model uncertainties.

These results pose a practical challenge for water-resource managers and decision makers in Central European countries, since a deeply rooted assumption that future hydrological droughts will be more severe than today drives the process of designing climate adaptation and risk reduction plans, programmes of measures, etc. Presented results should not be used as an indication that future increase in hydrological drought hazard is a myth. Instead, more research is needed to understand the nature of the difference between the observed historical trends and the model-based future projections in this region.

Keywords: droughts, systematic review, hydrological modelling, climate change

The National Science Centre in Poland is gratefully acknowledged for funding the projects RIFFLES "The effect of RIver Flow variability and Extremes on biota of temperate FLoodplain rivers under multiple pressurES" (2018/31/D/ST10/03817) and "Integrated modelling of hydrological and agricultural aspects of droughts in the Odra river basin under a changing climate" (2019/35/O/ST10/04392).

Session III. Climate Change Rising Seas, Melting Ice, Thawing grounds

Session Chairs: Jakub Małecki (Glacjoblogia; Cryosphere Research Department, Adam Mickiewicz University in Poznań) and Matt C. Strzelecki (Institute of Geography and Regional Development, University of Wroclaw)

Even if we significantly cut the emissions in the coming decades, more than a third of the world's remaining glaciers will melt before the year 2100. Melting glaciers add to rising sea levels, which in turn elevates storm surge as warming air and ocean temperatures create more frequent and intense coastal storms. When it comes to sea ice, 95% of the oldest and thickest ice in the Arctic is already gone. At the same time, the rapid collapse of ice-rich permafrost in the Arctic already pumps tons of methane and carbon dioxide into the atmosphere every year—accelerating greenhouse gas emissions. In this session, we will use examples from past records and present observations to determine how climate warming affects the state of the cryosphere and sea-levels.

KEYNOTE LECTURE:

Glacial oscillations in the Antarctic Peninsula region since the Last Glacial Maximum

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The spatial and temporal patterns of glacial retreat constrain the typology and intensity of geomorphological, hydrological and ecological processes prevailing in ice-free environments of the Maritime Antarctica. In the Antarctic Peninsula region, the chronology of glacial oscillations since the maximum ice expansion of the last glacial cycle is still very poor and mostly limited to a few sites. The existing glacial histories are generally based on single records, mostly relying on radiocarbon ages of lake, coastal and marine sediments. Over the last decade, new geochronological approaches have improved the temporal resolution, and allowed including a variety of depositional and erosional records to better constrain the glacial history of the region. In this communication, I will present a multiple-dating approach combining absolute (cosmic ray exposure, radiocarbon, luminescence, lichenometry) and relative dating approaches (Schmidt hammer) based on terrestrial and lacustrine records to reconstruct the spatio-temporal patterns of glacial thinning and retreat in several ice-free areas of the South Shetland Islands, namely on Livingston (Byers and Hurd peninsulas) and King George islands (Fildes and Barton peninsulas). Ice thinning already started during the Last Glacial Maximum at ~22 ka but intense glacial shrinking occurred from ~18 to ~13 ka, when the highest nunataks became exposed. The ice-free areas located far away from the ice domes and the highest peaks became ice-free during the Early Holocene (ca. 10-8 ka) and the central plateaus remained glaciated until the Mid Holocene (ca. 6-5 ka). During the Late Holocene, glaciers have remained close to the most internal moraines, with only two minor advances identified at ca. 4 and 1 ka.

Keywords: Antarctic Peninsula, South Shetland Islands, Last Glacial Maximum, deglaciation, multiple-dating.

KEYNOTE LECTURE:

Future climate change impacts for high mountain water resources and downstream consequences

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Mountains are the water towers of the world, and sustain a substantial part of global natural and anthropogenic water demands [1]. While the downstream dependence on high mountain water resources is increasing [2], mountains are highly sensitive and prone to climate change [3]. Climatic changes cause changes in the cyrosphere and shifts in overall water availability, seasonality of flows and changes in extreme flows. At the same time, downstream demand for water is increasing, putting further pressure on water resources. This presentation provides an overview of the current state of knowledge of climate change impacts for high mountain water resources, and what the downstream consequences of these changes are, illustrated by examples of studies conducted in river basins and hydrogical catchments with high dependency on mountain water.

Keywords: mountains, water resources, hydrology, climate change

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Listening to glaciers: Can we measure ice loss with passive cryoacoustics?

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The retreat of glaciers is reshaping the Arctic landscape, impacting local communities and ecosystems, and raising sea level. Marine-terminating glaciers lose mass through melting and break-off of icebergs at the ice-ocean boundary, the latter known as 'calving'. Studying these two processes in harsh polar environments is difficult, driving the development of new, remote measurement techniques. Fortunately, both submarine melting and calving are sources of unique underwater sounds, which can be recorded from a safe distance and analyzed in order to extract detailed information on the glacier behavior. Calving icebergs produce underwater noise when they impact onto the sea surface. On the other hand, tiny air bubbles bursting from the ice as it melts generate impulsive sounds, making Arctic fjords one of the loudest environments in the global ocean. This talk will cover recent developments of passive cryoacoustics as an emerging tool for the monitoring of glacier mass loss. Moreover, current knowledge gaps, future challenges and technological requirements, will also be discussed. *Work supported by the National Science Centre, Poland (grant 2021/43/D/ST10/00616), Polish Ministry of Science and Higher Education ('Mobility Plus' program, grant 1621/MOB/V/2017), Institute of Geophysics, Polish Academy of Sciences (grant 2a/IGF PAN/2017 and a subsidy for the Institute of Geophysics, Polish Academy of Sciences), US National Science Foundation (grant OPP-1748265), US Office of Naval Research (grant N00014-17-1-2633), and National Research Foundation, Prime Minister's Office, Singapore (Marine Science Research and Development Program MSRDP P-42).*

Keywords: ice loss, glacier melting, iceberg calving, passive acoustics

Determining drought indices using geodetic data

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Nowadays, many regions of the world are struggling with the problem of the continental water disappearance. The rate of this process is rapidly increasing. A high influence on the significant water resources changes is exerted by the climate impact, which leads to more frequent and more severe droughts, wildfires or floods. Hence, the ways to assess the magnitude of drought and its impacts must be specified. It might be useful to drought mitigating or it preventing and is possible by observing changes in water mass. For two decades (since 2002 to now), global information about terrestrial water storages is successfully provided by the Gravity Recovery and Climate Experiment (GRACE) mission and its follow-on mission (GRACE-FO). It is also provided by e.g. hydrological or climate models. Thus, in following study, we estimate a new monthly global drought severity index (DSI) based on satellite gravity data and hydrological models. The reliability of the estimated indices are assessed by other commonly used drought metrics relied on the meteorological inputs and/or simple water balance models, including the self-calibrating Palmer Drought Severity Index (scPDSI), the Standardized Precipitation Index (SPI) and the Standardized Precipitation Evapotranspiration Index (SPEI). The presentation will include a discussion on global and regional analysis upon the areas characterized with frequent and extreme droughts, including Amazon and Central Europe.

Keywords: GRACE, hydrological model, climate index, drought category

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Ablation and outflow from Waldemarbreen in summer season, Kaffiøyra (Svalbard)

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The Arctic (including Svalbard) is a region where the impact of climate change on the natural environment is particularly intense. Every year there are new records related to the values of air temperature, as well as the rate and magnitude of glacier melting (ablation), which significantly shapes the outflow of rivers from them.

The objects of the study were the Waldemar Glacier and the Waldemar River flowing out of it, which are located in northwestern Spitsbergen within Oscar II Land. The river is mountainous in the glacial part of the catchment before flowing into the coastal plain of Kaffiøyra, where it reaches a width of several hundred meters before flowing into the Forlandsundet Strait. Waldemar Glacier is one of several glaciers on Kaffiøyra. However, it has one of the longest measurement series on Svalbard.

During the field survey, data were acquired on several hydrological and meteorological elements. At a minimum, the flow of the Waldemar River was measured every two days at a designated fixed measuring point using a hydrometric mill. In addition, a HOBO automatic station was installed at the measuring point, recording temperature and water level at an interval of 5 minutes. Ablation measurements were taken every 6 days based on the measurements of ablation sticks installed on the Waldemar Glacier. The study used data from an Automatic year-round Weather Station (AWS) located near the UMK Polar Station.

Based on the study, this summer season was one of the warmest since 1975. The average river flow in the month of August was one of the highest since 1997. A strong relation was found between the magnitude of runoff and the magnitude of glacier melt, although periods were observed when the connections were not so obvious. This testifies to the complex regime of the glacial river and the influence of different sources of supply on its dynamics.

This study was carried out as part of the project "Changes of north-western Spitsbergen glaciers as the indicator of contemporary transformations occurring in the cryosphere" (2017/25/B/ST10/00540) funded by the National Science Centre, Poland.

The use of remote sensing methods and the capabilities of UAV in research of dynamics of changes in the coastline of Kaffiøyra (Svalbard)

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Since 1975, based on the NCU Polar Station in Spitsbergen, research monitoring the scale of global warming has been carried out, including measurements and analyzes using remote sensing methods. The conducted research includes, e.g. changes in the mass balance of glaciers, the range of their foreheads, the outflow of meltwater, transformation of landforms in the foregrounds of glaciers.

The aim of this paper is to initially compare the changes in the coastline in the northern part of Kaffiøyra, after one summer season and over the last four decades. The comparative analysis covers about 50 ha of space divided into 4 groups: the mouth of the Waldemar River, the central beach, the bay of Hornbækbukta and Hornbæk Spit. The work is based on DEM models, orthophotomaps, created with the help of UAVs and geodetic equipment, and on the basis of remote methods of data acquisition, including aerial and satellite images. With the support of full software among others, Agisoft Metashape Professional, ArcGIS (enriched with a DSAS patch – Digital Shoreline Analysis System), high-resolution DEM models and a number of comparative parameters of the coastline were determined e.g. DoD (DEM of Difference), LRR (Linear Regression Rate), NSM (Net Shoreline Movement). All of this made it possible to assess the pace and dynamics of changes taking place in the coastal zone related to climate change in the Arctic, the most sensitive area of modern transformations.

This study was carried out as part of the project "Changes of north-western Spitsbergen glaciers as the indicator of contemporary transformations occurring in the cryosphere" (2017/25/B/ST10/00540) funded by the National Science Centre, Poland.

Long-term Oceanographic Monitoring in Hornsund (LONGHORN)

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Hornsund, a fjord in southern Svalbard, is an ideal location for studying interactions between marine, coastal and glacial systems. Retreating glaciers deliver freshwater and organic and mineral matter into the fjord. Consequently, sedimentation rate accelerates in close proximity of glacier outflows. Long-term OceaNoGraphic monitoring in HORNsund, the so-called LONGHORN project, was established to better understand these processes and how they are influenced by the ongoing climate change. The monitoring is operated by the Polish Polar Station Hornsund. Frequent and consistent measurements of temperature, salinity, turbidity and dissolved oxygen started in 2015; the vertical profiles are taken in various parts of Hornsund during spring, summer and autumn seasons, providing extensive horizontal and temporal coverage in the area. All year measurements of temperature are obtained in Hansbukta, a bay in contact with Hansbreen, from bottom-moored instruments. Suspended sediment concentration from water samples is studied in front of several tidewater glaciers and the central parts of Hornsund during spring, summer and autumn. In addition, sedimentation rates are monitored in Hansbukta using sediment traps and continuous tide and wave measurements have been ongoing since 2013. Moreover, sea ice conditions, glacier activity and coastal erosion are monitored using autonomous time-lapse cameras. Oceanographic data will be analyzed within the Grieg RAW – glaciers Retreat And fjords Wither -project. The project aims to study the influence of glaciers recession from tidewater to land-based. All data is freely available at the data repository of Institute of Geophysics Polish Academy of Sciences https://dataportal.igf.edu.pl/.

Keywords: fjord systems, arctic ocean, hydrography, glacier melting, sedimentation

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Hydrological conceptual model for Wrenskioldbreen catchment with special recognition of the glacier's foreland role

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Nowadays, the recession of the glacier is observed in the Arctic [1-5] as a result of climate changes [6] and the new areas of proglacial zones are being uncovered and enlarging every year [7-9]. Concerning changes in air temperatures and precipitation [10-12] and increased glacier ablation [1], more water is supplying the glacierised basins. These generate changes in the catchment water balance and surface and sub-surface drainage system. Therefore, we aimed to answer the following question: as the glacier recession continues and the thickness of the active layer increases, how do these affect the drainage system of glacier's forealand. We conducted preliminary hydrological research at the Werenkioldbreen catchment (Spitsbergen), taking into account two components: 1 – a glacier as a factor influencing changes in the catchment geomorphology by its progressing recession and supplying melting water, 2 – a forefield surface water component.

The first step is a conceptual hydrological model prepared for the SWAT (Soil and Water Assessment Tool) model and GIS analysis. Preliminary results highlight the foreland geomorphology changes due to glacier recession and related drainage changes in past reconstruction.

A unique element in this study is a more complex approach to hydrological modelling conception than most published research used black-box type models, without information on the functioning of the foreland itself. We are highlighting what happens inside the "box" – glacier foreland, with its spatial aspect and environmental context, to determine its role in the glacierised catchment in view of ongoing climate change.

Keywords: glacierised catchment hydrology, SWAT model, Spitsbergen, Weresnkioldbreen

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Session IV. Climate Change on the Blue Planet

Session Chair: Monika Kędra (Institute of the Oceanology of Polish Academy of Sciences)

The global ocean covers 71 % of Earth's surface and plays an important role in climate regulation, including uptake and redistribution of carbon dioxide (CO2) and heat. It is home to a wide variety of live forms and habitats, and it provides multiple services essential to human well-being. Currently, it is largely impacted by the on-going climate change causing ocean warming, acidification, and oxygen loss, which further affect marine organisms at multiple trophic levels and ecosystems, and finally, weaken ecosystem services. During this session, we will look into climate change impacts on the marine ecosystem's functioning. We welcome contributions from physical, biogeochemical, and ecological marine studies, as well as contributions from social sciences. Particularly welcome are studies showing how the ecosystem is responding to ongoing stressors in the marine environment, including long-term trends and observations.

KEYNOTE LECTURE:

Ecosystem Dynamics in the Pacific Arctic: Key Drivers of Biological Change in the Context of Climate Warming

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Warming seawater and reduced sea ice have changed the status of the marine ecosystem in the northern Bering and Chukchi Seas. Variations in upper-ocean hydrography, light penetration, primary productivity, lower and upper trophic levels, pelagic-benthic coupling and carbon cycling are being evaluated through the Distributed Biological Observatory (DBO). This international cooperative venture was initiated in 2010 in the Pacific Arctic to facilitate multiple process research cruises by cooperating countries[1]. The DBO emphasizes annual standardized sampling by researchers on an international suite of ships occupying agreed-upon transect lines to measure the current ecosystem status as well as developing environmental trends. Continuous data are also obtained through mooring measurements, satellite observations, and autonomous glider sampling. The first decade of DBO sampling has revealed that seasonal and interannual hydrographic changes are driving shifts in species composition, distribution and abundance, with northward range expansions into Arctic waters for some temperate species and negative impacts for some ice dependent species. The seasonal timing of phytoplankton growth influences food exported to the underlying sediments that are then used by epi- and infaunal benthic animals, which are important prey for benthic-feeding marine mammals and seabirds. The sediments are also indicators of changing organic carbon cycling that provides seasonal and interannual records of water column biological events. This presentation will highlight findings from studies of biological change, the use of sediment chemistry to understand ecosystem status, and key physical drivers for these observed changes. It will also discuss the ongoing development of the DBO concept to the Atlantic sector and Davis Strait/Baffin Bay, bordering Greenland and Canada.

Keywords: Pacific Arctic, Distributed Biological Observatory, Marine Ecosystem Dynamics, Pelagic-Benthic Coupling

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KEYNOTE LECTURE:

Increasing importance of meroplankton to the functioning of high latitude marine ecosystems – future climate change scenario

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The early development of most benthic invertebrates, living on and in sea sediments, involves some form of pelagic larval stage, collectively referred to as meroplankton. While meroplankton shares many functional traits of holoplankton (species completing their entire life cycle in the water as part of the plankton), there is a fundamental difference between these two groups. After larval release, meroplankton transports benthic secondary production to the water column where it becomes available in the pelagic food web. Furthermore, meroplankton assimilates pelagic production during their planktonic phase, which is later exported to the seafloor during settlement, and closes the energy and material cycling in the oceans.

Our research in the sub-Arctic Lofoten-Vesterålen region demonstrated that the relative contribution of meroplankton to the total plankton abundance and biomass [1,2] has increased in comparison to the mid-20th century [3], suggesting an increased importance of meroplankton for benthic-pelagic coupling (thus links between sediments and the water column) and as a component of the planktonic food web, including increased importance as a prey for first feeding fish larvae. In contrast, meroplankton contributes little to high Arctic plankton communities. Using the current state of the sub-Arctic as a space-for-time substitution for the future Arctic, it has to be expected that the northward range extension of boreal benthic species and the associated increasing importance of meroplankton will lead to functional changes of Arctic marine ecosystems.

Keywords: benthic invertebrate larvae, pelagic-benthic coupling, marine food webs

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Changes in colonisation of hard-bottom assemblages in a high-Arctic fjord (Isfjorden, Svalbard); observations based on a 15–yearlong experimental study

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Impacts of climate change in the Arctic are clear, and evidence suggest that this region is one of the most rapidly warming globally [1]. However, describing ongoing shifts and attempting to predict future changes remain challenging tasks due to the lack of reliable baselines [2]. The present study aims to provide a baseline understanding of colonisation of benthic assemblages and report trends of ecological change observed during times of major shifts at shallow depths of a high-Arctic fjord.

To do so, an underwater experiment was set up at two depths (6 and 12 meters) during summer 2004 in Isfjorden, the largest fjord of Spitsbergen [3]. Although the experiment still is ongoing, the biological and environmental data gathered until 2020 have been analysed. Significant variability in the colonisation process was observed during the time series. The assemblages on the settlement plates were taxonomically rich, represented by around 80 different taxa. Serpulid polychaetes (solitary) were the most numerically abundant, and bryozoans (colonial) the most species rich. Changes in abundance and relative coverage of the epibionts were also noted. Newcomers of boreal origin have not been observed despite of prominent penetration of Atlantic waters into the fjord carried by the West Spitsbergen Current. However, we did note a decreased abundance of typically Arctic species over time (e.g., the cheilostome bryozoan *Harmeria scutulata*).

Recorded assemblages were typical for the studied region and temperature variability was oscillating over the studied period within similar values (min. -1.8°C and max. 9.6°C). Therefore, significant variability in species composition, abundance and relative coverage seems to be driven by local processes such as predation. Climate-driven ecological impacts have already been described within other parts of the Arctic ecosystem (e.g., increasing distribution ranges of Atlantic species, higher sedimentation, decreasing carbonate saturation) and future disturbances may have a synergetic effect on the epibenthos. Underwater experiments shade light on important ecological processes occurring on rapidly changing environment of Arctic coastal shallows.

Keywords: colonisation, epibenthos, Arctic, long-term data

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Benthic Blue Carbon in rapidly changing polar seas

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Polar regions are critical to planetary function, and whilst the Antarctic and Arctic are expected to respond differently to environmental drivers, both regions share the chromatic metaphor „white to blue to green". This metaphor explains the transition from ice loss to open waters to increased primary production and summarises a fundamental climate-forced global change observed across most of the Arctic and Antarctic oceans. Arctic seasonal sea ice coverage has been reducing steadily since we have been able to detect this using remote sensing. In contrast, it has been stable or increasing in most areas around Antarctica, although an unprecedented decrease was observed for the yearly average ice extent minimum in 2017 only 3-y after its 2014 maximum [1].

Sea ice losses can produce longer phytoplankton blooms leading to an increase in zoobenthic production and carbon drawdown to storage [2]. Blue carbon (BC) storage by Antarctic zoobenthos has been shown to increase after seasonal sea ice loss and ice shelf retreat (60–100 and 10–40 MtC.yr^{-1}, respectively), turning this into a (natural) negative feedback to climate change [3]. However, the blue carbon stock along the Barents Sea, although comparable to the high levels in Antarctic shelf sediments, is latitudinally variable and any climate feedbacks remain unclear [4]. Newly exposed marine ice-free areas are particularly important in coastal shallows and fjords, where phytoplankton and macroalgae (such as kelp) –if tolerant to suspended particulate matter– can thrive over new habitable space. In doing so, they capture CO_2 and ultimately transport some carbon (~10%) to nearby deeper soft-bottom areas. West Antarctic fjords, although contributing comparatively small BC storage gains (<1 MtC.yr^{-1}) are becoming important BC hotspots since their storage-to-sequestration efficiency is very high [5].

Research focussing on quantifying the BC storage and sequestration potential in polar seas has increased during the last decade, and this approach is also expanding towards ecosystems in subpolar seas. However, more multidisciplinary studies are needed to understand the response of benthic assemblages' capacity to store carbon to environmental drivers and stressors. Conservation efforts to protect this expanding ecosystem service, that could be the largest negative feedback to global climate change, will pose a challenge, particularly since both, Antarctica and the Arctic, also differ in jurisdiction, management, and policy mechanisms [6].

Keywords: polar benthos, blue carbon, climate feedback, climate policy

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"RAW – Retreat And Wither" - What is the influence of glaciers recession from tidewater to land-based on the marine biological production and biogeochemistry in the Arctic?

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Productivity of marine ecosystems is an important factor conditioning element and organic matter cycling on Earth. It also influences the composition of the atmosphere and thus to shape our climate. The world's oceans are a great source of O_2 and sink for atmospheric CO_2. The Arctic Ocean, due to its relatively high productivity and low water temperatures enhances CO_2 solubility, is responsible for as much as 5-14% of the global CO_2 uptake by marine regions. Recent findings show that Arctic fjords are especially effective in absorbing atmospheric CO_2. The biogeochemistry of the fjord systems is, however, very complex and not yet fully understood.

Climate change is disproportionately strong in the Arctic, which is the most rapidly warming region on Earth. One of the observable consequences of the transformation of the Arctic environment is the rapidly receding glaciers. Glaciers are recognised as the main source not only of freshwater supply into the fjord, but also mineral, organic matter and nutrients. All nutrients have in the past been argued to affect marine primary productivity in the areas where there are tidewater glaciers. However, there is a growing body of evidence suggesting that deep water upwelling at the terminus of tidewater glaciers causes the most important increases in primary production. These deep waters are usually rich in nutrients, including nitrogen. The opposite situation is near the land-based glacier inputs, where low nitrogen availability in meltwater limits the productivity. Futhermore, sustained glacier recession will change the glacial regime from predominately tidewater to land-based. The current oceanographical, sedimentological, and biogeochemical conditions will, therefore, adopt more characteristics of land-based glaciers and non-glacial inputs. This, in turn, may alter the total nutrient flux supplied to euphotic zone. Therefore, it remains uncertain how the marine ecosystem productivity will respond to future changes in the Arctic.

Keywords: fjord productivity, fjords biogeochemistry, fjords sedimentology, glacier recesions

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SatBałtyk System - reliable information on environmental changes in the Baltic Sea

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The global climate changes observed in recent years have had a profound impact on marine ecosystems. At the same time, increasingly noticeable changes to the marine environment, whether due to natural or human causes, can have a significant impact on the Earth's biosphere, resulting in changes to climate and ecosystem both locally and globally. Only the systematic monitoring of marine ecosystems makes it possible to identify the causes and effects of these changes. This offers an opportunity to avoid or minimise their undesirable long-term consequences. Tracking changes in the marine environment requires comprehensive, precise and high-quality data. Since 2015, such data describing the Baltic Sea environment has been shared by the SatBałtyk System [1,2], an innovative tool for monitoring this sea. This system provides reliable information by effectively combining three types of data: satellite data used for day-to-day monitoring of the whole Baltic Sea area, model data using hydrodynamic and ecohydrodynamic models describing phenomena taking place in the marine environment, and point data obtained using traditional oceanographic measurement techniques. As a result, the SatBałtyk System presents on the website www.satbaltyk.pl current daily maps of the spatial distribution of values of several dozen current characteristics of the Baltic Sea environment, including the coastal zone as well as the state and optical properties of the atmosphere. The available data set covers 8 selected areas: 1. Atmosphere, meteorology, 2. Hydrology, 3. Ocean optics, 4. Radiation budget, 5. Sea water components, 6. Phytoplankton, photosynthesis, 7. Coastal zone, 8. Hazards. Systematic observations available for the first time on such a spatial and temporal scale can provide invaluable information about the condition and trends of changes in the Baltic Sea ecosystem in the long term. In the global climate analyses, the factor of major importance is the amount of biological primary production in the sea. The already accumulated 10-year data resource allows for many interesting analyses of the productivity of the Baltic Sea by providing a verified quantitative description of spatial and temporal changes in the primary production rate in this basin. A longer observation period will be possible in the following years of operation of the SatBałtyk System. The SatBałtyk System data are made available on the SatBaltyk.pl platform and will boost the Oceanographic Data and Information System, eCUDO.pl.

Keywords: SatBałtyk System, Baltic Sea Environment, Climate changes, Primary production

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eCUDO.pl – oceanographic data and information system for long term data curation

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Global ocean systems play an important role in climate regulation. An accurate status diagnosis and comprehensive analysis of the impact of marine ecosystems on the Earth's climate requires reliable data from a variety of sources. The eCUDO.pl system ("Elektroniczne Centrum Udostępniania Danych Oceanograficznych", eng. ODIS ("Oceanographic Data and Information System")) is developed by scientific consortium consisting of Institute of Oceanology Polish Academy of Sciences, Polish Geological Institute National Research Institute, National Marine Fisheries Research Institute, University of Gdańsk, Maritime Institute of Maritime University in Gdynia, Pomeranian Academy in Słupsk and University of Szczecin. These organizations have long history of marine research and acquisition of oceanographic data. These organizations established good international cooperation, being members of international projects, organizations, and initiatives provide data to international data and information centers and systems so far. To share results of these activities they have consolidated efforts and undertook actions to make Polish oceanographic scientific data resources accessible for public from one national repository. In order to increase Polish contribution to pan European oceanographic data resources they work together to establish the structure of the Polish National Oceanographic Data Committee and ODIS infrastructure for the future cooperation.

Consortium has successfully submitted project proposal in the frame of the Digital Agenda Poland program and has been awarded for the project eCUDO.pl . This project aims to harmonize Polish oceanographic data, make them interoperable through implementation of committed standards for information structure and communication protocols. The project is developing and deploying ODIS as distributed infrastructure for data management, and providing open access to oceanographic data resources to foster reuse of date for scientific research.

Present activities encompass harmonization of environmental data collection and its preservation in accordance with INSPIRE requirements and SeaDataNet standards, securing resources for data management and stewardship, as well as digitalization of hardcopy data archives. The most significant results as expected, are better data discovery findability, accessibility, interoperability and finally higher potential for reuse of data collected during the years of research activity. Design of the system according to the program requirements is user oriented and driven by development of services demanded by users.

The system design is focused on better accessibility to oceanographic data nad deployment of M2M interfaces for data ingestion and data sharing. Extensive data volumes provide valuable base for further processing and support of environmental studies.

Keywords: *oceanography, data management, databases, tools*

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Climate Change impact on resource utilization of fjord benthic communities

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Benthic communities, the fauna living on and in the seafloor, play important roles in the marine ecosystems, and these roles are dependent on species composition which differs among climate zones and further among different depth zones, for example within fjords [1,2]. As a response to the ongoing climate change, however, benthic species are shifting their ranges to colder regions, changing benthic community composition [*e.g.*, 3]. Whether such altered communities will affect ecosystem functioning and the provided ecosystem services (*e.g.*, carbon sequestration) remains largely unknown. To study whether today's community differentiation reflects spatial differences in ecosystem functioning, benthic fauna and organic matter (OM) mixtures (surface sediment and suspended OM) were collected from an Arctic, two sub-Arctic, and a temperate fjord located along a latitudinal gradient (59-78°N). Within each fjord, samples were collected from 2 depth zones (100-150 m vs 200-250 m). Stable isotopes analysis of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) was used to identify if OM utilization and benthic food web structure differs among fjords and depth zones.

Within each fjord, the OM quantity in sediment and bottom water was typically larger at deep than at shallow stations, except for the bottom water of one sub-Arctic fjord. In contrast, the isotopic composition of the OM pools varied almost exclusively among climate zones, while depth had only a small and non-consistent effect on stable isotope ratios of sediment or bottom water. Benthic community composition differed strongly between fjords depending on climate zone and local environmental conditions. Suspension feeders were virtually absent from the fauna that was collected at deep stations across all biogeographic zones, which suggests that deep communities rely predominantly on sedimentary OM (food bank). This also implies that deep communities are likely more resilient toward climate change induced environmental shifts, like the expected changes in the timing of primary production and vertical carbon export to the sea floor. These changes are likely to alter OM utilization and carbon cycling in shallow benthic communities stronger than in deep ones.

Keywords: food webs, stable isotope analysis, pelagic-benthic coupling, latitudinal gradient

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This study was funded by Polish National Science Centre, project no 2019/35/D/NZ8/01282 (CLIMB).

Session V. Climate Change threatens Biosphere

Session Chair: Krzysztof Świerkosz (Museum of Natural History, University of Wroclaw)

Apart from changing the way we use land and exploit natural resources, climate change is currently one of the greatest threats to the biosphere. We can observe it not only on a global scale but also in the immediate vicinity, regardless of the area of the globe in which we are located and the type of ecosystem under analysis. During this session, we will try to answer the question of whether climate change can cause the extinction of the living world, and if so, on what scale. Is it Anthropocene the final stage of the Pleistocene extinction event for fauna and flora, PETM episode, or the loss of a million species, predicted by the latest IPBES reports? Can we counteract this and how?

Global changes – does plant's sex matter?

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Dioecious plants may experience differentially impact of global changes which can be related to sexual dimorphism. As it has been observed female and male plants may have different responses to environmental stressors and have different costs of reproduction [1]. Increased anthropogenic deposition of nitrogen and phosphorus is observed and can affect environmental biodiversity [2]. Thus both male and female plants of dioecious species have equal impact on seeds production and offspring performance, knowledge about the effect of resource availability on the reproductive potential of both sexes described by seeds and pollen grains quality and quantity, is needed.

Our results obtained from pot experiments indicated that long-term higher nutritional availability impacts the reproductive potential of males and female plants of two dioecious species - *Taxus baccata* L. and *Juniperus communis* L. and can have a great impact on species distribution [3–6].

Keywords: dioecy, nitrogen deposition, reproductive potential

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Is knowledge a driver of pro-climate consumer behavior and purchase decisions?

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Households are responsible for 70% of global greenhouse gas emissions among all anthropogenic emission sources [1]. Thus, consumer behavior is a key determinant of successfully limiting climate change. On the one hand, pro-climate consumer behavior is driven by law (e.g. waste segregation requirements), but on the other hand also by voluntary actions (e.g. reducing water and electricity consumption). Changing consumer habits cannot be solved only by new technologies, but rather greater awareness is needed in the society regarding the impact of their actions on climate change [2]. The aim of the study was to verify the impact of knowledge about climate change on pro-climate consumer behavior and purchase decisions. Hence, we conducted a survey in May 2021 among 1,000 Polish citizens. In the survey using three questions, we verified the level of knowledge about the climate change and checked pro-climatic behavior used in everyday life. We analyzed the collected data using least square regression and ordinal logistic regression (as a robustness check). At the same time, we focused on an instrumental variable analysis due to endogeneity issue of educational variables. According to the results, Polish society has an average level of knowledge about climate change and global warming. While respondents are aware of the cause of global warming and are able to correctly identify a greenhouse gas, they are less familiar with the effects of climate change. We also confirmed that consumer pro-climate behavior significantly dependents on society's awareness of climate change. This underlines the importance of educational aspects in research on the risk of climate change. In addition, greater awareness of climate change encourages consumers to purchase products that are manufactured in an environmental friendly manner. This also applies to the banking sector, where more knowledgeable consumers are more likely to choose a bank that engages in green banking. In the future, this may result in a greater reputational risk among banks that finance high-carbon entities.

Keywords: climate change, consumer behavior, green banking, education

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This work was supported by the SGH Warsaw School of Economics (research grant no. KZIF/S21/:1.34.).

‘I’m not a typical flyer’: normative narratives on justified and excessive use of international flights in a highly mobile society

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Reversing the growth pattern in passenger aviation emissions seems necessary for climate change mitigation. However, climate-related concerns and norms are weakly correlated with practices. This study contributes to the discussion on the normative character of flying, strategies of legitimizing air travel, and perspectives for its reduction using 21 in-depth interviews conducted in a mixed-methods study in the Reykjavik region. We show that the purpose and manner of flying are crucial arguments that justify travel practices under increasing environmental awareness. Differentiation between legitimate and excessive flights reduces cognitive dissonance, serves to satisfy social expectations, and is deeply rooted in the institution of cyclical holidays. It may also result in practices of ‘flight shaming’ that refer not to flying per se but to unjustified forms of flying. However, such selective shaming seems problematic from the perspective of climate and mobility justice. In addition to policy implications, we propose methodological improvements to measuring travel-related social norms and climate concerns and their impact on behaviour which will be implemented in the forthcoming study in Poznań and Tricity metropolitan areas in 2022.

Keywords: social norms; cognitive dissonance; air travel; qualitative research

This research in Iceland has been funded by: The Eimskip University Fund, The Icelandic National Planning Agency, The Icelandic Road Administration, The University of Iceland Research Fund. The study to be conducted in Poznań and Tricity metropolitan areas in 2022 is a part of the research project „Travel behavior in Polish cities: causality, behavioral changes and climate impacts“ (2020/37/B/HS4/03931) funded by the Polish National Science Centre.

Climate change and outgroup attitudes: why do we care?

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Perceived threats are one of the most prominent factors shaping intergroup attitudes (1;2). Various studies show that both intergroup threats (i.e. 1) and macrostructural threats (3) can influence the perception of and behavior toward outgroup members. Usually, people who are highly threatened tend to be less accepting of the outgroup. Surprisingly though, results of recently conducted Polish Prejudice Survey 2021 show that individuals who are highly worried about the impacts of climate change tend to be more accepting of all of the minority groups in the study, including the refugees. Noteworthy, this result cannot be reduced simply to political orientation of study participants. In this talk I aim to present the results, offer possible explanations for them, and discuss their implications for climate change interventions.

Keywords: climate change threat, outgroup attitudes, prejudice, political orientation

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The Attitudes Towards Climate Migrants in Poland and Germany: A Mixed-Methods Study

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In 2015 and 2016, Germany accepted about a million refugees, while Poland refused to let anyone in. Fast forward to 2022, Poland's strategy still holds for those who attempt to cross the border from Belarus, but the refugees from Ukraine arrive without hindrance. The topic of attitudes towards war-related migration is complex and as such has received a lot of attention in recent years. But are we even aware of the fact that climate change leads to migrations as well? We collected data from 190 participants in Poland and 207 participants in Germany to explore the attitudes towards climate migrants and compare them across the two countries. We asked close-ended questions about people's knowledge of climate refugees and emotions they evoke. We also asked an open-ended question about what Poland/ Germany should do with regard to climate refugees who might come in the future. The results showed that Germans reported to know more about climate refugees than Poles, and they viewed it as more likely than Poles that the climate refugees would come to their country and have an impact on their life. Moreover, Germans indicated they felt more helplessness and pity than Poles, who experienced more disgust. Germans were also more inclined than Poles to think that the refugees must leave their homes and not just choose to do so. Automated extraction of themes from the open-ended question revealed that Poles were often unaware of and not interested in the topic. Germans opted for combating the causes of climate change. These patterns were further corroborated in the manual coding of the answers. The findings provided initial insights into the attitudes towards a relatively unfamiliar group and confirmed the usefulness of a mixed-methods approach to the study of a multifaceted social issue.

Keywords: climate refugees; attitides; mixed-methods

This work was supported by the Faculty of Psychology, University of Warsaw, from the funds of the Ministry of Science and Higher Education in the form of a subsidy for the maintenance and development of research potential in 2018 awarded to the authors.

The need to improve the forest fire forecasting system in Poland - a consequence of global climate changes

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The most readable and unambiguous symptom of contemporary climate change is global warming. Although changes in air temperature appear with different intensity in different parts of the world, the consequences of the temperature rise are observed around the world through the increasing frequency of many, both long- and short-term, extreme events, such as heat waves, droughts in the growing and winter seasons, floods, landslides, strong winds, including hurricanes, and wildfires. In Europe, including Poland, the most likely scenario is an increase in temperature regardless of the season, and the largest being expected for the winter period. At the same time, Kundzewicz [1] predicts that the increase in the mean annual temperature in Poland will be higher than the increase in the global mean. All these human-induced and natural changes affect the boundary conditions for the formation of wildfires and increase the fire risk in Polish forests. It is very likely that there will be an observed increase in the number and size of fires throughout the country, and that their spatio-temporal structure will change. With the general rise in the number of fires, a specific increase will be expected not only in hot summers and dry springs, but also in the autumn and winter periods. Moreover, fires will also occur more frequently in cooler and wetter areas, e.g. in mountainous areas.

In this context, effective forecasting of forest fire risk is becoming an increasingly important part of the fire protection system. The current Polish fire risk forecasting system takes into account only four meteorological factors, and forecasts are made for 60 large-area zones, excluding the winter and early spring periods. This seems far insufficient in the context of the upcoming environmental changes and the growing need to respond quickly and effectively to threats and extreme events, such as forest fires. This work presents selected research methods and approaches which might improve the Polish forest fire forecasting system. These improvements include: wider set of variables (e.g. landscape indices, meteorological data from mesoscale Weather Research and Forecasting model, anthropogenic factors), higher spatial resolution (4 km x 4 km), spatially continuous forecasts, and modeling using logistic version of geographically weighted regression (taking into account spatial non-stationarity of processes).

Keywords: global warming, fire risk forecasting, forest fires, Poland

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The work was supported by the National Science Centre, Poland, under research project no. 2019/35/N/ST10/00279

Session VI. Climate of Polluted Earth

Session Chair: Małgorzata Werner (Institute of Geography and Regional Development, University of Wroclaw)

During this session, we will evaluate the impact of climate change on pollution emission, transport, and deposition on the ecosystems. We will debate on the population and ecosystem exposure and possible mitigation strategies. Contributions focused on climate – emission interactions, climate – population exposure, and joined effect of e.g. urban heat island intensity and pollution levels on population health are welcomed.

KEYNOTE LECTURE:

Changes of $PM_{2.5}$ concentrations in the last two decades across the UK and Europe and the potential impact of a warmer climate

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Fine particulate matter ($PM_{2.5}$) suspended in the atmosphere is, when inhaled, harmful to human health. $PM_{2.5}$ can comprise hundreds of components which may also have different health impacts. While primary emissions are a substantial component of $PM_{2.5}$ in Europe, secondary inorganic and organic aerosols are also very important and, depending on their origins, harder to control. As an example, reductions in exposure to nitrogen dioxide in city centres are achievable with local controls, for instance by restricting vehicle traffic, but secondary $PM_{2.5}$ contributions to urban fine particulate matter exposure are associated with long range transport and usually not possible to control by local measures. Since 2002, modelled UK average annual $PM_{2.5}$ concentrations have been steadily decreasing from 12 μg m^{-3} to about 6 μg m^{-3} in 2018. However, inter annual variability may perturbate the UK average by up to 2 μg m^{-3}. This has direct implications for any emissions reduction policy. In addition to anthropogenic precursor emissions, natural sources of $PM_{2.5}$ such as biogenic primary and secondary organic aerosols, sea salt spray, forest fires, resuspended dust, and volcanic emissions present a challenge for future air quality target attainment. Even with zero anthropogenic emissions, ambient $PM_{2.5}$ concentrations would not be completely eliminated. At the same time, a warming climate may have several adverse effects on $PM_{2.5}$ over Europe. On the one hand, higher average temperatures will act to reduce the formation of ammonium nitrate (a large component of SIA), while at the same time enhancing ammonia emissions [3] with a potential for more formation of ammonium nitrate. Wildfires, in particular in regions which have not previously been subject to much fire activity, directly inject particulate matter and precursors into the atmosphere, but also reduce the potential for capturing pollutants in the following years due to reduced tree canopies after fires [4].

Keywords: Air quality, atmospheric composition, climate change, emission reduction

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KEYNOTE LECTURE:

Pollen allergy in the polluted environment

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Currently, more than 30% of the European population suffer from allergy and most of the patients are sensitive to pollen allergens. The main reason for the increase in the pollen allergy mordibity is pollution. The study performed in Kraków, highly polluted Polish city, in 2017-2019 showed that the physiological state of birches, growing in a large urban agglomeration do not show a significant stress response expressed through the physiological indices. On the other hand, the level of Bet v1, the main allergenic protien of birch pollen was significantly higher in the pollen samples collected at the more polluted sites, what indicates that the higher stress proteins occurrence in pollen can testify to the growth and development in the non-favorable conditions [1]. Air pollution has a substantial impact on qualitative and quantitative results regarding chemical compounds of pollen, including the secondary structure of the manin Bet v1. While the birch pollen allergenic potential is determined, the both pollen exposure and the content of the main allergenic components should be considered, as factors causing immunological response and clinical symptoms manifestation in sensitive individuals.

Keywords: pollen, pollution, allergy, allergens

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Airborne pollen grains in a changing world

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Pollen grains play a fundamental role in sustaining life on Earth. By ensuring flower fertilization and production of seeds they maintain both natural plant communities and agricultural vegetation [1]. On the other hand, pollen is the major cause of seasonal allergies, affecting millions of people worldwide. Importantly, allergic diseases have been increasing in prevalence over the last decades [2].

Recent climate and environment changes have detrimental effects on the distribution, composition and physiology of plants. Therefore, it also directly impacts on pollen grains, including their production and release periods. In additon, increasing temperature and other environmnetal stressores such as air pollution, affect key traits of pollen, such as viability and allergenicity [3].

In this study, the latest reports on the impact of climate change and human activity on pollen distribution will be thoroughly presented. The risks and consequences of these changes for both human health and the natural environments will also be discussed.

Keywords: pollen, climate change, allergy.

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Analysis of the impact of climate change on modeled pollens emissions

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Citizens of Europe struggle with seasonal exposure to the nuisance effects of atmospheric allergens. Six of the twelve most important aeroallergens biogenic species are currently forecasted as part of the Copernicus Atmospheric Monitoring Service (CAMS). The service provides forecast information about near-surface concentrations and spatial distribution of pollens. Products from eleven partner models from European Institutions (incl. Polish IOŚ-PIB) and Ensemble analysis are provided to the users.

All models have a unified parameterization for pollen production. This scheme uses two temperature-dependent threshold functions [1] to calculate the release of pollen grains. Six pollen types follow this scheme: Alder, Birch, Grass, Mugwort, Olive and Ragweed.

This study analyses potential emission production changes with surface temperature increases following future climate change (horizons 2050, 2100). Regarding future climate conditions, results from Klimada 2.0 [2] will be used.

Keywords: Climate change, Surface temperature, Pollens, Forecast,

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Sources of air pollution in Poland based on modelling

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Assessing sources of air pollution is a critical issue in applying appropriate emission reduction measures. In Poland, permissible air pollution concentration levels are exceeded mainly for PM_{10} and $PM_{2.5}$. Effective reduction of concentrations of these pollutants requires the knowledge of the contribution of the local sources and the transboundary impact.

IEP-NRI (Department of Atmospheric and Climate Modelling) conducts annual modelling analyses of air pollution source contributions. The GEM-AQ air quality model with the national bottom-up emission inventory is used as a computational tool. As a result, the contribution from five groups of emission sources is provided as supplementary information to the annual air quality assessment. Also, contributions from transboundary sources based on EMEP emissions are assessed. In cooperation with the CoMobillity project, contributions from the transport sector are analyzed for the city of Warsaw.

Reduction strategies can be supported by the SHERPA (Screening for High Emission Reduction Potential on Air) software tool developed by the JRC. The tool allows for assessing the contribution of emissions from different sources. SHERPA for Poland was configured using high-resolution scenarios calculated with the GEM-AQ model, based on the high-resolution CBE national emission inventory. A web portal was created to post results from predefined reduction scenarios for selected SNAP categories in each region of Poland (www prototype: http://sherpa.kaskada.tk).

We will present the estimated contributions from different emission sources to air pollution levels in Poland in terms of annual averages and episodic situations. In addition, we will present the application of the SHERPA tool along with a prototype of a website available online and describe its capabilities.

Keywords: Modellig, Air quallity, Emission reduction, Transboundary pollution

Air quality related health exposure in 2019 and mitigation potential due to the national "Clean air programme"

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Air quality modelling allows for spatial analysis of health and environmental exposure. IEP-NRI provides national scale modelling under the Environmental Protection Act. Based on the modelling results, we assessed health exposure for administrative units using data from the Central Statistical Office.

The World Health Organization's AirQ+ [1] model was used to estimate health exposure. The health exposure analysis was performed based on annual average concentrations of PM2.5, PM10, and nitrogen dioxide.

We will show the estimation of health exposure in 2019 and for scenarios assuming the implementation of the national 'Clean Air Programme'.

In 2019, annual average PM2.5 concentrations were estimated to cause around 5% of deaths from natural causes, about 8% of ischaemic heart disease deaths, and about 5% of lung cancer deaths. The annual average PM10 concentrations influenced about 11% of adult bronchitis incidences, while average nitrogen dioxide concentrations influenced 1.5% deaths from natural causes.

Emission reduction due to implementing the "Clean Air" programme would improve air quality in Poland and thus significantly limit health exposure. There would be a significant reduction in premature deaths due to PM2.5 and bronchitis incidence due to PM10. For NO2, on the other hand, health exposure would not change significantly.

Keywords: air quality, health exposure

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Downscaling of the regional air quality model with a gaussian plume model and random forest

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Poor air quality is one of the major causes of premature death and potential years of life lost due to cardiovascular diseases (WHO, 2016). Many densely populated urban and suburban areas do not comply with the WHO guidelines. The most significant pollutants are suspended particulate matter, expressed quantitatively as PM10 and PM2.5 concentrations. As standard tools for assessment of the exposure areas and hot spots location as well as the evaluation of mitigation strategies, numerical models are used. In a regional and continental scale, Chemical Transport Models - CTMs are used (e.g., WRF-Chem, GEM-AQ). For local decision support, Gaussian plume or puff models are used (e.g., AEROMOD, Operat2000).

This work aims to design an approach that would benefit from the advantages of both methods. Thus, it would produce high-resolution results (< 1km) with visible local sources and spatial concentration patterns that at the same time are expected to be accurate (in comparison to field measurements).

We have implemented the Gaussian plume model for PM10 and PM2.5 and simulated concentrations for 2019-2021 with a resolution of 250 meters. The same simulations were performed with regional 2.5km resolution, regional GEM-AQ model. The southern part of Małopolskie and Śląskie voivodships was selected as a study area due to relatively high population density and many industrial sources located there. Emissions from the national emission inventory were used.

Finally, the results of both models (Gaussian and GEM-AQ) were used as input features to the machine learning algorithm (random forest) with ground-based observations as target values (learning dataset). Results of the random forest algorithm represent the resolution of the Gaussian plume input (250 meters) while being consistent with the regional GEM-AQ model.

Keywords: air quality, modelling, gaussian model, random forest

Waste management as a source of odour compounds and greenhouse gas emissions - a case study of selected waste management plant

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Waste management facilities are usually characterized by high environmental impact, mostly due to the extensive emissions of pollutants to the air, water and soil [1]. Air emissions from waste management facilities are extremely diverse, both in terms of the substances emitted and their concentration. Two main groups of substances could be distinguished based on their origination: odors and greenhouse gases (GHGs). Both of these are generated and emitted into the atmosphere due to the decomposition of organic matter contained in waste [2, 3]. Odors are emitted at different waste management steps and processes and could affect the quality of life for the nearby residents by causing odour nuisance [4]. The emission of GHGs (CO_2 and CH_4) is mostly considered at landfill sites, and aerobic or anaerobic waste processing areas. The mechanical-biological treatment of waste within many different processes related to waste management including aerobic or anaerobic treatment (oxygen stabilization/composting/fermentation processes) or landfilling could be a possible important source of the aforementioned substances [1-3, 5, 6]. The scope of the proposed work is to identify and characterize the activity of the odors and GHGs sources at a selected waste management plant. A preliminary analysis of time trends in greenhouse gas emissions from the waste management sector and a spatial analysis of waste management facilities in Poland within processes that are potential sources of odor and greenhouse gas emissions also is being presented.

Results indicated significant temporal variation in atmospheric methane concentration ranging from 2.1 to 22.2 ppm with a mean of 3.9 ppm within the boundaries of solid waste management plant, especially close to the main emission sources (e.g. active quarter, aerobic stabilization site). The analysis of spatial changes in CH4 concentrations (background levels were between 1.9–2.1 ppm) did not reveal the potential influence on the air quality in the close vicinity to the landfill site at a distance of 200 m.

The results of the research also indicate a significant diversification of odor concentrations in the given waste management plant. The highest odor concentrations, measured using the field olfactometry method, were recorded at the waste aerobic stabilization area (up to 78 ou/m^3), the landfill site was characterized by lower concentrations (up to 43 ou/m^3, with the average concentration circa 22 ou/m^3), while the concentration lower than 22 ou/m^3 were recorded in the case of waste sorting hall and landfill leachate tanks. In addition, the highest levels of volatile organic compounds (VOCs) concentrations were found at the aerobic stabilization site (up to 23 ppm). For the most part, the variability in odor concentrations was correlated with VOCs concentrations.

Keywords: odour compounds, greenhouse gases, waste management

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Climate change and the severity of allergenic pollen seasons – a case study for birch pollen in Europe

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In recent years, allergies due to airborne pollen have shown an increasing trend, along with the severity of allergic symptoms in most industrialised countries [1], [2]. Several studies have shown that climate change will worsen the impact of allergy in the next decades due to e.g. longer frowering period, more plant productivity and higher pollen emission [3]. In this study we aim to estimate changes in birch pollen emissions related to projected climate changes over Europe.

We used a birch pollen emission model that is based on heating degree day (HDD) threshold parametrisation [4]. In the first step the model calculates the sum of daily temperatures above a cut-off level from the 1st of March. If the calculated sum exceeds the temperature sum thresholds at any grid in the domain, the emission model starts the calculation of birch pollen emissions for this area. We used CMIP6 (Coupled Model Intercomparison Project Phase 6) climate projections to feed the emission model. The birch pollen emission was calculated for two scenarios: 1) BASE – based on meteorological parameters for the years 2015-2025, and 2) FUTURE – based on meteorological parameters for the years 2090-2100. The FUTURE scenario was run two times, first based on the „middle of the road" climate projection and then based on the „fossil-fueled development" projection.

The results show that the projected climate changes affect the birch pollen season characteristics, such as the start, length and severity of the season, which can have serious consequences in number and severity of allergies in Europe. The detail differences between the projections are also discussed in this work.

Keywords: climate change, climate projections, birch pollen, allergies

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Session VII. Climate Changing Towns and Cultures

Session Chair: Michał Czepkiewicz (Faculty of Civil and Environmental Engineering, University of Iceland)

Recent research shows that mitigating the climate crisis requires a deep restructuring of the economy and lifestyles, in addition to technological changes and efficiency gains. In this session, we will discuss the role that cities, lifestyles, and cultural changes can play in pro-climatic transformation. What cultural and political changes are needed to reduce consumption and production to sustainable levels? How can such transformation occur without being a threat to human well-being? What role can cities and urban lifestyles play in such a transformation? Can we have a "good life for all" within planetary boundaries?

KEYNOTE LECTURE:

Sustainable Welfare and wellbeing within planetary boundaries

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Transformative action is required to avoid global heating of above 1.5 degrees above pre-industrial levels. However, radical climate action is likely to have considerable implications for welfare states, especially if emissions and economic growth cannot be decoupled in absolute terms, requiring a move towards a postgrowth economics framework [1, 2].

In this talk, I will discuss how welfare states could be transformed so that they are compatible with postgrowth, while also contributing to emissions reductions in a socially fair way, as well as to needs satisfaction for all. Here Drawing on the literature on sustainable welfare and social ecological policy [3-5], needs satisfaction [6, 7] and post-growth economics [2, 8, 9], I will argue that sustainable welfare policies will have to put great emphasis on fair climate policies, redistribution and social inclusion in the absence of growth, and on combining needs satisfaction with facilitating low carbon lives.

Keywords: Sustainable welfare, social-ecological policy, needs satisfaction, post-growth

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Adapting the city or adapting the citizens? Role of urban administrative structures in facing climate change

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Adaptation to climate change became the mainstream and unavoidable answer for climate crises. However, the literature on urban adaptation policies highlights that their implementation challenges local policy-making [1], [2], and they require more reflexive governance [3] based on critical self-reflection of governing bodies, experimental approach, and dynamic co-creation of knowledge on human-nature relations. In fact, recent empirical studies frequently point to the cultural dimension of the climate crisis among challenges to address by reflexive governmental structures. For instance, social emotions [4], place attachment [5], and imaginative practices [6]. This study aims to discuss the opportunities and challenges of urban reflexive governance in influencing lifestyles and cultural changes, based on the example of climate change urban adaptation policy in Polish cities. Inspired by the above-mentioned inclusivity, value-based, and beneficiary-oriented approaches in climate change urban adaptation, the coding strategy to cover 'reflexive adaptation' was developed and tested on 49 urban adaptation plans in Polish cities. Next, the analysis was triangulated with 15 interviews among key stakeholders of urban adaptation planning, and the available monitoring results of urban adaptation plans. The findings recognise critical tensions between the assumptions of reflexive governance and the legitimacy of urban administrative structures to inspire lifestyles, and cultural changes. The analysis also identifies some strategies of local public administration which were already tested in Polish cities to unlock the transformative potential of climate change urban adaptation policies.

Keywords: bureaucracy, adaptation to climate change, behavioral change, local policy

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Has the representation of degrowth in media changed after the outbreak of the COVID-19 pandemic? A content analysis of press publications from the Global North

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The impossibility of decoupling economic growth from environmental degradation has resulted in the rebirth of concepts critical towards the growth paradigm [1]. Among them, degrowth seems to be particularly promising as it combines a comprehensive critique of growth with a positive vision of 'good life for all within planetary boundaries' [2]. But despite an increasing recognition within academia and social movements, degrowth remains marginal in the broader public debate. In this context, some scholars argue that the occurrence of a crisis is an opportunity [3] or even a prerequisite [4] for mainstreaming and, eventually, implementing the postulates of degrowth, since a crisis exposes the flaws of the dominant regime and enables alternative trajectories to take hold. I test this assumption by analysing how the representation of degrowth in press changed after the outbreak of the COVID-19 pandemic. Rooted in quantity of coverage and framing theories, this study employs a content analysis of 391 press articles published in Global North regions over 2 years before and 2 years after the outbreak of the COVID-19 pandemic. The results show that although there are many indicators of a more favourable representation of degrowth in press after the COVID-19 outbreak, the framing of degrowth has also shifted in a way that is ambivalent–and possibly harmful–for the further mainstreaming of the degrowth agenda. I conclude that popularizing degrowth without watering down its radical potential might be best achieved by metaphors that reconcile its necessity and desirability.

Keywords: degrowth, media representation, crisis, COVID-19

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Embodying climate change: the experiences of heat and adaptation measures of older adults in Warsaw

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With this paper, I would like to introduce a transdisciplinary research project Embodying Climate Change: Transdisciplinary Research on Urban Overheating (EmCliC) [1] and present some preliminary, partial results.

The project aims to understand people's everyday experiences of climate change and to explore it as an environmental, social and embodied phenomenon. The project focuses on heatwaves and urban overheating, as heat stress is exacerbated in cities by the Urban Heat Island effect [2, 3]. Heat can severely affect people's health and due to physiological as well as socio-economic structural factors, some groups are more vulnerable than others. Evidence suggests that adults are particularly susceptible to rising temperatures [4]. That's why in the project we study the experiences of urban heat among elderly populations in Warsaw and Madrid. Thus, the project is also focused on cultural differences in heat experiencing and ways of adapting to heat dependent on culture. To manage such a wide scope, team members come from different disciplines, including physics, sociology, economy, environmental and climate science, social anthropology and cultural studies.

To illustrate what and why we study I will share some preliminary results from parts I share responsibility for – focus groups (81 participants over 65 years old, 14 meetings conducted in July and August 2021 in Warsaw, Poland) and policy analysis. I will briefly discuss chosen cases of solutions (Air Conditioning, opening/closing windows/ staying home/going out) that are recommended by policy or considered default by public opinion but in our research they turn out considered not beneficial by the supposed beneficiaries. The difference often lies in cultural dimension – already present ways and practices of living and thus experiencing and adapting to heat.

Although focused more on the adaptation than mitigation side, the results of this research seem also important for mitigation strategies. As restructuring of the economy and lifestyles is needed, it is crucial to know what lifestyles are there, how they fit into what is and what is planned and if they themselves offer any solutions. Especially, that some obvious and seemingly very efficient adaptation strategies (like A/C) are not only contested on those fields (efficiendy, impact, energy use) but also are not embraced by potential beneficiaries and does not fit into existing lifestyles.

Keywords: heat, adaptation, older adults, urban heat island

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Consumption-based carbon footprint of households – review of recent studies and research priorities

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Most climate change mitigation policies require significant reduction in greenhouse gas (GHG) emissions still in this decade. Recent efforts focused on supply-side policies aiming at increasing eco-efficiency of production and de-carbonising the energy sources. However, absolute decoupling of GHG emissions from economic output by means of technological changes has not been, to date, observed in scale large enough to be trusted as the sole solution ensuring necessary emission cuts. Therefore, there is need to design complimentary demand-side policies, which will actively influence the level and structure of the demand for goods and services of varying impact on the environment – including the households' demand.

To build impactful demand-side policies, policymakers need to know the level and structure of household carbon footprint and their relationship to potential influencing factors among household-level and individual-level characteristics. For this reason, consumption-based approach to carbon footprint estimation (CBCF) is utilised to reallocate emissions from supply side of the economy (the producers) to its demand side (the consumers). One of the most frequently utilised techniques for reallocation is Environmentally Extended Input-Output (EEIO) analysis. It allows to attribute the GHG emissions induced along the value chain directly to final goods and services offered by a range of sectors, in form of carbon intensity of unit worth of their production. When the intensities are applied to the data on household expenditure on the products, the CBCF can be estimated for each household.

This paper presents the results of a review of the recent studies of household consumption-based carbon footprint performed by means of environmentally extended input-output analysis. Focus is put on factors influencing the level of footprint and its variation between households, such as degree of urbanisation or household income, and their implications for climate change mitigation policy.

The paper closes by presenting rationale and research design for analysis of consumption-based carbon footprint of Polish households.

Keywords: consumption-based carbon footprint (CBCF), environmentally-extended input output analysis (EEIO), demand-side climate change mitigation policies, lifestyle changes, built environment.

Seasonal Variations of CO_2 and CH_4 and Their Carbon Isotope Composition in the Urban Atmosphere

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Concentrations of two, the most important greenhouse gases (GHGs), carbon dioxide (CO_2) and methane (CH_4), in Earth's atmosphere have reached the record levels in recent years The proposed research was focused on the measurement of seasonal variations of the atmospheric CO_2 and CH_4 at the number of urban sites in Wroclaw urban area, conducted during a one-year period from June 2017 to August 2018. The study applied the Cavity Ring-Down Spectroscopy (CRDS Picarro G2201-i) to measure concentrations and carbon stable isotope values ($\delta^{13}C$) of CH_4 and CO_2. The CO_2 and CH_4 mixing ratios and their isotopic composition sampled in the urban atmosphere are strongly influenced by the seasonal and synoptic variability, variations of biogenic fluxes, and changes in the heating-related emissions with temperature. Finally, the current study reveals a high variability of the driving forces, such as current patterns of energy use and presence of natural carbon reservoirs, weather events and atmospheric transport. The changes observed in the stable isotopic signatures in CO_2 and CH_4 allowed appointment of two main source categories existed in the city area, dominantly from fuel combustion and biogenic origins. The identification of $\delta^{13}C$-CO_2 end-member values (–27.9 ± 1.4‰) suggests that the biogenic share in total emissions from the city of Wroclaw is dominant in the growing season. The atmospheric CH_4 concentration showed night-time and early morning peaks with values from 2.1 to 3.0 ppm during heating and from 1.9 to 2.0 ppm in the vegetation season. The obtained in winter end-member $\delta^{13}C$-CH_4 values of each peak were in the range from –45.2‰ to –53.4‰ suggesting thermogenic methane processes.

Keywords: Greenhouse gases; Urbanization; Stable ($^{13}C/^{12}C$) isotope composition

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Implementation of The Driver-Pressure-State-Impact-Response (DPSIR) Framework in the field of air quality

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DPSIR (Driver-Pressure-State-Impact-Response) is an innovative approach to discern the multidisciplinary interactions between environment and society thus providing a framework of key objectives subject to environmental assessment. DPSIR provides a consistent and structured approach to address anthropogenic problems through integrated policy response mechanisms.

The Framework was used by Jacobs to produce a high-level State of the Environment Report for a major city in the Middle East. Assessment was conducted by identifying the driving forces causing environmental degradation (e.g. demographic, legal), the pressures applied by those drivers and by environment itself (e.g. emissions from transport, soil dusting), the current state of the receiving environments according to various metrics and the impact driving forces have on the environmental state. The process culminates with the development of a response programme (i.e. readdressing degradation)

The DPSIR approach can be undertaken to address multiple or specific states such as the air environment. In reality, driving forces have an effect on multiple states and so the framework is typically applied allowing responses to be developed to protect all states.

The Poster presented will demonstrate that the DPSIR Framework is a valued and practical approach to understanding environmental states and an optimum strategic approach for addressing air quality and the climate emergency.

Keywords: DPSIR Framework, Air Quality, Climate, State of Environment Report

RIGHTEOUS 2040 a climate activists' tale about a just, equitable future.

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I strongly believe in the power of imagination, when it comes to redesigning and equipping modern cities with ways they can be resilient. This poster shows the true voice from the streets: every vision described comes from the speeches of youth activists, spoken during climate strikes in Poznań. They are about Righteous 2040 – a year, when we look back at the visions we had at the beginning of 2nd decade of XXI century. In this vision, Poznań of 2040 is a well-mitigated city, where people love to live, where they care about the policy changes and have been a part of the process for the last two decades. It shows how we perceive the changes happening in energy systems, how the climate education is centered around resilience and how the politicians use their power to secure the climate promises they have made. Sadly, in 2022 it still sounds like a fairytale – and this is exactly why we framed it as such. But the first step is to imagine and share the vision with others. More information on the vision: sprawiedliwy2040.pl Accessible for Polish, English, German, Ukrainian and Russian speakers.

Remote rural areas in Europe–trends vs. future dreams of the youth in the context of climate change mitigation and adaptation

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The ongoing rural decline taking place across Europe is exacerbated by the impacts that climate change has on rural areas. Hence the need to adjust rural development patterns in a way that at the same time generates new opportunities and improves resilience–especially of areas that have been 'left behind'. In order to achieve this, it is necessary to identify trends affecting the development of rural areas and to determine how the generation that will decide on the development of these areas in the future perceives their role. The aim of the study is to confront the identified megatrends, trends and weak signals with the dream futures of young people. The analysis focuses on exploring the situation of remote rural areas in comparison to other types of rural areas. Based on the analysis of European research reports, scientific journals, futures literature and national sources, 1.560 trends were identified, which were then assessed in terms of their impact on different types of rural areas. In parallel, we surveyed young people from 20 regions in 10 European countries about their views on work, place of residence, lifestyle in 2035. Remote rural areas will be subject to many negative trends, but there are also indications of possible directions for their development. These areas are expected to be peaceful and 'green' but with opportunities for generational renewal and sustainability transition. It is therefore crucial to respond appropriately to trends so that the dreams of young Europeans can be matched with the urgently needed mitigation of, and adaption to, climate change.

Keywords: remote rural areas, rural decline, resilience, generational renewal

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Session VIII. Climate Change transforming Agriculture, Energy and Technologies

Session Chair: Adam Choryński (Poznań University of Life Sciences)

Shifts in climatic conditions affect the way local communities are functioning. Institutions are facing the need to adapt to more difficult circumstances. The consequences of meteorological conditions are becoming more severe and increasing risks for human health and for different sectors of people's activities. We produce and consume energy and food and force the global economy to invest in new technologies to mitigate the climatic crisis. In this session, we will concentrate on three major social-economic challenges: (1) the way climate change is affecting local communities and its institutions; (2) the impact of climate changes on food security at the global, regional, and local level; as well as on the energy markets through both energy demand and supply and (3) how climate can drive technological, social and institutional innovation, sustainable production and climate-positive businesses.

KEYNOTE LECTURE:

Cascading climate change impact and rapid decarbonization pathways

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Climate change impacts and maladaptive responses to them have potential to disrupt societies at multiple scales via networks of trade, finance, mobility and communication, and to impact vulnerable groups most heavily. Such disruptions that may cascade across geographical and political boundaries need risk management strategies that treat the world as a complex adaptive system. Understanding where and how to intervene in the system to best reduce potentially cascading impacts is becoming an essential part of resilience planning. The presentation will also explore how the knowledge on complex systems and non-linear dynamics can be used in climate mitigation. Profound and exponential changes in human lifestyles, social institutions, governance, infrastructure, and technology are needed. The key interventions that have can activate rapid system wide tipping to reduce the greenhouse gas emissions in this decade include removing fossil-fuel subsidies and incentivizing decentralized energy generation, building carbon-neutral cities, divesting from assets linked to fossil fuels, revealing the moral implications of fossil fuels, strengthening climate education and engagement, and disclosing greenhouse gas emissions information. They operate at different time scales and different social structure layers.

This work was conducted in the European Commission H2020-funded CASCADES (CAScading Climate risks: towards ADaptive and resilient European Societies) project, Grant agreement number 821010

Photovoltaics and solar cells: investigations and role in renewable energy sources

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Photoviltaics (PV) and renewable energy sources (RES) are issues that focus the attention of many important research centres in the world, e.g.: in Germany, France, Japan, China, the USA or Taiwan. The European Union (EU) is consequently moving away from the processes of burning solid fuels as a foundation for energy. Therefore i.a. PV sector is one of the fastest-growing RES sectors around the world.

Russia's invasion of Ukraine, which began on February 24th 2022, made the EU to become independent of Russian imports of energy resources. In the face of this situation, it is worth looking at photovoltaics not only in terms of climate change, but also taking into account its participation in the pursuit of independence and energy security of the state.

Within the lecture the field of photovoltaics will be discussed in the context of its role in RES as well as protection of the atmosphere and climate. In the presentation, there will be explained the physical basics of solar cells operation and their role in renewable energy will be emphasized. Additionally, the development of research and application of solar cells in the photovoltaic industry in Poland as well as in the world will be discussed. Finally, our scientific achievements in sudies of modern materials and semiconductor structures for photovoltaic cells will be presented.

Keywords: photovoltaics; solar cells; renewable energy sources

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Forecasts of solar conditions for the Central and Eastern Europe

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Due to ongoing climate changes and its associated consequences, it is necessary to modernize the energy sector. Due to numerous programs and plans aimed at reducing emissions, especially of greenhouse gases, it is important to systematically increase the share of electricity from renewable energy sources. In this field the most promising is the solar energy industry - especially photovoltaics. The region of Central and Eastern Europe, due to the meteorological conditions peculiar to that area, is not the most favorable one, while the progressing climate change will make them much better in the perspective of the next several decades. Photovoltaics is the most dynamically developing branch of the solar energy industry, new technologies make the process of photovoltaic conversion more and more efficient, and the panels themselves in various forms can be installed practically everywhere, thus the amount of electricity from this source possible to obtain becomes larger almost every day. One of the main problems associated with the renewable energy sector is forecasting the amount of energy generated by it. The main research problem is to develop an optimal configuration of Weather Research and Forecasting (WRF) numerical model for forecasting solar parameters to estimate the amount of photovoltaic electricity generated in the near future. This is a difficult and complex challenge due to the area of interest - the temperate latitudes of the northern hemisphere.

A characteristic feature of this region is an active cyclogenesis with frontal zones separating arctic and polar or polar and tropical air masses, which are responsible for the occurrence of cloudiness - a meteorological element directly affecting the amount of radiation reaching the Earth's surface.

The presentation will discuss simulation results for the northeastern Germany region for the selected situations for 2020, taking into account the most difficult to predict conditions during moving weather fronts (warm, cold and occluded). The results of the forecast data were related to the terms with high pressure situations as reference conditions for the solar parameter forecasts.

Keywords: solar energy, forecast, WRF, Central and Eastern Europe

This research was funded by the Military University of Technology in Warsaw, Faculty of Civil Engineering and Geodesy, Institute of Geospatial Engineering and Geodesy statutory research funds UGB/22-785/2022/WAT.

Variations of precipitation in the warming climate of Poland and its consequences for urban and rural areas

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Variations of precipitation means on the one hand the values excess the normal and on the other shortages of water. Both problems with precipitation affect communities as well as other sectors. Extreme precipitation generates threat of soil erosion, inundations and traffic disruptions, local flash floods in both urban and rural areas, damage to infrastructure, as well as adverse effects on human well-being, including even loss of human life [1]. Scarcity of precipitation, exacerbated by high air temperature, may lead to development of different stages of droughts: from meteorological, through soil to hydrological droughts [2]. As droughts develop, their effects on agriculture, water supply, energy and the environment grow. Since the year 2000, Poland has faced multiple severe droughts, accompanied by heat waves, such as in 2006, 2010, 2015, 2018, 2019 and 2020 [2]. Consequences of these dry periods are worsening the lack of snow during winters impacted also drying conditions in 2021 and 2022. Cumulative water shortages from year to year led to the development of severe drought, as reflected in very low SPEI values and low soil moisture, especially in western Poland.

According to the Clausis-Clapeyron law, the higher temperature by increasing the water capacity, creates conditions for higher rainfall. The analysis of sensitivity of precipitation to temperature showed that the scaling factor calculated on the basis of pairs of 99th percentile of precipitation and daily mean temperature above 5°C was higher for the warmer period, 1989–2018 (6.06%/°C) in comparison to colder period 1959–1988 (5.26%/°C). There are periods of intense rainfall, separated by longer and more intense dry periods. On 22nd of June 2021 in Poznań and Swarzędz (part of the Poznań agglomeration) extreme precipitation has been recorded (79.4 mm and 136.9 mm, respectively) causing local flash floods and triggering nearly 170 interventions of the State Fire Service units [3]. This precipitation occurred after 5-day of heat wave with temperature above 30°C. This day in Poznań was 28.5°C.

Extreme events from the past will no longer be classified as extreme in Poland. During warmer months, prolonged dry spells (interrupted by intense precipitation events), high evapotranspiration and occurrence of heat waves may lead to the development of a multi-year drought. Without effective climate change mitigation, too little or too much water can become increasingly frequent problem in our future and coping with them will be one of the major challenges for the society.

Keywords: extreme precipitation, drought, local flash flood

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Increased demand in the face of reduced production. Current and future problems of the Polish power sector during droughts and heat waves.

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The heat wave of 2003 is a clear example of climate change consequences. It was felt most strongly in the Western and Southern Europe. In addition to the well-known tragic consequences of tens of thousands of deaths, significant losses were also recorded in other sectors, including the energy sector. Water-cooled power plants had to limit energy production because the of the water discharged into the rivers. After cooling the reactors, it was too hot and could endanger biological life in the rivers. From the point of view of the energy sector, there were several negative factors at the same time. The high demand for energy for air conditioning was met with a reduction in the possibility of its production due to unfavorable weather conditions lasting for several weeks.

In Poland, a similar situation occurred in 2015, causing limitations in the supply of the electricity to industrial recipients. Restrictions also affected commercial facilities that had to turn off air conditioning and reduce lighting power. Energy consumption in Poland has been increasing for 20 years. It takes place during all seasons of the year, but it is the highest in the summer, among others due to the increase in the number of air-conditioned spaces, mostly in residential buildings. In the presented research, the authors will analyze the factors that led to the crisis in 2015. The subject of the analysis will be factors influencing increased demand, such as heat waves, and limiting energy production, such as drought in river basins in Poland. Regional climate models predict that both the drought problem and the frequency and intensity of heat waves will increase in the coming decades. The results of regional climate models also covering the territory of Poland will be used to estimate how often the conditions of crisis for the energy sector will be repeated in the future.

Keywords: droughts, heat waves, energy sector

Research has been supported by the National Science Centre of Poland - Project number 2018/31/B/HS4/03223.

The impact of the Europeans economic situation on the attitudes towards climate change

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The European Green Deal (EGD) announced by the European Commission in 2019 is a legislative roadmap to European Union carbon neutrality by 2050. This very ambitious effort requires unprecedented investments, significant technological innovations, as well as societal transformation that involve transformative learning and the formulation of new narratives of sustainable societies. Although EGD has gained comprehensive political and public support, the effects on many groups and stakeholders are difficult to foresee. Therefore, the question arises whether ambitious EU climate policies succeed when faced with rising societal divisions between Europeans?

This paper analyses differences in Europeans' climate change (CC) perception and searches to determine what factors influence it. Relying on the European Social Survey data, we examine the impact of economic factors (namely household income and GDP per capita) on public attitudes to CC.

Our analysis relies on data from the eighth round of the European Social Survey. Our analysis originates with a replication of the explanatory models proposed by Portinga et al. [1], which demonstrate a) a significant impact of universal basic human values, b) political orientation on the attitudes to CC, as well as c) the presence of significant differences in this respect among the major regions of Europe. We expand the original analysis by incorporating additional explanatory variables into the Multi-Level Regression models. On top of basic human values and the left-right scale, we also add i) household income (at the individual level), ii) GDP per capita (at country level), and iii) the interaction between HH income and GDP per capita. We retain the original control variables in our models: gender, age, and education level. We were motivated to expand the original set of explanatory variables to explore the impact of structural economic characteristics of countries and individuals on the observed relationships between ideological orientations and the attitudes towards CC.

Our preliminary analysis demonstrates that the economic situation of respondents and the structural characteristics of countries are significant predictors of CC trend skepticism. Contrary to Poortinga et al. (2019), who showed that regions of Europe (i.e., geographically defined groups of countries) modify the impact of the ideological orientation of the Europeans on CC attitudes, our study incorporates the interaction effect between declared household income and the GDP per capita at the country level.

Keywords: climate change perception, economic factors

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The paper is a part of the project titled Determinants of populist opposition to climate policy, funded by the National Science Centre (2020/37/B/HS6/02998).

Radiative Water Mattress - Conductive Cooling Solution as the dairy cattle's heat stress mitigation strategy for Global Milk Security

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Climate change affects not only the well-being and energy efficiency of city communities but also the food security, due to direct weather influence on the agricultural sector. Presented work, being the result of the RadMAT Project, is focused on the dairy sector, which is especially burdened with climate change due to its diversified influence on factors determining dairy cattle breeding (Figure 1). The sector is particularly afflicted by the prolongate day and night heat waves occurrence, due to the dairy cattle's high thermal sensitivity and large metabolic heat production. Unbalanced heat generation results in animal physiological and behavioral reactions which are characteristic of the heat stress phenomenon. Its consequences traverse boundaries of the cows' welfare and the breeder's economical losses, due to numerous health problems of the animal and correlated with them demand for veterinary intervention as well as the reduced milk yield.

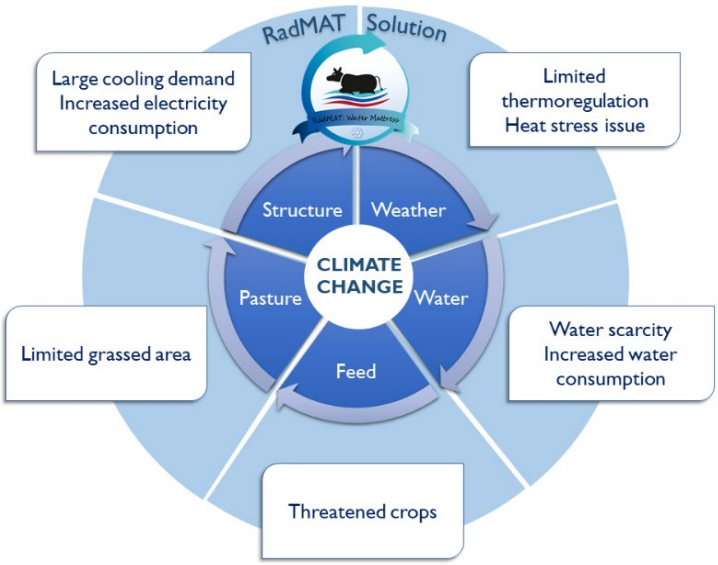

Figure 1. Influence of climate change on the factors determining dairy cattle breeding.

Compilation of the regional meteorological conditions with the amount of the dairy cattle indicates the USA, India, and Brazil [1] as the most affected by the heat stress issue regions. Nevertheless, the continuously rising global demand for dairy products, together with progressive climate change, have increased significantly the contribution of the European countries, in which Poland

is the 5th milk producer, and 12th in the world ranking [2], to global milk production, affecting significantly its security.

The high importance and global magnitude of this issue drive the dynamic development of the technology applied in the dairy sector, especially for local heat removal from the animal, which is limited by the hygiene problems and challenged by low cooling efficiency. RadMAT solution is an innovative conductive cooling technology for heat stress mitigation, designed to tackle these difficulties using a dairy cattle water mattress working in the flow regime. Excessive heat can be transferred from the lying on the mattress animal to the coolant ensuring almost continuous heat removal between 12 and 14h [3] during the day, with simultaneous reduction of the cow's body tension and improvement of the hygiene conditions. Furthermore, the operation of the proposed system in a closed water cycle is monitored and controlled by the Supervisory, Control, and Data Acquisition system. Developed infrastructure will give an opportunity for future system optimization helping achieve energy and water savings in dairy industries.

Keywords: heat stress, dairy cattle, conductive cooling, milk security

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Solar cells based on oxide and silicon

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Photovoltaics is still one of the most promising and highly demended source of green energy. In the last couple of years several number of new technologies have emarged, such as: perovskite solar cells [1], CIGS solar cells [2], organic solar cells [3], and others. However, none of those technologies has surpassed the silicon solar cells in common applications yet. Therefore, it is still important to develop cheap and highly efficient solar cells to bring green energy for more receipents.

In this work solar cells based on heterojunctions of oxides and silicon will be presented. Oxides, such as zinc oxide or tin oxide, are cheap, common and accessible. Due to the large band gap, their optical properties are suitable for pairing with Si, which technology is well developed. At the same time, oxides are used as transparent electrodes on top of the structure.

Solar cells based on ZnO/Si and SnO/Si will be presented. The best effciency aquired is 8%. The incorporation of metallic nanoparticles and ferroelectric layers for increasing the efficiency to 11% will be shown. The work will focus on optical, electrical and photovoltaic parametrs and properties of the presented structures.

Keywords: photovoltaics, oxides, silicon, efficiency

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Impact of projected climate change on the frequency of energy droughts in Europe

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Non-dispatchability of solar and wind energy is one of the major challenges when it comes to their efficient integration to the existing power system. To make things more complicated the highly variable nature of these two energy sources can be observed simultaneously in temporal and spatial domains. This work documents the results of analysis concerning the frequency of energy droughts [1] concerning wind and solar energy in Europe on the NUTS-2 level. The analysis considered the projected climate change based on experiments denoted as RCP 4.5 and RCP 8.5 [2]. Daily average capacity factors for solar, wind and solar-wind hybrid were used as input data. Period 1970-2020 was used as a reference, whereas frequency of droughts was estimated for years 2040-2098. The exemplar results obtained based on MPI-ESM-LR (MPI, Germany) global climate model and CCLM4-8-17 (CLM-Community, EU) regional climate model both for RCP 4.5 revealed: an increase of solar droughts by an average of four daily events per year and decrease of wind droughts by an average of 2.7 daily events per year among all considered NUTS-2 regions. Highest increase of solar droughts is observed in central parts of Germany, central-western Italy and northern parts of Romania. For wind power the largest reduction was estimated for northern Greece and south-eastern Germany. For Poland the number of drought events increased and decreased respectively for solar and wind energy by 5.7 and 1.7 daily events.

Keywords: solar energy, wind energy, climate change, energy droughts

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Solar-powered and next generation refrigerants based cooling system to boost air quality and shrink carbon emission in the city: COOLSPACES 4 LIFE

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Increasing population and improved living standards are directly linked to higher cooling requirements, causing an ever-increasing demand for conventional energy resources, and resulting in environmental pollution issues. The importance of renewable cooling technologies in our energy chain has become one of the main global priorities, impacting not only on the energy sector but also on the economy and the general public. Space cooling demand rose by more than 33% between 2010-18 and by 5% in 2017-18 [1]. Moreover, the implementation of zero-emission cooling concepts in the building sector should be all the more important the more a country's energy production depends on burning fossil fuels. Developing such a system in Poland, whose total share of fossil-fuel-generated energy amounts to 86.1% [2], could be the cornerstone for changing perceptions regarding renewable energy throughout the society. COOLSPACES4LIFE project will develop a vision for how a particular city can become a less polluting and more sustainable place to live and work. We wish to highlight the giant steps that can be taken for institutional buildings to have a positive impact and see that consideration is given to the huge potential market for such new solutions.

Therefore, the primary goal of this ongoing COOLSPACES4LIFE project is to replace marginal fossil-fuel-based peak energy demand with solar-powered climate-friendly refrigerants-based building cooling (BC) system coupled with cold storage systems. This novel BC system will be design and built to provide year-round cooling of a selected part of Geocentrum building at Wrocław University of Science and Technology. Implementing the technical solutions developed in the COOLSPACES project in the urban environment will impact greenhouse gas emissions in three ways: reducing the use and thus the emission of fluorinated greenhouse gases; using renewable energy as the main source of power for the presented device, thus reducing primary energy consumption from fossil-fuel combustion; and increasing the energy efficiency of large air-conditioning systems by introducing new refrigerants and incorporating the new energy accumulation system. Thanks to the use of mixtures based on natural refrigerants (hydrocarbons), COOLSPACES will provide significant support to the refrigeration and air-conditioning sector in implementing the F-gas phase-out schedules included in Regulation (EU) No. 517/2014, and transforming the refrigeration market. The above-mentioned activities, combined with the educational side of the project and its location in the center of academic cities, will highlight the transformative impact of COOLSPACES on the air-conditioning industry and on energy use in buildings.

Keywords: solar-powered, public building cooling, energy storage, climate-friendly refrigerant

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Influence of meteorological conditions on the variability of indoor and outdoor PM concentration in a selected health resort.

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The quality of the environment, including air quality, especially particulate matter (PM) concentration is an important aspect for the effectiveness of treatment in a health resort and for obtaining or maintaining the status of a health resort [1,2,3].

In Poland, health resort facilities, most often dating back to the 19th century or early 20th century, face similar problems with air quality. They are usually under conservation protection and are not subject to thermal modernization, replacement with airtight windows, which affects the infiltration and migration of pollutants between outdoor and indoor environments.

The intensity of the penetration of pollutants depends on meteorological conditions, which determine the outdoor air quality [4,5,6,], and affect the ventilation rate due to pressure differences [7]. Moreover, studies indicate a relationship between the type of ventilation and the indoor air quality in the case of gravity ventilation [8].

The main aim of the study was to analyze the indoor-outdoor characteristics of PM concentrations. The influence of meteorological factors on indoor air quality was evaluated, taking into account the migration of pollutants between the two environments: outdoor and indoor, especially during the high-PM episodes.

The research was carried out during the periods: 5.-25.02.2021, 5 - 25.08.2021, 4 - 14.02.2022 in a treatment room in one of the Lower Silesian health resorts. This facility can be considered as representative of this type of building. The study included 24-hour data of PM_{10}, $PM_{2.5}$, PM_1 concentrations, and temperature monitored inside and outside the buildings. The meteorological data provided by IMGW and the concentration of air pollution from the National Monitoring Station were used as additional data.

During the two winter seasons, PM concentration was characterized by high variability due to different weather conditions, but the indoor PM concentration was generally lower than the outdoor (Tab. 1.). The main factors affecting the results obtained included wind speed and direction, which influenced the infiltration rate, as well as the thermodynamic state of the atmosphere favoring the accumulation of pollutants (22-25.02.2021). Besides local circumstances and emissions rate from heating sources, the transport of PM from the Sahara region shaped the air quality (23-24.02.2021). During the summer, higher concentrations of PM_1 indoors than outdoor were observed, mainly influenced by indoor gravity ventilation as well as other indoor sources.

Table 1 Examples of the results of measurements carried out in the resort

	winter '2021	summer '2021	winter '2022
	Max concentrations [µg/m^3]		
PM_{10} (I)	49,8	23,3	18,7
$PM_{2.5}$ (I)	42,1	19,4	14,5
PM_1 (I)	40	14,3	8,8
PM_1 (O)	37,4	8,2	17,6

Keywords: health resorts, meteorological conditions, PM, indoor and outdoor air quality

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Magnetic materials engineering for low-power electronics

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Nowadays, magnetism studies are focused on finding materials that can be suitable for novel electronics, in which the power consumption needs to be reduced. In particular, this applies to data processing and storage devices. The development of appropriate technologies requires proper material choice and engineering. Therefore, we focus on Co/Ni layered system, because it exhibits high thermal stability, low Gilbert damping, and high spin polarization. It is also easy to control the magnetic anisotropy of this system by changing the thicknesses of the layers and, thus, induce Perpendicular Magnetic Anisotropy (PMA), which is required to achieve extremely high-density data recording. All these properties are crucial to fabricate *energy-efficient* devices.

In our studies, we have shown that the magnetic properties of Co/Ni bilayer can be easily tailored by plasma oxidation (PO) of the top Ni layer. We found that PO can serve as a tool to enhance the PMA [1] and it is great to tune the magnetic properties locally. Using this method, we created two-dimensional artificial magnetic structures with tunable magnetic properties. Therefore, this technique serves an efficient approach for magnetic patterning suitable for diverse applications, especially since plasma oxidation can be performed on a large scale using commercially available tools.

Keywords: Magnetic materials, perpendicular magnetic anisotropy, thin films,

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Session IX. The psychology of Climate Change: attitudes, emotions, and behaviors

Session Chair: Magdalena Budziszewska (Faculty of Psychology, University of Warsaw)

The road toward global climate change mitigation is strewn with obstacles. Judging by the current lack of progress, achieving carbon emission reduction goals might seem impossible, resulting in climate fatalism. Misinformation, misunderstanding of climate science, outright denialism, disavowal, and behavioral disengagement are common worldwide. On the other end of the spectrum, climate anxieties, stress, and depression are on the rise among those who are involved in climate action. Moreover, the problems of the individual and collective agency are also embedded in climate mitigation attempts. Thus, understanding human psychology, motivating people's beliefs, attitudes, and behaviors, is crucial in addressing climate change. These psychological processes will be the subject of this session.

KEYNOTE LECTURE:

Hope in the face of climate change: Wishful thinking or a precondition for sustainability transformation?

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Many people, not least young people, worry about climate change [1]. Many also feel helplessness regarding their ability to help mitigate this problem [1]. At the same time there is a need for all actors to get involved in the process of transforming our society in a more sustainable direction. In this regard one could argue that hope is something that should be promoted. In the general debate climate-change hope has, however, become a conteted concept that is embraced by some, while seen as wishful thinking by others. But what does research, in for example psychology, say about cimate-change hope? The aim of this presentation is to discuss what role hope may play in young people's climate-change engagement. The discussion will be based on empirical studies about hope and climate change [for example: 2,3,4,5] as well as theories about hope [6,7,8]. I will focus on studies with young people in the age-span from late childhood to young adulthood. The importance of considering the different sources that climate-change hope is based on will be emphasized, since they are more or less constructive seen from the perspective of climate-change engagement. I will end the presentation by discussing practical implications and needs for the future regarding research about climate change and hope.

Keywords: climate-change hope, coping, pro-environmental behavior, climate engagement, subjective wellbeing

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Climate Change-Related Distress and Climate Action

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This presentation summarizes the results of three surveys that concerned relationship between climate change-related distress and climate action. The surveys were carried out on national, representative samples of Poles in August 2019 (Study 1, N = 454; age, M = 47.37; SD = 14.56), in March 2020 (Study 2, N = 1028; M = 44.42; SD = 15.85), in September 2021 (N = 589; age, M = 46.70; SD = 16.35). This presentation summarizes analyses of the frequency of individual behaviors undertaken to mitigate climate change, e.g. limiting meat consumption, limiting consumption, and support for energy transformation (e.g. support for abandoning coal). In all studies, climate change-related distress was positively related to individual climate action, and it was a significant mediator of the relationship between climate change risk perception and climate action. Distress was also positively related to support for energy transformation. The results of these studies indicate that although negative emotion related to climate change can be a source of suffering, they can also play an adaptive role as a source of motivation for climate action.

Keywords: climate change related distress, climate action

Study 2 was supported by University SWPS, Faculty Research Program founded under the subsidy of the Ministry of Science and Higher Education. An awarded project: A three-stage sequential model of involvement in climate change mitigation. Verification of the basic assumptions.

Climate Change Distress Distinguishes People Who Experience Climate Related Symptoms of Psychological Disorder From Those Who Do Not, Whereas Generalized Anxiety Predicts How Often Such Symptoms Occur

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We used zero-inflated Poisson regression to analyse the occurrence of climate related symptoms of psychological disorders (e.g., problems sleeping and problems working) in a representative national sample of Polish adult (n = 1133). For all eight symptoms we measured, we found that when distress about climate change and scores representing generalised anxiety and depression were included simultaneously as predictors, distress about climate change was positively related to the possibility that people would experience a symptom (the logit parameter), whereas generalised anxiety was positively related to how often people experienced each symptom (the log parameter). With one exception, depressive symptoms were unrelated to either the logit or the log parameters, and with one exception, generalized anxiety was unrelated to the logit parameter. These results suggest that distress about climate change predisposes people to experience climate-change related symptoms of psychological disorder, whereas the frequency with which they experience these symptom is determined by their dispositional, generalized anxiety.

Keywords: Climate change distress, psychological disorder

Acknowledgments and funding information should be placed at the end of the abstract, written in italics.

Climate emotions and the impact of climatic changes on mental health in Europe – what we know and what we don't know

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There is a widespread scientific consensus on anthropogenic global climatic changes, as well as their disruptive influence over ecosystems and communities around the world. The climate crisis indicates a threat to environment, society, economy, geopolitics, and human health. An increasing negative psychological impact of climate crisis has been identified in academic literature and in global health policy documents as the next challenge for public mental health, thus expectedly a challenge for mental health practice [1]. While the challenges have been identified in the global context, it is important to understand climate crisis-related impact on mental health and wellbeing specific to individuals and communities of Europe (e.g., for Central Europe among other European regions). Up to know, knowledge of climate crisis consequences for mental health mainly comes from locations already deeply afflicted by climatic changes and related extreme weather events (e.g., from Australia that has been conducting systematic studies on mental health consequences of droughts and wildfires for several decades). (Central) Europe is a region which seems comparatively intact by environmental damage resulting from climatic changes (so far), where every-day consequences of climate crisis for most of the people are not yet a lived reality – often due to the politically-laden lack of public awareness and recognition. These regional differences may count for variety and specificity of mental health impacts and should be understood in order to provide adequate mental health support to individuals and communities of concern [2]. Climate emotions, dynamics of engagement in individual and collective climate action, and environmental concern (grounded in individuals' cognitive and ethical attitudes, as well as in sociodemographic characteristics) are believed to underlie the climate crisis-related risk for mental health and well-being in the European context. This risk may be characterised as anticipatory and mediated in personal values and education [3]. We also seem to assume the risk is experienced by a small and specific group of European citizens. However, virtually no research has been done on direct and indirect mental health consequences of climate crisis in the European regions with respect to the unmediated impacts of natural disasters and extreme weather events. The presentation will consist of results of multi-method exploratory study on climate emotions and climate crisis-related risk for mental health and well-being (desk research, discourse analysis, participatory field research, individual and group interviews). Perspectives of climate activists, individuals suffering ecological distress, youth, and mental health practitioners will be presented as examples of communities of concern.

Keywords: mental health, climate emotions, populations of concern, exploratory study

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Greenwashed - the role of defensive and secure social identity in pro-environmental support

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Past work showed that strong national identification is negatively related to environmental protection. In this presentation we aim to demonstrate: (1) that only some forms of national identity oppose environmental concerns; (2) and that this effect is driven by national narcissists' need to defend the group's image. In three studies, we examined the association between support for anti-conservation policies and narcissistic versus conventional national in-group identification. Collective narcissism is a belief in in-group greatness associated with the need for external validation. We found that national collective narcissism (but not national identification without the narcissistic component) was positively associated with support for anti-environmental policies like: government subsidy for the coal industry, and logging the Bialowieza Forest. These effects were mediated by an increased need to make decisions independently of external influences.

Additionally, in line of follow-up studies we found that although national narcissists might not support proenvironmental actions, they would support promoting a proenvironmental image of their nation (i.e., greenwashing). In five studies (overall N = 2231), we demonstrated that individuals high in national narcissism were less likely to support actual proenvironmental actions, but more likely to support greenwashing campaigns.

Implications for promoting proenvironmentalism across distinct groups are discussed.

Keywords: conservation psychology; social identity; collective narcissism

This work was supported by the National Science Center Grant 2018/29/B/HS6/02826.

How social norms affect people's willingness to act for climate?

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Climate activism is a unique example of collective action. Even though it is in most people's best interest to become involved in efforts to address the problem of climate change, most people remain disengaged even when they recognize how important the threat is - not only for them personally, but also large groups of people and the nature. Understanding differences between climate activists and disengaged majorities could help reduce the gap in climate action. The goal of the three quantitative studies (N = 1437) conducted in different contexts was to examine the impact of social norms on activists and nonactivists and their willingness to engage in climate activism and support governmental regulations. We found that social norms impact disengaged people's willingness to engage on behalf of the climate to larger extent than activists.

Keywords: collective action, social norms, apathy, climate

The climate for discussions. American climate scholars and society: dialogue or denial?

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My presentation's topic reflects American climate scholars' presence in the public sphere. It started with an observation that when we discuss climate change in the context of science-society relations, we often miss one element in the equation: scientists themselves. What we take for granted is their role in communicating and promoting climate knowledge and confronting climate change denial in public. Not only do they fight with misinformation, but as a result, they are often targeted and discredited by climate change deniers [1]. I focused my research on climate change communication in the US because of the particularity of its climate denialism, which has an organized and well-funded structure [2]. It challenges the American scientific community and forces scholars to act beyond their academic comfort zone.

Concerning how pressing the climate change issue is, many scholars perceive active participation in public debate as a responsibility. At the same time, due to their expertise and study, climate researchers are also listed among the social groups most profoundly affected by the emotional burden of climate change [3]. Being "professionally depressed," yet often expected to provide reassurance to others. Therefore, I place climate scientists at the center of climate change discourse. Consequently, I am interested in them not only as authors of scientific discoveries and future climate scenarios but also as communicators and social actors in the fight against global warming, better or less prepared to bear the emotional burden of these confrontations.

To gain academic knowledge of the public activities of climate scientists and obtain quantitative and qualitative data to analyze their communication strategies, I conducted in-depth interviews based on a semi-structured questionnaire. I sampled 15 American climate scholars known for their commitment to climate change communication and asked them about: their responses to climate change denial; strategies they adapt to promote science and actions required by scientific findings; the extent to which they speak in public and openly confront deniers; and methods they developed to cope with the rejection. The study was conducted during my research visit to the US, where I worked under the supervision of prof. Naomi Oreskes (Harvard University).

Identifying the main barriers that climate scholars encounter while communicating their findings to the public is critical to moving from "climate change" to "climate to change" [4]. By presenting American climate scholars' perspectives, I believe this study will be another step in filling the knowledge gap and inspiring broad international discussion on climate science communication and science-society dialogue on climate change.

Keywords: climate change communication, climate scholars, climate change denial, social communication

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Eco-emotions and activists' well-being - a qualitative case study of climate activists' movement in Poland

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The climate crisis is the greatest contemporary challenge faced by communities and individuals from various regions of the world. In addition to the motivational factors of engagement in global climate action that are addressed by social psychology research, emotional suffering, deteriorated mental health and well-being experienced in the context of climate crisis became a focus of psychological studies. Research on the rise in anxiety levels, PTSD, and severe stress among residents of regions affected by extreme weather events, wildfires, and droughts is growing exponentially. However, less space is devoted to the experience of people who live in relatively safe regions but are deeply concerned with climate catastrophe. Trying to understand their emotional well-being, we conducted a qualitative case study of a group of climate activists, who are described as a particularly sensitive population. Participants were recruited from one of the grassroots environmental movements active in Poland. Our study consisted of a six-month ethnographic participatory observation of support group meetings, climate emotions diaries carried by the activists, and a series of in-depth individual interviews. The results provided insight into their diverse experiences of climate crisis and climate activism, depending on the age, gender, and other personal characteristics of the participants. Usually, climate emotions are not addressed directly in conversations between climate activists. They are rather expressed as moral feelings and everyday concerns. Many emotions are associated with the activism itself, often communicated with the words "fatigue" and "burden". However, working in an activist group can be empowering and emotionally relaxing.

Keywords: climate emotions, well-being, climate activists, case study

Vegetarians are more Distressed by Climate Change than Non-Vegetarians and They are more likely to Engage in Climate Change Mitigation Behaviour

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Climate change is arguably the greatest threat to the world at present. The recent ICCP report provides indisputable evidence that unless greenhouse gas levels decrease, a series of catastrophes will occur that will result in the widespread destruction of life on Earth. Moreover, mitigating climate change requires action at the individual and institutional levels. Raising animals for slaughter creates large amounts of greenhouse gases, and so there have been calls for reducing meat consumption, including following a vegetarian diet, and consistent with this, many vegetarians are concerned about environmental degradation due to the production of meat. This begs the question about whether vegetarians are more distressed by climate change and more engaged in climate change mitigation than meat-eaters.

In four samples, we examined how vegetarians and non-vegetarians differed in terms of climate change distress and climate change mitigation behavior. The samples were convenience samples of university students in the US (n = 1894) and in Poland (n = 584), a nationally representative sample of adults in Poland (n = 1054), and a nationally representative sample of adults in the US (n = 1098, with vegetarians oversampled). In each study we measured the distress people felt about climate change and climate change mitigation behavior. These constructs were measured slightly differently across the studies. Regardless of how these constructs were measured, vegetarians were more distressed by climate change than non-vegetarians, and vegetarians reported engaging more often in climate change mitigation than non-vegetarians.

The present results suggest that the vegetarian community can be an important voice in the fight against climate change.

Keywords: Climate change distress, climate change mitigation, vegetarianism

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Development and validation of the Emotional Climate Change Vignettes

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The climate emergency requires urgent action. Yet, despite convincing evidence of the links between human activity and climate change, carbon emissions from human activities are still rising [1]. Numerous studies investigated how particular emotions - such as anger, anxiety, and sadness - are related to individual and collective climate-friendly behavior and intentions [eg. 2, 3, 4]. Choosing appropriate stimuli to reliably induce emotional states in an experimental setting is important for advancing the research on affective predictors of climate action taking. Existing standardized databases of stimuli suitable for studying the emotional response to climate change typically use visual material [5, 6]. Here, we introduce a novel Emotional Climate Change Vignettes (ECCV) dataset. ECCS consists of 100 realistic, short personal stories aimed at eliciting five distinct emotions found especially relevant to climate change (anxiety, anger, guilt, hope and compassion). The stories were composed on the basis of in-depth explorative interviews with 40 individuals highly concerned about climate change and a survey conducted in the general population. In a multi-step validation procedure, the emotional properties of the stories were rated by over 400 Polish participants. Moreover, the content and formal properties of the stories were further provided. ECCV provides researchers with the means to investigate the effect of distinct emotions on environmental attitudes, climate action taking, or mental health and wellbeing. The ECCV set is freely accessible to the scientific community for noncommercial use.

Keywords: climate emotions; climate change; emotional stimuli set; emotional stories

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Climate Catastrophe in the Light of Class Conflict: (Post)operaist Analysis of the Trade Union "Przeróbka" Activity for the Just Transformation in Poland

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This paper aims to answer the question of to what extent the activity of the Polish Trade Union "Przeróbka" (Związek Zawodowy "Przeróbka", ZZ "Przeróbka") can be read as an example of a grassroots ecological policy of the working class. I consider the proposed analysis crucial due to the need to develop a narrative regarding planetary changes that would be acceptable by the greater part of society (and thereby: new voters with a pro-ecological attitude). Nowadays, over 80,000 people in Poland work directly in the mining sector, while another 400 thousand perform mining-related professions. This is a significant group that needs to be taken into account when implementing the energy transition. Positioning operaism and postoperaism as the theoretical framework of the conducted research, I draw from the achievements of sociologists of unionism as the basis for my methodological workshop. The research material consists of official postulates and public speeches given by members of ZZ "Przeróbka". I intend to trace the changes in the rhetorics of unionists in the light of the European Green Deal and its impact on the ecological policy of the Polish government. I would like to present mining organizations as independently defining the interests and needs of their communities, hence, operating autonomously in the face of government transformation projects. Ultimately, I argue for considering my paper as an incentive to carry out further, in-depth sociological research, which, adequately to the development of events, would revise the research perspective proposed in the work. As I hold, the stake of the scrutinised phenomenon is the possibility of creating a politics of the commons, thus, such a community that creatively nurtures social relations and the wealth we share, which is the natural environment.

Keywords: coal mining, Italian theory, just energy transition, trade unions

Session X. Climate Change and Pandemic risks

Session Chair: Anna Moniuszko (Department of Infectious Diseases and Neuroinfections, Medical University of Bialystok)

Climate change may be putting people at risk for more pandemics like COVID-19. Habitat loss due to climate is bringing animals that can transmit disease in contact with humans more often. In this session, we will learn how climatic changes influence the risks of pandemic outbreaks by changing environments and disease transmission vectors. Lessons from historical pandemics and future strategies for pandemic risk reduction are highly valued too.

KEYNOTE LECTURE:

How might climate change affect important vector tick species in Central Europe?

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The two most important vector tick species in Central Europe are *Ixodes ricinus* (castor bean tick) and *Dermacentor reticulatus* (meadow tick). Both are members of the family Ixodidae (hard ticks), and both spend only a few weeks parasitic on hosts, but their ecology and ecophysiology during the remaining extended periods spent off the host differ. The life cycle of *I. ricinus* takes 4−6 years with long breaks between the 3 bloodmeals, but the development of *D. reticulatus* from the egg stage to the unfed adult must take place within only one growing season, and only the adult stage is long-lived. *Ixodes ricinus* is an inhabitant of forests and forest edges and also forest-like locations (parks, cemeteries etc.), whereas *D. reticulatus* prefers more open, steppe-like landscapes. *Ixodes ricinus* takes advantage from shady, summer-cool woods with a permanent leaf litter that offers a rather constantly humid microclimate throughout the year. In contrast, *D. reticulatus* profits from higher microclimatic summer temperatures, and they survive periods of dryness better than *I. ricinus*. Although both species co-occur in large parts of Central Europe, they prefer different microhabitats, and climate change might have a different effect on these two tick species and the abundance of the pathogens they transmit. This will be outlined in the present contribution based on some essential biological facts about both tick species.

Keywords: Ticks, Ecology, Ecophysiology, Weather

Emerging and re-emerging diseases

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In 2007 the World Health Organization that infectious diseases are emerging at a rate that has not been seen before and since the 1970s, about 40 infectious diseases have been discovered.

One of potential factors influencing on the sudden outbreak of emerging diseases is changing climate. Global warming resulting in milder winters with fewer days of frost and warmer summers allow the infectious diseases vectors to expand into new geographic areas.

For vector-transmitted diseases, biological traits of both the vector and the pathogen may be sensitive to climate (biting rate, adult lifespan, population size and distribution) and the pathogen (extrinsic incubation rate). The influence of climate is different in dependance on the specific disease, for example for Zika virus disease, climate change may lead to an expanded range, while for malaria it may shift the spatial range of the infection to higher latitudes. Roughly 60% of new pathogens come from animals — including those pressured by diversity loss — and roughly one-third of those can be directly attributed to changes in human land use, meaning deforestation, the introduction of farming, development or resource extraction in otherwise natural settings. Vector-borne diseases — those carried by insects like mosquitoes and ticks and transferred in the blood of infected people — are also on the rise as warming weather and erratic precipitation vastly expand the geographic regions vulnerable to contagion.

Changing condtions of the enviroment have complex influence on the infectious diseases incidence, especially vector-borne disease. This fact has to be taken into consideration in preparing epidemiological survivalance in the whole globe.

Keywords: climate change; emerging; re-emerging; diseases

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Artificial intelligence to predict West Nile virus outbreaks with eco-climatic drivers

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In Europe, the frequency, intensity, and geographic range of West Nile virus (WNV)-outbreaks have increased over the past decade, with a 7.2-fold increase in 2018 compared to 2017, and a markedly expanded geo- graphic area compared to 2010. The reasons for this increase and range expansion remain largely unknown due to the complexity of the transmission pathways and underlying disease drivers. In a first, we use advanced artificial intelligence to disentangle the contribution of eco-climatic drivers to WNV-outbreaks across Europe using decade- long (2010-2019) data at high spatial resolution. We use a high-performance machine learning classifier, XGBoost (eXtreme gradient boosting) combined with state-of-the-art XAI (eXplainable artificial intelligence) methodology to describe the predictive ability and contri- bution of different drivers of the emergence and transmission of WNV-outbreaks in Europe, respectively [1]. Our model, trained on 2010-2017 data achieved an AUC (area under the receiver operating characteristic curve) score of 0.97 and 0.93 when tested with 2018 and 2019 data, respectively, showing a high discriminatory power to classify a WNV-endemic area. Overall, positive summer/spring temperatures anomalies, lower water avail- ability index (NDWI), and drier winter conditions were found to be the main determinants of WNV-outbreaks across Europe. The climate trends of the preceding year in combination with eco-climatic predictors of the first half of the year provided a robust predictive ability of the entire transmission season ahead of time. For the extraordinary 2018 outbreak year, relatively higher spring temperatures and the abundance of Culex mosquitoes were the strongest pre- dictors, in addition to past climatic trends. Our AI-based framework can be deployed to trigger rapid and timely alerts for active surveillance and vector control measures in order to intercept an imminent WNV-outbreak in Europe [1].

Keywords: West Nile virus; XGBoost; Climate adaptation; Preparedness;

References:

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Increase of health risks due to living in the vicinity of air pollution hot-spots

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Air pollution is an immense problem in Poland, especially because of frequent short-term (days, weeks) episodes of high concentration of PM10 and PM2.5 (smog). The main reason of this situation is related to emission from solid fuel (coal and biomass) combustion in individual households. Therefore, the highest concentrations can be most often observed in small towns which lack district heating or gas network. Moreover, air pollution hot spots, which are usually single houses characterized by excessive emission, can be identified in each municipality. Emission from such hot-spots pollutes neighbouring areas and causes increased health risk for citizens. These locations can be identified with the so-called transect method, which is based on mobile measurements and allows evaluation of pollutants' concentration in real time. As a result, concentration data coupled with geographical information is created. Post-processing of such data provides spatial representation of air quality during smog episodes, which helps identification of the aforementioned hot-spots.

Authors of this study decided to transpose such spatially distributed concentrations into health risk estimates. First step was to assign the transect measurements to a particular grid. Next, the instantaneous measurement values were extrapolated into proxy for a longer timestep and then the values assigned to particular grid cells were compared with the measurements available from stationary monitoring stations, which allowed further extrapolation into spatially distributed 24h average concentrations. This procedure was necessary to refer the PM10 concentrations to the existing air quality standards and to conduct the assessment of health risk. Second step focused on application of existing concertation-response functions for asthma attacks and hospitalization. Using World Health Organization Air Quality Guidelines as a reference for PM10 concentrations, for each grid cell we calculated the increase of health risk related to the pollution level estimated in that cell. Our results provide spatial representation of the risk increase for asthma symptoms and hospitalization in 5 municipalities in selected smog-episode days.

Keywords: air pollution hot-spot, PM10, asthma, hospitalization

The study was conducted under the grant "Integrated support system for policies and programs Limiting Low Emissions—ZONE" and co-financed by the National Center for Research and Development under the strategic and R&D work "Social and economic development of Poland in the conditions of globalizing markets" GOSPOSTRATEG with the number Gospostrateg1/385807/4/2018/NCBR

Waste management in the COVID-19 pandemic

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The COVID-19 pandemic has affected all aspects of everyday life as well as the industrial sector. Numerous problems caused by successive waves of disease, and thus - limitations in social and economic life, contributed to the disturbance of many systems, including waste management. Issues in this regard appeared globally, especially in the initial phase of the pandemic, when there was an unexpected increase in medical waste and problems with its proper management. The crisis also affected municipal waste management, with an increase in their quantity as well as changes in the qualitative composition. Another challenge was the proper classification of waste, as well as the handling of the so-called „coronawaste" – waste masks, gloves or home kits for self-testing. All these aspects forced the introduction of immediate actions to prevent the negative impact of waste on the environment and climate. Nevertheless, it was not possible to reduce the effects of the pandemic in all aspects in the context of waste management, as exemplified by the numerous online reports on the increasing amount of plastic in the oceans, which was also due to waste disposable masks and gloves used to protect against SARS-CoV-2 virus infection.

Taking into account the various challenges and potential changes in the quantitative and qualitative streams of medical and municipal waste, a thorough analysis of the available statistical data on the management systems of these types of waste in Poland in 2020 and 2021 was made. The results were discussed in the context of the actual impact of the COVID-19 pandemic on waste management. The actions that could be taken in the future were also indicated.

Keywords: waste management, COVID-19 pandemic, Circular Economy, climate change

COVID-19 pandemics - what have we learnt?

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According to the WHO, the most important threats to human health in the 21st century include air pollution, non-communicable diseases such as diabetes, cancer, heart disease, the global flu epidemic, living in regions of the world without sufficient health care and people are exposed to, among other things, famine, drought and armed conflicts (approx. 850 million), increasing antibiotic resistance, Ebola haemorrhagic fever and other high-risk pathogens, hemorrhagic fever, fever, and other diseases. The global influenza epidemic, living in regions of the world without sufficient health care and people are exposed to, among other things, famine, droughts and armed conflicts (approx. 850 million), increasing antibiotic resistance, Ebola and other high-risk pathogens, Dengue haemorrhagic fever, HIV infection, poor primary health care, lack of vaccination, and, from autumn 2019, infection with the seventh human pathogenic beta-coronavirus SARS-Cov-2, the first cases of which have been observed in the city of Wuhan, China.

For reasons that are not fully understood, it has not been possible to contain the outbreak to its localised location. The consequence of the infection, which is mainly airborne and droplet-borne, is a disease known as Covid-19, fortunately only observed in about 20 % of infected patients, manifesting mainly as severe interstitial pneumonia with a mortality rate of more than 30 % in elderly patients with coexisting multimorbidity. However, asymptomatic patients are also an active source of infection. Hence the importance of consistent action by the authorities of a country and the maturity of the population in complying with current, although not necessarily popular, sanitary restrictions, keeping a distance in personal contacts, avoiding enclosed spaces and the need for constant ventilation, wearing protective masks of appropriate quality in enclosed spaces and mass vaccination, both basic and booster doses. As far as Poland is concerned, the Covid-19 epidemic showed that we are to a large extent a non-citizen society, poorly educated, susceptible to "fake news"; at the same time, the necessary anti-epidemic measures of the authorities were often adversely affected by political factors.

Keywords: SARS-Cov-2, Covid-19

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WORKSHOPS

WORKSHOP 1- Thursday 29th September *09:00-10:30*
How to involve stakeholders in the climate-related R&I projects?

Session chair: Joanna Komperda Polish Science Contact Agency "PolSCA" of the PAS in Brussels

Being ready to identify and engage different actors to work hand in hand on research projects is the key step to address and tackle grand challenges of the climate change. Thanks to this session we will find out how joint projects can benefit from multi-actors approach and stakeholders' contribution. We will discover valuable guidelines and specific methodologies, learn from practitioners and their good practices on creating living labs and engaging local communities, and other valuable participants.

Keynote speaker: Heather Mckhann
Invited speakers: Joanna Suchomska & Lidia Sas Paszt

WORKSHOP 2 – Thursday 29th September *18:15-19:00*

Communicating climate changes Q&A session

Session chairs: Aleksandra Kardaś & Jakub Małecki – *Nauka o klimacie*

How to communicate the results of climate change research? How do you explain the complexities of how the climate system works to your friends and relatives? How do you debate the deniers of anthropogenic climate change? These and other questions will be answered by the unique experts of Nauka o Klimacie – Aleksandra and Jakub.

WORKSHOP 3 -Friday 30th September *09:00-10:30*

Tackling Climate change challenges at the academia and institutions in Poland

Dobre praktyki i aktywności polskich środowisk akademickich i instytucji w kontekście zagadnień związanych z ochroną klimatu

Session chair: Izabela Sówka, Politechnika Wrocławska

Warsztaty w języku polskim, 30.09.2022 r. godz. 9:00- 10:30, biblioteka Uniwersytetu Wrocławskiego

9:00 - Przywitanie osób prezentujących oraz uczestników warsztatów: dr hab. Izabela Sówka, prof. Politechniki Wrocławskiej

9:05 - Katastrofa klimatyczna – źródła, oblicza i przeciwdziałanie - aktywizacja proklimatycznego potencjału poszczególnych dyscyplin : Dr hab. Jacek Schindler, Uniwersytet Wrocławski

9:15 - 'Learning-by-doing' czyli jak wprowadzić zagadnienia związane z ochroną klimatu do edukacji. Przykład EKOEksoc : dr hab. Małgorzata Burchard-Dziubińska, prof. Uniwersytetu Łódzkiego

9:25 - Zielony uniwersytet – działania Uniwersytetu Ekonomicznego w Krakowie na rzecz środowiska naturalnego : dr Monika Sady, Uniwersytet Ekonomiczny w Krakowie

9:35 - TBA : dr hab. Bożena Ryszawska, prof. Uniwersytetu Ekonomicznego we Wrocławiu

9:45 - Obszary działań i aktywności uczelni wyższych na rzecz ochrony klimatu - przykład Politechniki Wrocławskiej : dr hab. inż. Izabela Sówka, prof. Politechniki Wrocławskiej

9:55 - Działania w zakresie ochrony klimatu w Poznańskim Centrum Superkomputerowo-Sieciowym : dr hab. Ariel Oleksiak, Poznańskie Centrum Superkomputerowo-Sieciowe (PCSS)

10:05 - Opracowanie narzędzi i analiz wspierających drogę do neutralności klimatycznej : dr Krystian Szczepański, Instytut Ochrony Środowiska -Państwowy Instytut Badawczy.

ARTISTS

BŁOTO - BIO

Bloto (The Mire) is a band that came into being accidentally, yet naturally, like a puddle after a rainy day. It all started in the summer of 2018 when the Wrocław-based EABS sextet had a day off between concerts in Brzeg Dolny, Łódź and Sopot. On the way to TriCity, the lineup in the car was getting smaller and smaller. Marek Pędziwiatr aka Latarnik (keyboards / synthesizers), Paweł Stachowiak aka Wuja HZG (bass), Marcin Rak aka Cancer G (drums), Olaf Węgier aka OlafSaxx (tenor saxophone) and Maciek Jakimiuk (sound engineer) stayed in the car.

It was Friday afternoon when the band were passing Gdansk. Somewhere on the way to Wejherowo one of the guys mentioned that there is a nice recording studio nearby... An evening off, a well-tuned rhythm section on the road, harmonious as can be, and a great deal of creative potential within the members of the Błoto band forming at that very moment stirred up common enthusiasm. However, the studio that the band was passing was not really available at short notice. Fortunately, the burning desire to record something new did not stop the group. It was Grzegorz Skawinski of the legendary polish synth-pop group Kombi who eventually hosted the band in his superbly equipped Maska studio that Friday evening. This is where Błoto was born. Two years on from these events, the band continue to collaborate and release new albums.

After the surprising success of their debut album, the dust has yet to settle. Pandemic disrupted all promotional plans, so the band didn't get an opportunity to promote and tour the first album well, and despite the immediate sale of their entire record stock, the band decided not to re-press again. Following the blow, Błoto, known for improvising in difficult conditions, released their second album of 2020, entitled 'Kwiatostan' on Astigmatic Records in collaboration with the Jassmine club in Warsaw.

In early 2021, the reality around us continued to provide inspiration for the team to create. That is why the Błoto quartet, having another point of attachment, only needed a small impulse to enter the studio. The reason for the next musical meeting turned out to be Program Two of the Polish Radio, which came out with the initiative of inviting the band to "Domówka z Dwójką". This was the starting point for "Acids and Bases". The third full-fledged Mud album. The team has always operated in the sphere of metaphors close to nature. It is similar this time, but Mud has gone deeper into "chemical compounds" called acids and bases. In the end, the theme of the album cleverly avoids the direct meaning of these words, playing with convention again. A set of improvised beats refers to interpersonal relationships, which nowadays often have an extreme, corrosive and explosive nature, so we need a framework that will allow us to counteract them.

The music is deeply rooted in brutal hip-hop grooves, referring quite loosely to the sound of the 90s. Dirty and uncompromising, this music's strength lies in the drums and bass. Radical in a sense, it also captures the atmosphere of the times in which it is created. The times of climate change, distinct social divisions, hate speech, growing nationalism, police brutality, nepotism, political deals

and the dismantling of legal state structures. All this is happening before our eyes. Our soil is eroding right now.

Band members:

Latarnik - piano, synthesizers, percussions

Wuja HZG - bass guitar, percussions

Cancer G - drums

OlafSaxx - tenor, soprano and baritone saxophone, perscussions

Discography:

Błoto - *Erozje* [Astigmatic Records, 2020]

Błoto - *Kwiatostan* [Astigmatic Records, 2020]

Błoto - *Kwasy i zasady* [Astigmatic Records, 2021]

Social Media:

https://www.facebook.com/blotoquartet/

https://www.instagram.com/bloto_quartet/

https://bloto.bandcamp.com/

"Kwartet Błoto powstał naturalnie przy okazji wspólnego muzykowania. Samo utworzenie nazwy zespołu sprowokowało nas do zabawy wielowymiarowością tego słowa. Najdobitniej przedstawiał to nasz pierwszy album „Erozje", który opowiadał o niszczycielskim wpływie człowieka na gleby. Opowiadał - to za dużo powiedziane, ponieważ była to muzyka bez słów, a odpowiednią intencję nadawały utworom ich nazwy (np. „Ziemie Zdegradowane Przez Człowieka" albo „Bielice"). Dzięki temu ta muzyka, rzekomo ilustracyjna, otworzyła pole do dyskusji na tematy istotne w kwestii ekologii. Nasz zespół nadał buntowniczy kolor naszej rodzimej jak i światowej scenie jazzowej. Dzięki temu, chociażby przy okazji wywiadów możemy nie tylko rozmawiać o samej muzyce, ale też uświadamiać naszych odbiorców o opłakanym stanie naszej planety."

Marek Pędziwiatr

KAROLINA JACEWICZ, FRYDERYK SZULGIT

Poznańscy artyści audiowizualni, których praktyka artystyczna w dużej mierze dotyczy zmian klimatycznych - zwrócenia uwagi na procesy oraz konsekwencje.

Karolina Jacewicz

Absolwentka dwóch kierunków: Animacji oraz Projektowania Graficznego, aktualnie doktorantka na Wydziale Grafiki i Komunikacji Wizualnej UAP.

Twórczyni kilkunastu wielkoformatowych projekcji multimedialnych w różnych przestrzeniach miejskich m.in na festiwalu Urban Affairs w Berlinie, Outer Spaces w Poznaniu, Festiwalu Światła I Mappingu Skyway w Toruniu, Lumo Bialistoko, oraz autorka licznych scenografii multimedialnych do oper wystawianych m.in w Polsce, Chinach, Grecji, Bułgarii, Hiszpanii, Argentynie, Estonii. Współautorka instalacji multimedialnej Drogi Innowacji podczas Ceremonii Otwarcia Europejskiej Stolicy Kultury 2016 we Wrocławiu.

Jej klip do utworu Marcina Zabrockiego "Herbu warkoczyk" został nominowany poza konkursem do nagrody YACHA oraz nagrody głównej na Ogólnopolskim Festiwalu Filmów Animowanych O!PLA.

Prelegentka TEDx oraz wykładowczyni na UAP.

Fryderyk Szulgit

Absolwent kierunku gitara jazzowa na Poznańskiej Akademii Muzycznej oraz Wydziału Malarstwa Uniwersytetu Artystycznego w Poznaniu. W swoich kompozycjach zawiera elementy współczesnej produkcji, jazzu, fusion, muzyki western, ambientu, free jazzu oraz wszelkich zdobyczy muzyki eksperymentalnej. Wykorzystuje improwizację jako pełnoprawną składową kompozycji. Laureat głównej nagrody w na festiwalu Art Of Improvisation.

Zajmuje się instrumentalistyką, produkcją muzyczną, kompozycją, aranżacją, realizacją nagrań oraz sztukami wizualnymi opartymi na nowych mediach.

W ramach konferencji zostaną zaprezentowane dwa projekty duetu:

TOGETHERNESS

Lodowiec. Niewyobrażalnie stary, powoli topniejący relikt minionych tysiącleci oraz zagadka i pewnego rodzaju “archiwum dziejów”, które bardzo pomału, niechętnie i w sposób zdawkowy dzieli się z ludzkością swoimi tajemnicami.

Jedną z takich tajemnic są także polskie lasy.

W plejstocenie lądolód zajmował ogromne połacie kontynentu wielokrotnie. Ostatnim wspólnym momentem i zarazem rozstaniem był okres zlodowacenia północnopolskiego, które zakończyło epokę lodowcową.

Lądolód cofnął się w stronę północy pozostając na Islandii i opuszczając tereny dzisiejszej Polski, pozwalając na bujny rozwój form życia, a w tym bogatych puszczy i lasów, które odegrały niebagatelną rolę w rozwoju naszej kultury karmiąc, dając schronienie i surowce naszym praprzodkom.

Zderzenie tych dwóch światów można interpretować w kontekście pewnej przerwanej historycznej koherencji i spotkania po latach.

Dwoje polskich artystów postanowiło przenieść polskie lasy na lodowiec w sposób metaforyczny za pomocą projekcji video. Ta wizja określa naszą rzeczywistość, współczesność jako czas wielkich i gwałtownych zmian, których jesteśmy obserwatorami, oraz przedstawia byty pradawne, majestatyczne, wieczne (drzewa, lodowiec) jako wręcz efemeryczne, kruche, przemijające. Ta przemijalność niesamowitych zjawisk, pomników przyrody jest przede wszystkim motywacją do artystycznej i poznawczej eksploatacji tego, czego przyszłe pokolenia mogą już nie doświadczyć.

"TOGETHERNESS"

Incredibly old and unchangeable in its form, a slowly melting relic of past millennia. It is a great mystery and a kind of "archive of the World" that reluctantly reveals its mysteries to humans. One of such mysteries are also the Polish forests. In the Pleistocene, the ice sheet occupied vast expanses of the continent several times. The last moment that connected Polish forests and a glacier was the period of the Weichselian glaciation, which ended the Ice Age and at the same time tore them apart. The ice retreated to the north, staying in Iceland and leaving the territory of today's Poland. It allowed for the growth of various life forms, including lush forests and primeval forests, which played a significant role in the development of our culture by providing our ancestors with shelter, food and raw materials. The clash of these two worlds can be interpreted in the context of a certain interrupted historical coherence and a reunion after long separation. Two Polish artists decided to metaphorically transfer Polish forests to the glacier with a use of video projections. Their vision reflects on today's reality and our contemporaneity as a time of great and rapid changes that all of us can witness. It is an attempt to present ancient, majestic, eternal beings (trees, glaciers) as almost ephemeral, fragile and transient forms of existence. This transience of incredible phenomena and natural monuments is, most of all, a motivation for the artistic and cognitive exploitation of what future generations may no longer experience. The project has been executed within "Polish Culture Around the World" programme by @Instytut Adama Mickiewicza.

OBRAZ LIMINALNY

Termin „liminalność" w języku polskim po raz pierwszy pojawił się w przetłumaczonym na polski dziele „Obrzędy przejścia" etnografa Arnolda van Gennepa. W języku angielskim słowo „liminality" pochodzi od łacińskiego „līmen", oznaczającego „threshold" („próg").

Obraz liminalny zatem to obraz, który znajduje się w stanie przejściowym. Próba zdefiniowania jego koncepcji i formy w drodze praktyki artystycznej jest pytaniem zarazem o kondycje wytwarzanych przez ludzkość „obrazów", relacje człowieka z naturą w dobie przyśpieszającego kryzysu klimatycznego (nieuchronnego końca) oraz o indywidualną samoświadomość jednostki w obliczu nieustannej zmienności czasoprzestrzeni.

Motyw przemijalności towarzyszy sztuce niemalże od samych jej początków. Jednak dzisiejsze czasy znacznie odbiegają od poprzednich tysiącleci istnienia ludzkości i widmo katastrofy nigdy nie były tak bliskie i realne.

Od początku XIX wieku (kiedy postęp technologiczny wraz z przemysłem zaczęły radykalnie przyśpieszać) do dziś - ludzkość powiększyła się o ok. 6 miliardów istnień, co jest znacznym obciążeniem dla planety.

„Tempo wzrostu poziomu oceanów od połowy XIX w. jest większe niż średnie tempo w poprzednich dwóch tysiącach lat" - możemy wczytać w raporcie IPCC z 2013r., a od lat 80 XX wieku straciliśmy ok 2,5 mln km2 masy lodowcowej w rejonach arktycznych. Tempo topnienia kluczowych dla świata lodowców Grenlandii i Antarktydy rośnie w coraz większym tempie, na co bezpośredni wpływ ma działalność człowieka.

Takiego tempa zmian i destrukcji planety przez jej mieszkańców nie było nigdy wcześniej - ostatnie 100 lat naszej działalności miało większy wpływ na środowisko naturalne niż dziesiątki tysięcy lat.

Obecna sytuacja i prognozy sugerują, że właśnie dziś znajdujemy się na progu („līmen") - w kluczowym dla ludzkiego świata momencie przejściowym, tuż przed katastrofą.

Punkt „na progu", w którym się znajdujemy wymaga zdefiniowania na nowo pojęcia przemijalności (liminalności) w sztuce, co wiąże się z potrzebą skonstruowania nowego modelu obrazu - nie tylko adekwatnego do czasu i miejsca, ale wybiegającego dalej - aby zadać pytanie: co może nastąpić po przemijaniu lodowców?

Większość prac pokazanych na wystawie (w technologicznym aspekcie) jest zaprojektowana w sposób nietrwały - ich treść zniknie częściowo lub w całości na skutek czynników, które mają wpływ także na lodowce - światło, woda, powietrze.