Book of abstracts
Interdisciplinary - Multicultural - International

Oral presentations given on-line at BUP Symposium 2020
Challenges and Possibilities for Sustainable Development in a Baltic Sea Region Context

Current policy, planning and research on sustainable development, and in particular the Sustainable Development Goals (SDGs), provide an arena for possible changes, transformations and innovations in society. At the same time there are huge challenges and complexity to meet when goals towards sustainable development goes in parallel with other goals, trends and tendencies in society at large eg related to lifestyles, consumption, mobility, poverty and growth. The United 2030 Agenda for Sustainable Development includes 17 goals with indicators to monitor progress. The Academia and research community constitute a crucial group of stakeholders who can strongly support the achievement of the SDGs. Whether it is at the global, regional or local level, universities can contribute in multiple ways, through knowledge generation, innovations, data, technical analysis, and above all through training the next generation of students in building a sustainable future. The Baltic University Programme contributes as a regional actor in this work.

Working for sustainability in a Baltic Sea Region context requires an inter- and transdisciplinary approach to overcome challenges and in developing possibilities. The BUP Research Forum documents and promotes scholarly research that stresses challenges as well as show how efforts within different research fields can contribute towards implementation of sustainability in practice in the Baltic Sea Region. The BUP Research Forum challenges researchers from different disciplines with an interest in the Baltic Sea Region as an empirical field, to present research relevant in a sustainable development perspective. This Book of Abstracts is a compilation of the 84 oral presentations held at the symposium. The abstracts have been written by some 219 colleagues. The presentations of research findings were an opportunity to disseminate and take part of new knowledge and to get published in three Special Issues in scientific journals.
It is great to experience that so many colleagues submitted an abstract to the BUP Research Forum. The ones being accepted and later on orally presented, is found in this Book of Abstracts.

Enjoy!

Madeleine Granvik, Dr., Associate Professor
Director The Baltic University Programme
1. Climate Change and Renewable Energy

Climate change refers to the changes that occur in the world’s climatic systems caused by anthropogenic emissions of greenhouse gases. As stated by the Paris accord, the world’s countries have agreed to limit the global temperature increase to no more than 2°C above the pre-industrial levels. At the same time, the countries have also pledged to aim for a global average increase of 1.5°C. Renewable energy plays a crucial role in the transition to a zero-emission society. Changing our energy production becomes essential in order to phase out the fossil fuels. It will require both technological and societal changes to accomplish such a transition. Science is already and will continually play a crucial role in the mitigation and adaptation to climate change, as well as transforming our energy production to be renewable.

Coordinator
Joakim Widén, Prof., Uppsala University, Sweden

Scientific Committee
Joakim Widén, Prof., Uppsala University, Sweden
Aiste Balžekienė, Assoc. Prof., Kaunas University of Technology, Lithuania
Viktor Karamushka, Prof., National University of Kyiv-Mohyla Academy, Ukraine

Contributors
Iryna Artsukevich, Implementation difficulties of heat pumps in Belarus
Ranjula Bali-Swain, Implication of electricity taxes and levies on Sustainable Development Goals in the European Union
Aistė Balžekienė & Agnė Budžytė, The role of Environmental Attitudes in Explaining Public Perception of Climate Change and Renewable Energy Technologies
Anna Bernaciak, Towards sustainable academic infrastructure - contemporary challenges and model solutions
Svitlana Boychenko, Viktor Karamushka, Climate change processes impact on wetland ecosystems of Polissia Region in Ukraine
Irina Danilovich, Moisture conditions changes over East Europe with a focus on Belarus
Teija Järvenpää, Practical solutions for increasing energy efficiency in the maritime cluster
Linas Kliučininkas, Climate change mitigation in the Baltic Sea region: balancing socio-economic and technological development
David Lingfors, Determining the feasibility of solar power parks at northern latitudes through utility-scale solar guides
Andrey Nikishin, Wind energy - one of the options for sustainable development of Kaliningrad region energy sector
Laurynas Virbickas, Environmental impact assessment of biofuels production processes from various types of woody biomass. A case study in Scots Pine forests stands
Olexandr Zbrutskyi, Passive Remote Study of the Aerosol in the Upper Atmosphere of the Earth
Magnus Åberg, Can district heating production in Uppsala become a carbon sink? – An investigation of BioCCS potential
Implementation difficulties of heat pumps in Belarus

_Iryna Artsukevich_

Any human habitat requires thermal control creating a favourable climate for living. Humanity spends up to 30% of energy resources on this problem. The way to decline these figures is one of the directions in the fight against global climate change on our planet. Heating engineering technologies for premises vary from a region to a region. In most countries buildings are heated individually.

A radically different heating system still exists in the countries of the former USSR. This is central heating. With lavish energy resources central heating was mostly paid by the state. Its basis is the presence of a large thermal power station and a branched heat pipe network coming from it, so that numerous consumers are supplied. As a result, the consumption of thermal energy in Belarus significantly exceeds the EU standards.

Environment Facility through The United Nations Development Programme allocated $ 4.9 million to equip them with new technologies: including heat pumps that use ground heat. However, at the moment it turned out that at the existing tariffs for central heating and electricity, the residents of these buildings refuse using a heat pump. The fact is that to get thermal energy using a heat pump, it is necessary to use electricity the cost of which significantly exceeds the savings obtained by using the pump. The state subsidizes the payment of thermal energy to its citizens. Thus, the cost of one GCal received through central heating is BYN 18,4831 or $ 8,72 and the same amount of heat generated by electricity costs BYN 38,96 or $ 18,38. The only way out in this situation is to change the government pricing policy about it.

**Keywords**
central heating, The Global Environment Facility, heat pumps

**Author**
Iryna Artsukevich, Ph.D. Assoc. Prof., Docent
Faculty of Engineering and Construction
_Yanka Kupala State University of Grodno_
Grodno, BELARUS
allmazz@tut.by
Implication of electricity taxes and levies on Sustainable Development Goals in the European Union

Ranjula Bali Swain & Amin Karimu

Environmental/energy taxes are supposed to benefit the environment but may also have macroeconomic benefits such as increase in employment and economic growth. The current high electricity prices in the European Union (EU) due in part as a result of high taxes may have some influence on some of the sustainable development goals (SDGs). In this study, we examine the synergy and trade-off effects of electricity taxes on selected SDGs for EU countries. Using panel data and panel vector autoregressive estimation approach, our findings revealed that higher household electricity taxes reduces both carbon emission and unemployment, which is in line with the double- divided hypothesis of such taxes. Whereas higher industry electricity taxes increase responsible production and consumption (SDG12) and a reduction in unemployment. Moreover, there is evidence of a strong synergy effect between electricity taxes, unemployment and carbon emission but a trade-off between tax and SDG9 (innovation and sustainable infrastructure). Furthermore, taxes contribute significantly to future variation of unemployment, carbon emission, economic growth, responsible production and consumption in the EU.

JEL Classification: H2, Q56, O13, O14, Q41, Q43

Keywords
Electricity, EU, Household, Industry, Tax, Sustainable development goals

Authors
Amin Karimu
University of Ghana Business School,
Legon, GHANA
a.karimu@ug.edu.gh

Ranjula Bali Swain
Misum, Stockholm School of Economics,
Stockholm, Sweden
Södertörn University
Stockholm, SWEDEN
Ranjula.Bali@hhs.se
The role of Environmental Attitudes in Explaining Public Perception of Climate Change and Renewable Energy Technologies

Aistė Balžekienė & Agnė Budžytė

Public support for renewable energy technologies is crucial in energy transition, yet public attitudes towards preferable energy sources are ambiguous, including concerns about high costs of renewables or little capacity of renewable to ensure energy needs. Public support for energy technologies can be explained by general public worldviews and environmental attitudes, and also by concern with climate change. Understanding this link helps to identify challenges in energy transition that are related to public support and public acceptance of renewable energy technologies.

This presentation will analyse how environmental attitudes, measured in New Environmental Paradigm scale (NEP) are shaping public attitudes towards climate change and acceptance of renewable energy technologies in Lithuania. Presentation is based on the data from representative public opinion survey, conducted in autumn 2018 in Lithuania (N=1029). This study includes NEP scale, and also variables measuring climate change concern, risk perception of non-renewable and renewable energy technologies and social acceptability of different energy sources.

The divide between human exceptionalism paradigm versus new environmental paradigm (developed by environmental sociologists Dunlap and Van Liere in 1978, and later constantly tested and revised), identifies the transition between anthropocentric towards eco-centric worldview. And in the case of energy transition, it could identify the shift from support of non-renewable energy sources to the support of renewables.

Empirical data of our study revealed that NEP scale items work in different directions with the risk perception of renewable energy technologies, and non-renewable. People with stronger pro-environmental attitudes perceive risks from renewables as less risky and most significant dimension from NEP predicting perception of renewables, is related to the balance of nature.

Keywords
Climate change, risk perception, environmental attitudes, renewable energy technologies

Authors
Aistė Balžekienė, Ph.D., Assoc. Prof. Civil Society and Sustainability Research Group Kaunas University of Technology Kaunas, LITHUANIA aiste.balzekiene@ktu.lt
Agnė Budžytė, PhD candidate, lecturer Civil Society and Sustainability Research Group Kaunas University of Technology Kaunas, LITHUANIA a.budzyte@ktu.lt
Towards sustainable academic infrastructure - contemporary challenges and model solutions

Anna Bernaciak, Wojciech Kisiala & Katarzyna Suszyńska

A common and significant problem that universities face nowadays is the decapitalization of the technical infrastructure, particularly the real estate they are housed in. Modernization of the university's infrastructure aims on the one hand to improve safety and work environment, and on the other hand helps to achieve increasingly stringent ecological standards relating to energy efficiency, sustainable resource management or minimize negative impact on users. The process of thermal retrofit is particularly urgent, yet expensive and difficult to implement for universities. For some facilities, it may also require the removal of asbestos.

Currently, the leading economic university in Poland - Poznan University of Economics and Business, is facing such a challenge. A comprehensive thermal retrofit project of one of the university's main buildings is being implemented. University authorities have undertaken a number of organizational, informational and educational activities stemming from legal requirements, management standards and environmental procedures.

The aim of the study is to indicate a model solution in the implementation of the processes of modernizing the technical infrastructure of the university and adapting it to current environmental standards. To achieve this goal, the organizational conditions of the process were presented and the reaction of the academic community to the investment was examined. As a result, the conclusions may serve as recommendation for other universities facing this type of challenge.

Authors

Anna Bernaciak, PhD, Assistant Prof.,
Faculty of Management
Poznan University of Economics and Business
Poznan, POLAND
Anna.Bernaciak@ue.poznan.pl

Wojciech Kisiala, PhD
Faculty of Management
Poznan University of Economics and Business
Poznan, POLAND
wojciech.kisiala@ue.poznan.pl

Katarzyna Suszyńska, PhD
Faculty of Management
Poznan University of Economics and Business
Poznan, POLAND
katarzyna.suszynska@ue.poznan.pl
Climate change processes impact on wetland ecosystems of Polissia Region in Ukraine

Svitlana Boychenko & Viktor Karamushka

Under the influence of global warming, obvious changes in the environment are taking place that have already led to some negative environmental consequences and will further exacerbate them in the future. The analysis of instrumental observations data of meteorological stations network in Ukraine showed that the surface temperature on the territory of Ukraine has increased by 1.2 ± 0.2 °C per 100 years for the period 1900-2019. However, climate change processes in Ukraine have regional features. Thus, during the same period, in the northern, north-eastern and north-western regions, covering the territory of the Polissia, warming is more intense than over Ukraine in general (1.7 ± 0.4 °C per 100 years). During 1971–2019, the annual temperature increase in the Polissia regions was even higher (about + 0.04–0.05 °C per year). Precipitation regime has changed as well. The annual amount of precipitation in this humid region reduced by 10-15% per 100 years (for XX century). However, in the period 1971-2018, the annual amount of precipitation decreased by 30±5%, mainly in the summer (July-August). Monitoring stations have recorded a slight increase in the cold period with annual amount of precipitation 530–630 mm. Anomaly high-temperature indicators, alternating with the cool, long absence of atmospheric precipitation with sudden heavy showers, a manifestation of a number of adverse events (drier, dust storms, heavy winds, etc.) became the causes of degradation of some ecosystems in this region. Wetlands ecosystems, typical for Polissia, represent one of the most sensitive indicators of these environmental changes. The study paid special attention to the state of wetlands located in the Polissya region. Field studies of wetlands of the left-bank Polissia region have revealed the specific destruction of birch enriched biotopes. Relation of such destructions with extreme weather events has been confirmed. Most affected ecosystem services of such biocenoses has been determined, described and assessed.

Keywords
Climate change, wetland ecosystems, biocenoses

Authors
Svitlana Boychenko, Dr. of Science, Assoc. Prof.
S.I.Subbotin Institute of Geophysics of the NAS of Ukraine / National University of Kyiv-Mohyla Academy
Kyiv, Ukraine
uaclimate@gmail.com

Viktor Karamushka, Ph.D. Assoc. Prof.
National University of Kyiv-Mohyla Academy
Kyiv, Ukraine
vkarama2011@gmail.com
Moisture conditions changes over East Europe with a focus on Belarus

Irina Danilovich

The aim of the present study is an analysis of current regional peculiarities of the moisture regime and atmospheric circulation as a main climatic driver, estimation of the prevailing cyclonic passes over East Europe region and its climatology.

The hypothesis of the research work is that climatic changes observed in the study region in the recent decades (in first order, regional changes of the moisture pattern, number and spatial distribution of extreme events) are caused by changes in the frequency of cyclones of different origin which led to various hydrometeorological conditions on their passes. According to the Assessment of Climate Change in the Baltic Sea basin (2008 and 2015) moisture regime changed in the Baltic Sea basin during last 100 years. Precipitation increased in most regions of the Baltic Sea basin, but the significant growth is noticed in north. Insignificant changes were found in the center and south of the Baltic region. The increase of precipitation in the northern part of the Baltic Sea basin is associated with an increase in the frequency and intensity of extreme precipitation events. The neutral and negative trends in precipitation were detected for the central and south regions of the Baltic Sea basin. At the same time drying conditions were observed during last decade in the region and showed a certain constancy of drying periods in many regions of the Baltic Sea basin.

The territory of Belarus as a part of the Baltic Sea basin is characterized by moisture regime transformation. The annual precipitation insignificant increased in Belarus – up to 5% in the north and up to 7% in the south-east. The largest changes in precipitation are detected in winter and might be explained by the atmospheric circulation peculiarities in the Atlantic-European sector. In summer the increase of precipitation noticed in July. Also, the growing of precipitation extremes was marked: the rainfall duration has reduced while absolute maximum precipitation amounts have increased, especially in the southern and central regions of the country. Despite some increase of precipitation, the drying conditions are intensifying in Belarus, especially during the green season.

Keywords
Precipitation, drying, atmospheric circulation, extremes, climate

Author
Irina Danilovich, Ph.D, Lead Researcher
Institute for Nature Management, National Academy of Sciences
Minsk, BELARUS
irina-danilovich@yandex.ru
Practical solutions for increasing energy efficiency in the maritime cluster

Teija Järvenpää & Minna M. Keinänen-Toivola

The environmental regulations regarding climate change are increasing, as well as the requirements for energy efficiency. The regulations and requirements affect also the maritime cluster that works with shipping industry and shipbuilding processes. The companies in the maritime cluster require a lot of energy, e.g. electricity, heat and fuels, in order to build ships, transport goods and heat buildings. When there is high energy consumption, there is also great potential for saving energy and increasing the usage of renewable energy. The three-year (2018–2020) SataMari project (https://sub.samk.fi/satamari/) finds practical solutions to increase the energy efficiency of the maritime cluster especially in the Satakunta region in Finland, at the coast of the Baltic Sea. SataMari is based on a Living Lab concept and the project has a port area and an industry park with shipyard as pilot sites in Rauma, Finland. SataMari focuses on studying the current energy efficiency status of the region’s maritime cluster, raising awareness of energy efficiency and piloting energy efficient solutions within the aspects of legislation, technology and finance in the maritime cluster. Already 495 kWp of solar power have been installed during the project, and energy savings have been done e.g. by decreasing the indoor temperature in a maritime industry hall. Best available techniques will be applied, but people play a major role in the energy transition, too. The project raises awareness about energy wise manners with presentations, webinars and meetings with target groups but also with open access online material, such as reports, videos and a decision-making tool. The main result of the SataMari project is the decision-making tool that serves as a data bank on how to improve energy efficiency and increase renewable energy use in the maritime cluster. The competitiveness of the region will be increased when companies in the maritime cluster achieve savings in their energy usage and develop new products and services in the field of energy efficiency and renewable energy. Awareness about more energy efficient solutions will be raised not only in the Satakunta region but also more widely in the Baltic Sea area.

Keywords
energy efficiency, maritime cluster, energy consumption, renewable energy

Authors
Teija Järvenpää, B.Eng. Project Researcher
Faculty of Technology
Satakunta University of Applied Sciences
Pori, FINLAND
teija.jarvenpaa@samk.fi

Minna M. Keinänen-Toivola, Ph.D.
Research Manager
Faculty of Technology
Satakunta University of Applied Sciences
Rauma, FINLAND
minna.keinanen-toivola@samk.fi
Climate change mitigation in the Baltic Sea region: balancing socio-economic and technological development

Linas Kliučininkas & Remigijus Čiegis

Shared Socioeconomic Pathways (SSP) are scenarios of projected socio-economic global changes up to year 2100. The SSPs are based on five narratives describing alternative socio-economic developments, including sustainable development, regional rivalry, inequality, fossil-fuelled development, and middle-of-the-road development. The long-term demographic and economic projections of the SSPs depict a wide uncertainty range consistent with the scenario literature. They are used to derive greenhouse gas emissions scenarios with different climate policies. The overview of the SSP and their energy, land use, and emission implications were investigated by Riahu et al, 2017. The methodological approach of global socio-economic pathways extension to the Baltic Sea was developed by Zandersen et al, 2019. The extended SSP narratives are intended as sectoral developments at regional scale that enable detailed scenario analysis and discussion. The authors focus on agriculture, wastewater treatment, fisheries, shipping and atmospheric deposition, which all represent major Baltic Sea long-term environmental problems.

The aim of this study was to provide a long-term climate change mitigation narratives for the Baltic Sea region countries. The study has taken into consideration scenarios of socio-economic development and likely levels of climate change mitigation technologies. Also, possible regional development addressing “post Covid-19” climate change narrative is being discussed. The analysis comprised the major sectors contributing to the green house emissions, i.e. energy generation, agriculture, industry and transport. These sectors were considered as the main regional drivers for change. The pressures, in the form of greenhouse emission changes, were estimated and presented as the outcome results of the study. The insights into the driving forces and obstacles of regional climate change mitigation trajectories being discussed. The obtained results were compared to the findings of the other authors.

Keywords
Shared socio-economic pathways, Baltic Sea region, greenhouse emissions.

Corresponding author
Linas Kliučininkas, Ph.D., Prof.
Department of Environmental Technology
Kaunas University of Technology
Kaunas, LITHUANIA
linas.kliucininkas@ktu.lt
Determining the feasibility of solar power parks at northern latitudes through utility-scale solar guides

David Lingfors, Alfred Birging, Oskar Lindberg, Irene Almenar Molina & Joakim Widén

In the Baltic region, photovoltaic (PV) systems are in most cases placed on rooftop. This is not in line with the general global trend, where solar parks of several megawatts are dominating. However, due to decreasing system prices, solar parks are becoming more common also at northern latitudes. Currently, solar parks require cheap land, and therefore they are often placed in rural areas. However, in these areas the electricity grid is not as robust as near cities. To avoid costly grid-reinforcements, it is therefore important to find a resource-efficient strategy that identifies both suitable land and strong points of connection to the existing grid. In this study, this was done by developing a utility-scale solar guide methodology, similar to existing guides for wind power. The results of the study show that more than 90% of the substations in a rural distribution grid can accept a 1 MWp PV park. However, this potential is limited by the distance to suitable land, and for larger parks there are only a few substations that can host the connection without jeopardising the power quality of the grid. 4% of the municipality area is suitable for 1 MWp PV parks, but only 1% is within 750 meters from suitable substations. Furthermore, the methodology can be used to study the probability of grid-related problems in different scenarios of both supervised and unsupervised deployment of PV parks in a distribution grid, which would be useful for regional planners, grid operators and PV contractors.

Keywords

Corresponding author
David Lingfors, Ph.D., Researcher
Department of Civil and Industrial Engineering
Uppsala University
Uppsala, SWEDEN
david.lingfors@angstrom.uu.se
Wind energy - one of the options for sustainable development of Kaliningrad region energy sector

Andrey Nikishin & Edgar Harzfeld

For the moment the energy safety of Kaliningrad region (KR) is largely dependent on the mutual electrical energy exchange through existing connections to Lithuania and further to Belarus and Russia. Taking into account the upcoming KR energy system disconnection from Lithuania, followed by isolated operation (starting from 2025) and wind energy potential of KR, the question of electrical production by wind as an option for KR sustainable development should be considered.

The aim of the paper is to compare three different connection possibilities for onshore power plans (WPP) of different capacity (30 and 90 MW) based on preliminary system power flow calculations using especially developed energy system model, which are:

1. connection of WPPs to the existing substations of the grid;
2. connection of WPPs to “Wind Grid” (“WG”) – new lines and substations in energy system especially constructed for wind energy production;
3. simultaneous connection of WPPs to existing substations and to “WG”.

The results of the calculations show, that 1st option is the cheapest, but not viable, because WPPs create additional problems with voltage levels and lines overload. Some measures to overcome observed problems are proposed.

The electrical system parameters, such as voltage levels, power flows and power losses are very close for the 3rd and 2nd options. The 3rd option is more expensive, because of additional switching equipment, but most flexible and easy to handle for system operator. The conclusion of the paper: the wind as the new electricity source for KR will need system reinforcement and upgrade.

Keywords
Wind energy, electrical energy system, renewable energy, energy safety

Authors
Andrey Nikishin, Ph.D. Assoc. Prof., Docent Department of Electrical Equipment of Ships and Electrical Power Engineering Kaliningrad State Technical University Kaliningrad, RUSSIA Andrey.Nikishin@outlook.com
Edgar Harzfeld, Ph.D. Assoc. Prof., Docent Department of Electrical Power Engineering and Renewable Energies Hochschule Stralsund Stralsund, GERMANY edgar.harzfeld@hochschule-stralsund.de
Environmental impact assessment of biofuels production processes from various types of woody biomass. A case study in Scots Pine forests stands

*Laurynas Virbickas & Irina Kliopova - Galickaja*

European countries set more and more goals in the field of renewable energy sources. In northern countries, where there is not so much sun but sufficient forests, biofuels are the main renewable energy source. In Lithuania, more than 60% of thermal energy is produced from biofuels, and by 2050 the goal is to reach 100%. Many claims that the use of biofuels for energy production is environmentally neutral due to the carbon accumulated during plant growth. However, it has not been estimated how much additional energy is needed to produce a certain amount of energy from forest resources. Considerable amounts of fossil fuel are used in the harvesting process for mechanized harvesting, loading, shredding of biomass and biofuel transportation to combustion plants. Logging waste potential in Lithuania is over 1 mil. m\(^3\) per year. The most common tree species in the country is Scots Pine (Pinus Sylvestris) – 34.6%.

An experiment was carried out in the final felling forest areas with a purpose to determine the energy consumption for the preparation and transportation of woody biomass and to determine the main output of the processes (timber, firewood, and logging waste). These data were used for the created database with various material, energy and fuel flow charts for further estimation.

The results of analysis show that over 160 t of different biofuel (bark, cuttings, sawdust, and logging waste) can be produced from pine biomass, selected from 1 ha of fertile area during forest main felling (after 100 years), and over 500 MWh of thermal energy can be supplied to heat supply system, incl. 140 MWh due to burning logging waste.

The efficiency of energy recovery in the case of biofuel production from Pine stands forest is up to 96%. The energy consumption of this system is about 43 kWh per MWh of produced heat energy per 1 ha. The direct impact on air quality due to air emissions is 1.36 kg MWh\(^{-1}\) per 1 ha. The direct impact to clime change due to GWP is 5.61 kg CO\(_2\)e MWh\(^{-1}\) per ha (without assessing biogenic origin GHGs) and over 410 kg CO\(_2\)e MWh\(^{-1}\) per ha, incl. biogenic CO\(_2\).

**Keywords**

Biofuel production, biomass, forest residues, efficiency.

**Authors**

Laurynas Virbickas, Phd student
Institute of Environmental Engineering
*Kaunas University of Technology*
Kaunas, LITHUANIA
laurynas.virbickas@ktu.edu

Irina Kliopova, Assoc. Prof. dr.
Institute of Environmental Engineering
*Kaunas University of Technology*
Kaunas, LITHUANIA
irina.kliopova@ktu.lt
Climate changes on planet Earth are mainly caused by disturbances in the energy balance of the Sun-Earth system. It causes a decrease in the power of the ozone layer, the formation of "ozone holes" and global warming on the planet and other disasters. To study the causes of these factors it was proposed to conduct a satellite polarimetric experiment on passive remote study of the upper atmosphere of the Earth in the ultraviolet region of the spectrum in order to obtain information about the physical properties of the stratospheric aerosol according to the results of polarimetric and photometric measurements. Compared with other similar experiments, the proposed method for remote study of aerosol from space allows to cut off the influence of the tropospheric component of the atmosphere and the Earth’s surface and, as a result, to isolate the polarization component of the stratospheric aerosol for research in its pure form. To confirm the correctness of the chosen research ideology, the model was created and carefully examined at a specially designed and manufactured stand, later adapted for ground-based observations and mounted on the AZT-2 astronomical telescope. The cloudless sky observations showed that the polarization on the phase curve varies from minus 3 to 32%. A comparison analysis of the observational data with the calculation results shows that our observations best fit the calculations for the particle size \( r_0 = 0.16 \mu m \) and the real part of the refractive index \( n_r = 1.33 \) in the troposphere and up to 1.42 for the stratosphere. Therefore, it can be concluded that even such an approximate analysis of polarization observations of a cloudless sky under terrestrial conditions, both during the day and after sunset, indicates the possibility of studying the physical characteristics of the aerosol in the troposphere and stratosphere, respectively. And conducting a space experiment to study changes in the polarization component of the stratospheric aerosol in the ozone layer of the Earth will allow us to obtain data, the analysis of which will make it possible to judge the causes of the change in the thickness of this layer in the Earth’s atmosphere.

Keywords
onboard polarimeter, remote measurements, aerosol, ozone layer

Authors
Petro Nevodovskyi, PhD, Senior Scientist
Main Astronomy Observatory of NAS of Ukraine, nevod@mao.kiev.ua

Olexsandr Zbrutskyi, DrSc, prof
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”
zbrutskyi@kpi.ua

Anatoliy Vid’machenko, DSc, prof
Main Astronomy Observatory of NAS of Ukraine, vido@mao.kiev.ua

Mykhaylo Geraimchuk, DSc, prof
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”
geraimchuk@kpi.ua

Orest Ivakhiv, DSc, prof
Lviv Polytechnic National University
oresti@polynet.lviv.ua

Yurii Hirniak, Mgr
Lviv Polytechnic National University
yurii.b.hirniak@lpnu.ua
Can district heating production in Uppsala become a carbon sink? –
An investigation of BioCCS potential

Magnus Åberg, Robert Djurberg & Nader Padban

The importance of carbon sinks to mitigate the consequences of global warming have been stressed by the IPCC in the scenarios responding to the COP21 goals. In Sweden, district heating is the dominant heat supply technology for multi-family residential buildings. Large shares of the used fuels for heat production in these systems are biomass-based fuels and partly municipal solid waste. District heating production is generally large-scale and centralized, this provides an opportunity to apply carbon capture and storage (CCS) technology. Therefore, the combination of biomass fuels, which are carbon neutral, and CCS provides a possible carbon sink. This study aims to investigate the potential of implementing CCS-technology to the existing district heat production system in Uppsala, Sweden. Focus is on technologies that are mature enough to be implemented in a near future, but also on technologies that are less mature and require a more futuristic perspective. The heat production system in Uppsala is simulated using a tool that is based on production cost-optimization with linear programming. The scope of the analysis is also widened so that the global CO$_2$ emissions from heat and electricity production in the district heating plants are quantified. The difference in global climate impact between the current heat production and the heat production with implementation of CCS is investigated. The results indicate to what extent district heating production with CCS in Uppsala can contribute to local authorities’ ambitions to become a climate positive region.

Keywords
BECCS, district heating, carbon-sink, negative emissions

Corresponding authors
Magnus Åberg, Ph.D. Assoc. Prof., Department of Civil Engineering and Built Environment, Uppsala University, Uppsala, SWEDEN
magnus.aberg@angstrom.uu.se

Nader Padpan, Senior R&D advisor, Vattenfall Research and Development, Stockholm County, SWEDEN
Nader.Padban@vattenfall.com
2. Sustainable Societies

Wellbeing has direct correlations to several factors influencing the everyday quality of life, such as health, human rights, economy, the environment and poor management of our scarce resources. A sustainable society focuses on the current and future well-being of its citizens and the environment. The three spheres of sustainability encompass many concepts which explain how decisions and actions can have an impact on the overall sustainability of our world. In this perspective the issues of legislation and planning are essential.

How policy, planning, implementation and practice on local, regional and global levels involve issues on sustainable development matters in making progress. Planning is crucial in handling the many interests involved in decisions and actions influencing the society today and future. Issues such as public involvement and participation, transparency, the access principle and freedom of speech are crucial in the development of sustainable societies. Failing to put emphasis on the social factors influenced by decisions or actions may result in the collapse of the spheres of sustainability, and society as well. Research is crucial for a sustainable outcome and mitigation of the many interests involved in decisions and actions influencing our society today.

Coordinator
Joakim Ekman, Prof., Södertörn University, Södertörn, Sweden

Scientific Committee
Joakim Ekman, Prof., Södertörn University, Södertörn, Sweden
Hele Kiimann, Dr., Uppsala University, Sweden
Ildikó Asztalos Morell, PhD, Assoc. Prof. Department of Urban and Rural Studies, Swedish University of Agricultural Sciences, Sweden

Contributors
Anija Apsite, In search of a theoretical framework of factors influencing work and life balance & job satisfaction ..........................................................18
Ildikó Asztalos Morell, Indigenous-food-systems-in-transition ...........................................19
Janis Brizga, Towards sustainable societies local practice developments in Latvia: pro-environmental behavior studies in municipalities ..................................................20
Bárbara Maria Fritzen Gomes, Business incubators as a driver for sustainable development in Baltic Sea Region .................................................................21
Dorota Kamrowska-Zaluska, Digital transformation - chance or threat for regenerative transition of the cities? .....................................................................................22
Viktor Karamushka, Integrating environmental sustainability and climate change considerations into strategic planning of sustainable development of amalgamated territorial communities in Ukraine .................................................................23
Joanna Rutecka-Gora, Challenges of the sustainable development of supplementary pension markets – the case of individual pension products in Poland .........................................................24
Hanna Sasinovich, International engagement in the waste management for sustainable society ......25
In search of a theoretical framework of factors influencing work and life balance & job satisfaction

Annija Apsīte

The topicality of work and life balance has been growing in the past decades and it has gained attention from both sides – from the side of an individual and the side of an organization. The capacity of a healthy individual is not compatible with the needs of every role for the individual to be brilliant in all areas. This issue has not been left unnoticed since more and more individuals are experiencing the consequences of work and life imbalance. The imbalance in turn results as dissatisfaction of both work and life, it leads to greater stress levels and thus to stress related illnesses i.e. burnout. In extreme cases individuals may even experience so called „karoshi”, which is a phenomenon that appeared in the 70ies of 20th century in Japan and literally means „overwork death”.

From the organization point of view, work-life imbalance is an important factor itself when analysing efficiency of an enterprise – it may cause intentional or unintentional absence at work, high employee turnover, low productivity, higher insurance costs, low job satisfaction and other consequences. Also, this topic has received awareness due to increased importance of employer branding since organizations are eager to find out, what strategy should the organization choose to attract and retain employees due to deficiency of professionals. In this paper the aim is to examine and understand the theoretical framework of WLB and job satisfaction issues by looking deep into the existing literature connected with the influencing factors of these phenomenons to meet needs of both – the organization and the individual.

In the research it was found out that there are both individual and organizational factors, for instance, job involvement, tenure, workload & scheduling, organizational culture (leadership, recreational opportunities, flexibility, supervisor support, autonomy, boundary management, alternative working methods etc.), occupational stress, salary and others. It is important to mention that the importance of these factors differs, especially if these factors are measured across several fields.

Keywords
Job satisfaction, work and life balance, karoshi, wellbeing, employer branding

Author
Annija Apsīte, lecturer, Mg.admin.
Department of global economics and interdisciplinary studies
Faculty of Business, Economics and Adiministration,
University of Latvia
Riga, LATVIA
annija.apsite@lu.lv
There is a rise in global awareness for a holistic approach on food systems with more reliance on traditional food. The indigenous food systems of the Arctic create good example for holistic utilisation of reindeer, its adaptation, co-existence to the local environment and utilization of local biological diversity. From originally being part of a subsistence economy, reindeer is today commodified. This makes products available for a wider public, at the same time there is a growing interest for reindeer meat.

Therefore, we can see a future potential for products utilising traditional knowledge (freezed steaks, minced meat, smoked or dried venison, reindeer side streams utilised in other industries). New technologies can open new connectivity between producers and consumers concerning food products as seen with the ‘Internet of foods’. ICT technology allows food products to be scanned for information on culture, ethics, transparency, nutritional quality and carbon footprint of foods.

Meanwhile, the commodification of reindeer products implies several challenges for the social, economic and ecological aspects of the traditional food system. Another challenge is how this transition interacts with the rights of indigenous people to control access to knowhow, materials and benefits of value-adding activities.

This paper develops a participatory design for collaboration between academia and SMEs engaging with reindeer products and how such collaboration can forward the capabilities of reindeer herders to assess new consumer groups and take advantage of ICT technology to process and market their products.

Keywords
Indigenous-food system, reindeer herding, enterprise, empowerment,

Corresponding author
Ildikó Asztalos Morell, Ph.D. Assoc. Prof., Docent
Department of Urban and Rural Development
Swedish University of Agricultural Sciences
Uppsala, SWEDEN
ilandiko.asztalos.morell@slu.se
Towards sustainable societies local practice developments in Latvia: pro-environmental behavior studies in municipalities

Janis Brizga, Raimonds Ernsteins, Liga Biezina & Liga Zvirbule

Long term studies in Latvia recognize that there is not sufficiently effective environmental governance integration into statutory municipal development governance, with related planning, implementation and its monitoring practice, towards achieving necessary progress for pro-environmental behaviour (PEB) eventually to be aimed at all municipal governance processes, stakeholder segments and sectors for related practice actions of all target groups. Here we are aiming to provide insight into sustainable consumption governance multi-step interdisciplinary study in Latvia and related action policy practice developments. There was applied research-and-development framework overall approach and case study research method, including document analysis, semi-structured deep interviews with each stakeholder group representatives, and particularly, household pro-environmental behaviour questionnaire at national level (n=1004) and in two case study territories, as well as performed structured observations. Main attention was on PEB development in Latvia, taking into account individuals, households, communities and all other local society target groups, also business sector, but particularly local municipalities’ PEB development situation, perspectives and necessary instrumental requirements. PEB in the municipal practice was approached in the context of environmental (sustainability) communication action-oriented model frame by complementary and successively studying and also planning to enhance all four model components - environmental information and environmental education instruments, environmental participation and pro-environmental behaviour practice instruments, thus attracting also behavioural communication. In the studies and action policy proposal developments basic emphasis was focused on possibilities and conditions of public values-actions-loads interactions cycle further environmentally friendly development. Accordingly, in this context it is essential to explore, assess and in environmentally friendly manner further develop public values understanding and orientation, also daily practical action, behaviour and sustainable lifestyle, as well as societies at large and separate individuals and households environmental impact, anthropogenic loads. There were studied public governance process cycle basic components: values development planning process, content and documents; their implementation process and instruments, practical pro-environmental behaviors; monitoring and supervision of planning documents operation and public development. Study outcomes were discussed with main stakeholders and designed set of PEB development recommendations, step-wise realized in municipal practice as for now.

Keywords
values-actions-loads, households, environmental communication, research-and-development framework, instruments

Corresponding author
Janis Brizga, Dr.geogr. Lecturer
Department of Environmental Science
University of Latvia
Riga, LATVIA
Janis.Brizga@lu.lv
Business incubators as a driver for sustainable development in Baltic Sea Region

Bárbara Maria Fritzen Gomes

Business incubators are considered to be agents promoting innovation and when linked to universities they can promote technology transfer, entrepreneurship and transform research and development into innovation. Innovation is considered a transformational driver and a prerequisite for achieving the 17 UN Agenda 2030 Sustainable Development Goals. In this context, incubators are going beyond and realizing their role as possible agents for sustainable development by promoting start-ups that seek not only economic, but also social and environmental impacts. Several studies address business incubators and their impacts on the economic development of regions, but few emphasize the social, economic and environmental dimensions of sustainable development. This study aims to address this gap by analyzing the role and importance of university-linked business incubators in sustainable development in Baltic sea region context by case studies. The case studies demonstrate the perception of business incubator managers regarding sustainable development and global goals, the tangible benefits, barriers in inserting the concept into their daily routine, and how sustainable development concepts are implemented in the incubation stages. Recommendations on how university-linked business incubators can enhance their role as a driver for sustainable development in Baltic Sea Region are provided.

Keywords
Sustainability, incubators, businesses, universities, start-ups

Author
Bárbara Maria Fritzen Gomes, Ph.D. candidate
HAW - Hamburg University of Applied Sciences
Hamburg, GERMANY
barbara.m.fritzen@gmail.com
Today's processes of globalization and development of new disruptive technologies such as advanced machine learning, access to great amount of information (Big Data), real-time data based adaptive systems of virtual and augmented reality, especially embedded in urban space, strongly shape environment we live in and influence relations within the society (Castells, 1996). Smart solutions have a deep and pervasive impact on the spatial configuration and functioning of urban areas (Caragliu, et al. 2011; Neirotti, et al., 2014). Cities thought of as areas where the majority of innovations is being created and accumulated are also the places where those changes are the most distinctive.

At the same time, there is a need to change the paradigm as current patterns of consumption and development of human dwellings threaten the very existence of planetary ecosystem (C. Du Plessis, 2012). Implementing green growth, as this concept is understood by various global companies and governments, is not enough; there is a need to take positive steps to create regenerative cities (Girardet H., 2015). At the intersection of these two concepts the following questions, important for the future planning of the cities, have arisen:

1. What is the correlation between new smart solutions and regenerative planning of the cities?
2. What are the boundary conditions that allow digital transformation to support regenerative planning of the cities?
3. What is the role of civic society in this process (incl. co-design, co-creation of knowledge and open, civic innovations)?

The aim of the presentation is to examine the role of digital transformation in the process of regenerative transition of cities. It also evokes another issue which will be discussed during the presentation: what are the distinctive features of the Baltic Sea Region that influence this process. To support this query, case studies will be analysed, using projects assessment framework based on both quantitative and qualitative indicators. Apart from cognitive conclusions, recommendation for shaping sustainable, smart polices and projects on a local and regional level will be presented.

Keywords
regenerative city, digital transformation, urban development

Author
Dorota Kamrowska-Załuska, Ph.D. Assist. Prof.
Department of Urban Design and Regional Planning
Gdansk University of Technology
Gdańsk, POLAND
dzaluska@pg.edu.pl
Integrating environmental sustainability and climate change considerations into strategic planning of sustainable development of amalgamated territorial communities in Ukraine

Viktor Karamushka, Svitlana Boychenko & Ievgen Khlobystov

The state policy of Ukraine in the field of local self-governance envisages meeting the interests of residents of territorial communities and transferring to local self-governments more powers, resources and responsibilities. This policy is based on the provisions of the European Charter of Local Self-Government and the world's best standards of public relations in this area. In this regards, strategic planning of sustainable development of local communities has to take into account natural-geographical features of the territory, natural resources availability, level of economic development, and other factors. During last decades, climate peculiarities and, in particular, trends in climate change are becoming an important component of development initiatives. Summarizing an experience in integrating climate change considerations into strategic documentations of Amalgamated Territorial Communities (ATC), it is important to emphasize that assessment of resilience and adaptive capacity of the communities to the climate change is based on the implicit and explicit impact caused by weather phenomena. In general, the ATC have limited access to climate information at the local level, while living standards and job availability are largely dependent on climatic conditions. All these processes require the appropriate response from authorities, communities, the businesses, and such reaction must be reflected in the development strategies and action plans of the territories and communities. In these circumstances, one of the main roles of ATC is to ensure that climate risks are taken into account and the responsive actions are prepared. Assessment and management of an environmental risks, including those related to climate change, are especially necessary in regions that are already experiencing environmental stress or will be exposed to such risks in nearest future (first of all, in semi-arid, coastal and mountain regions). This paper focused on the discussions of the assessment of the climate risks, to which ATCs are exposed in different regions of Ukraine

Keywords
Local self-governance envisages, assessment of an environmental risks

Corresponding authors
Viktor Karamushka, Ph.D., Assoc. Prof.
National University of Kyiv-Mohyla Academy
Kyiv, UKRAINE
vkarama2011@gmail.com

Svitlana Boychenko, Dr. of Sc., Assoc. Prof.
National University of Kyiv-Mohyla Academy
Kyiv, UKRAINE
uaclimate@gmail.com
Challenges of the sustainable development of supplementary pension markets – the case of individual pension products in Poland

Joanna Rutecka-Góra, Milena Hadryan, Patrycja Kowalczyk-Rólczyńska
& Sylwia Pieńkowska-Kamieniecka

In the face of populations ageing, the future well-being of societies depends largely on the ability to provide adequate income in old-age. As mandatory pension systems are strongly reformed and state pensions are being reduced, more attention is paid to proper development of supplementary old-age pensions through the private markets. Financial institutions highly enjoy the proposals to broaden the supplementary pension coverage and introduction of tax favoured savings. However, too little attention is paid to fair and sustainable operation and development of supplementary pension markets.

The aim of the paper is to evaluate the individual pension market in Poland in terms of readability, clarity, efficiency and costliness of retirement products offered. The main question posed is whether they are efficient, understandable and beneficial not only for financial institutions. To examine the relations between the mentioned characteristics of pension contracts the correlation analysis was applied.

The research covers individual retirement products offered in Poland at the end of 2016. The results show that all retirement products are hardly understandable and unclear for individuals. Their efficiency and costliness differs a lot among providers, with voluntary pension funds being the most efficient ones. Moreover, there exists statistically significant positive correlation between the readability and efficiency of products offered by banks. In case of investment funds this relation was inverse.

Keywords
supplementary pension system, individual retirement accounts, pension savings, retirement products, efficiency of pension plans

Corresponding author
Joanna Rutecka-Góra, Ph.D., Adjunct Prof.
Institute of Statistics and Demography
Warsaw School of Economics
Warsaw, POLAND
jrutec@sgh.waw.pl
International engagement in the waste management for sustainable society

Hanna Sasinovich

The Thesis investigates the determinants and patterns of society and waste management in the context of sustainable development, social impact and input, relative factor endowments and preferences. Since the concept of sustainability was defined, several different indices and indicators have been developed in this area, which is becoming an ever-greater concern in society, since it will affect future generations. The 2005 World Summit on Social Development has identified three pillars of sustainability as Human Wellbeing, Environmental Wellbeing and Economic Wellbeing. Sustainability is the adjective for the economic development, the environment, and community. Waste management, probably more so than any other subject, needs updating because of the number of and rapidity of volume of waste generated. Proper waste management is a key element in ensuring resource efficiency and the sustainable growth of economies.

Thesis work includes the following sections:

- Theoretical and conceptual exploration of sustainable development.
- International experience of organizations in waste management.
- Improvement of waste management system in the Republic of Belarus in the context of sustainable development.

Thesis work presents the result of research concerning waste management system in the context of world economy and as one of the strategic goals of sustainable society. Sustainable society encourage activities that serve to prevent future harm. Rapid economic growth, urbanization and increasing population have caused (materially intensive) resource consumption to increase. Waste issues have been recognized as a global rather than local environmental problem and is correlated with sustainable society. International engagement plays an important role in the growth of economies across the world. Nowadays, we have global trend to reduce, re-use, rework, recycle, recover, so-called “waste products”. One company 's waste or even one person’s waste can become another company ’s (person's) valuable raw material. Selection of raw materials can improve the environmental profile of manufacturing. The purpose of the paper is to provide a different perspective how waste management impact the sustainable society. Improved waste treatment may be seen as the highest level in the hierarchy to protect the society and the environment better.

Keywords
waste, strategy, sustainability, efficiency, society, international engagement

Author
Hanna Sasinovich, Ph.D. Student
The Department of International Economic Relations
Belarusian State University
Minsk, BELARUS
aniutta1@mail.ru
3. Sustainable Water Resources

The field of sustainable water resources management has the challenge to adapt to the current and future issues facing the allocation of water. With the growing uncertainties of global climate change and the long-term impacts of management actions, the decision-making will be even more difficult. It is likely that ongoing climate change will lead to situations that have not been encountered. As a result, alternative management strategies are sought for in order to avoid setbacks in the allocation of water resources. Ideally, water resource management planning has regard to all the competing demands for water and seeks to allocate water on an equitable basis to satisfy all uses and demands. As with other resource management, this is rarely possible in practice. One of the biggest concerns for our water-based resources in the future is the sustainability of the current and even future water resource allocation. As water becomes more scarce, the importance of how it is managed grows vastly. Finding a balance between what is needed by humans and what is needed in the environment is an important step in the sustainability of water resources.

Coordinator
Artur Magnuszewski, Associate Prof., University of Warsaw, Poland

Scientific Committee
Artur Magnuszewski, Associate Prof., University of Warsaw, Poland
Aleksandra Ziemińska-Stolarska, Dr., Technical University of Lodz, Lodz, Poland
Walter Leal Filho, Dr. Prof., Hamburg University of Applied Sciences, Hamburg, Germany

Contributors
Lubos Jurik, Sustainability of water resources in the landscape with agricultural use………………..27
Juha Kääriä, Innovative Water Circulation in Turku region SW Finland...........................................28
Artur Magnuszewski, Urban flood exposition map of the city of Warsaw - example of climate change adaptation.................................................................................................................................29
Aliaksei Novik, The thermal regime of Belarusian lakes in conditions of climate change.............30
Petra Schneider, Role of the Water Energy Food Nexus in Industrial Applications: the Baltic Experience...............................................................................................................................................31
Petra Schneider, Jörg Slawinski, Nature-based Solutions in the Urban Realm: Water Related Applications in the Baltic Region ............................................................................................................................32
Olena Skyba, Regularities of content formation and distribution of phosphorus compounds in the rivers in Ukraine, and decreasing of phosphate content using higher aquatic plants..........................33
Rimantas Vaitkus, Practical method of cleaning of waste water left after extinguishing of fire of tires...................................................................................................................................................33
Aleksandra Ziemsinska-Stolarska, Continuous automatic monitoring as a method of assessing water quality on the example of large water reservoir in Central Poland.................................................35
Sustainability of water resources in the landscape with agricultural use

Lubos Jurik, Mohammad Ebrahim Banihabib, Aibek Ariyanov, Yesenkul Kalymbekova & Milada Stastna

Water is the largest natural resource but only just 1/3 is accessible for use in agriculture and cities. The agricultural sector has biggest part - 70% of the world’s annual water consumption, and it will be one of the first to feel problems with water quality and quantity of resources. Climate change and the hydrological variability of water’s distribution and occurrence are natural driving forces in all continents combined with the pressures from economic growth and major population change, make the sustainable development of our water resources a challenge. We can substantively predict short- or long-term variability in surface runoff and we can create solutions to deal with it. However, we do not have enough data on groundwater and aquifer systems, especially in developing countries where the lack of adequate surface water resources is most extreme. But we do not know the real and actual consumption of water for food production and we estimate it only on the basis of knowledge about current rainfall and runoff in rivers. However, this procedure does not ensure the sustainability of water resources in the country and their sustainable use for agriculture. The paper discusses aspects of sustainability of water use in relation to food production and climate change in different parts of the world.

Corresponding authors
Lubos Jurik, Prof.
Department of Water Resources and Environmental Engineering (WREE)
Fakulta záhradníctva a krajinného inžinierstva
Slovak University of Agriculture in Nitra
Nitra, SLOVAKIA
lubos.jurik@uniag.sk

Mohammad Ebrahim Banihabib, Prof., PhD
University of Tehran
IRAN
banihabib.m.e@gmail.com
Innovative Water Circulation in Turku region SW Finland

Juha Kääriä, Aki Artimo & Mirva Levomäki

Ensuring adequate drinking water supply and waste water treatment for rapidly expanding urban area requires creative solutions integrating regional watershed management with urban infrastructure. In order to increase the water security for the region of Turku in Southwest Finland, surface water from a watershed 90 kilometers away from Turku was utilised, then infiltrated into a large aquifer to produce drinking water, then extracted and transported by gravity to the Turku area. A regional wastewater treatment plant is then used to treat the waste waters of the 300 000 inhabitants living in the area. The water security plan was part of a larger “water circulation” management plan that includes power generation and energy recovery from a state-of-the-art wastewater treatment system that together produces 10 times the energy used for water distribution and treatment. In this paper, we discuss the water system in the context of developing a circular economy in Southern Finland.

Keywords
Water Circulation; Artificial ground water infiltration; Managed Aquifer Recharge; Wastewater treatment

Authors
Juha Kääriä, Ph.D. Manager of Climate Affairs, Principal Lecturer Engineering and Business, Chemical Industry
Turku University of Applied Sciences,
Turku, FINLAND
juha.kaaria@turkuamk.fi

Aki Artimo, Ph.D. Managing Director
Turku Region Water Ltd
Turku, FINLAND
aki.artimo@turunseudunvesi.fi

Mirva Levomäki, MSc in Engineering, eMBA, Managing Director
Turku Region Wastewater Treatment Plant Ltd.
Turku, FINLAND
mirva.levomaki@turku.fi
Urban flood exposition map of the city of Warsaw - example of climate change adaptation

Artur Magnuszewski & Maciej Lenartowicz

Warsaw is located in central-eastern Poland, has an area of 517 km$^2$ and is populated by over 1.7 million of people. To assess urban flood exposure this is necessary to include climatic factors (maximum daily precipitation sums), the relief influencing the structure of the urban drainage system, and the degree of soil sealing. First - the distribution of depression areas (closed basins) in Warsaw was calculated by processing of a digital terrain model with 30 m spatial resolution. Second layer - map of soil sealing was obtained from the Institute of Geodesy and Cartography based on the satellite images from LANDSAT 5 and 8 and took into consideration only the anthropogenic soil sealing. The third layer was a map showing spatial distribution of maximum daily precipitation sums in 2008–2014 obtained from the Institute of Geography and Spatial Planning of Polish Academy Based on data acquired from a network of 21 meteorological stations. The map of exposure to an urban flood hazard was obtained by superimposing the three input maps and summing the values in individual fields. The resulting map was reclassified into three classes denoting the areas with an increased, medium and lowered exposure to an urban flood hazard. The areas with values lying above the third quartile were identified as areas with an increased hazard, while the areas below the first quartile were qualified as the areas with a lowered hazard. New version of the urban flood exposition map takes as an input of rainfall field an operational data from Rain GRS synoptic product of now-casting provided by the Institute of Meteorology and Water Management. This product is an ensemble of data from ground measurements, meteorological radars and satellite images. This approach makes possible to create the dynamic map of urban flood exposure with the potential use for city emergency situation management in the city of Warsaw. The research was conducted for Fundacja Instytut na rzecz Ekorozwoju within the LIFE13INF/PL/000039 project entitled “Life_Adaptcity_pl – Preparation of a strategy of adaptation to climate change with use of city climate mapping and public participation,” funded under LIFE+ by the European Commission and the National Fund for Environmental Protection and Water Management.

Keywords
Warsaw, urban floods, risk exposition, Rain GRS

Corresponding author
Artur Magnuszewski, Ph.D. Assistant. Prof.
Department of Hydrology, Faculty of Geography and Regional Studies
University of Warsaw
Warsaw, POLAND
asmagnus@uw.edu.pl
The thermal regime of Belarusian lakes in conditions of climate change

Aliaksei Novik & Nina Sukhovilo

The thermal regime of lakes influences the development of physical, chemical and biological processes, which determines their trophic status. In turn, the spatial and temporal variability of the distribution of thermo- and hydrodynamic characteristics in lakes depends both on the zonal climatic features of the region, determining the influx of solar radiation, and on the morphometry of the basins, affecting the processes of mixing and redistribution of heat in the water column. The purpose of the study was to identify the relationships between climate conditions in Belarus and thermodynamic processes in different types of lakes.

We investigated thermal regime of 11 Belarusian lakes differing their origin, morphometry and trophic state. Our research was based on the data of the State institution "Republican center for hydrometeorology, control of radioactive contamination and environmental monitoring", and the Laboratory of Lake research of the Belarusian State University. Thermal stability of lakes was calculated using the thermodynamic model Lake Analyzer. Over the past three decades, the thermal stability and heat content of the studied lakes have increased. Average heat content in Lake Naroch risen from 5.4 to 5.6*10^16 J, in shallow lake Wygonoshchanskoe from 4.8 to 5.5*10^15 J. Surface water temperatures increased by 2 °C (from 19.5 to 21.5 °C). Bottom water temperature in stratified lakes during the period of summer stratification have decreased by 1 – 1.5 °C. In stratified lake Voloso Yuzhniy thermal stability can reach 1000 J/m². The mean is about 720 J/m². A more significant increase in thermal stability can lead to the oxygen depletion in the bottom water layers.

Based on the revealed patterns, an increase in summer heat contents of lakes by 5–8% is expected in the near future. It caused by an increase in air temperatures, which is most pronounced in the summer period. The ice-free period will be longer. As a result, anoxia will not form. The other important impacts of climate warming on lakes are lower transparency, change in mixing regimes from polymictic to dimictic, algal blooms and fall of water quality.

Keywords
lake, heat content, water temperature, thermal stability, climate change

Authors

Aliaksei Novik, PhD, Associate Prof., Docent
Department of Earth Science and Hydrometeorology
Belarusian State University,
Minsk, BELARUS
novikA@bsu.by

Nina Sukhovilo, PhD student,
Department of Earth Science and Hydrometeorology
Belarusian State University,
Minsk, BELARUS
SukhoviloNY@bsu.by
Role of the Water Energy Food Nexus in Industrial Applications: the Baltic Experience

Petra Schneider

The UN adopted the Sustainable Development Goals (SDGs) that range from ending global poverty to gender issues. An important point is ensuring water security and resource efficiency. Of particular note are the cross-connections between the SDGs and their integrative character. On an international strategic level, this integral interweaving of inter-sectoral aspects is called Nexus and denotes the interaction of system components in the form of dependency and impact. In recent years, it has been recognized that isolated, linear approaches to solving complex issues that the world is faced with under resource-limited conditions are unsuitable. Central challenges such as the supply of water, energy and food are therefore dealt with under the term “Water Energy Food Nexus” (WEF). Quantification base of WEF implementation is material flow analysis that allows resource flow optimization. In order to avoid or at least reduce competing usage claims, massive efficiency increases in resource use must be achieved worldwide. A further development of the WEF is Water-Soil-Waste Nexus (WSW) that includes waste management.

In industry, water is used for numerous production steps, including cooling, cleaning or as a solvent. Worldwide, the share of industry in water consumption is 4.7% and, according to UNESCO, could already be 24% in 2025 due to increasing industrialization of developing countries. Resource productivity actions are fostering circularity, increasing product’s and resources life time across the value chain as well as sharing resources, even between sectors. Since the 1970-ies, a circular economy concept for sharing resources in industry was developed as part of industrial ecology, the Industrial Symbiosis. The main principle is, that a residue from one company becomes a resource at another, benefiting both the environment and the economy. Industrial symbiosis might be organized as local business associations and regional recycling networks. The Baltic Sea region is a forerunner in that field as the first resource sharing network was the Industrial Symbiosis in Kalundborg (Denmark) in 1972. In the last decades, efforts have been made to further foster Industrial Symbiosis in the Baltic region. The contribution presents show cases of Industrial Symbiosis in Sweden, Finland, Norway, Germany, and Lithuania. First Industrial Symbiosis attempts are done in Estonia, Latvia, Poland and Russia.

Keywords
Water-Energy-Food Nexus, Water-Soil-Waste Nexus, Industrial Symbiosis

Author
Petra Schneider, Ph.D. Prof.
Department Water, Environment, Civil Engineering, and Safety
Magdeburg-Stendal University of Applied Sciences
Magdeburg, GERMANY
petra.schneider@h2.de
Nature-based Solutions in the Urban Realm: Water Related Applications in the Baltic Region

Petra Schneider and Jörg Slawinski

Ecosystems provide important services for human well-being, for example by providing drinking water. However, these functions are threatened by increasing fragmentation of ecosystems and need to be restored. One approach for the combination of ecosystem restoration and provision of ecosystem services (ES) are nature-based solutions (NbS), that for instance combine climate protection, adaptation to climate change, disaster preparedness, conservation of biological diversity and sustainable resource management. A particular approach is the creation of biotope networks through Green Infrastructure (GI). GI is a network of natural areas and green spaces in urban and rural areas. Such networks help to conserve ecosystems and strengthen their resistance against external pressures. GI backbone are protected areas such as Natura 2000 areas, national parks or biosphere reserves. River meadows, green spaces in rural and urban areas as well as artificially created structures such as green bridges and roof gardens are also included. GI assumes a multitude of functions: it serves to protect biodiversity, improves ecological processes (e.g. as ecological corridor) and promotes ES for humans (e.g. heat wave protection).

Efforts that have been made in the last decades in the Baltic region to foster NbS implementation resulted in extraordinary examples for water-related NbS in the urban realm and the linking of urban and rural areas. The contribution will highlight a few of them. With 12,500 km length, the European Green Belt (EGB) is an extraordinary ecological network and living memorial landscape that has been developed along the former Iron Curtain. Today the EGB forms the backbone of the Pan-European ecological network and provides a substantial contribution to the European GI. The EGB’s geographical location covers climate and ecological zones across Europe. In the Baltic region it comprises the Fennoscandian Green Belt (Finland, Norway, Russia), and the Baltic Green Belt (Estonia, Lithuania, Latvia, Poland). The Kristianstad water kingdom is a UNESCO Biosphere Reserve that was established in 2005. The coastal estuary is located at the Baltic Sea, close to the small town of Kristianstad in southern Sweden. This estuary was appointed a Biosphere Reserve because the area has successfully demonstrated how to tackle practical challenges combining nature conservation with urban development.

Keywords
Nature-based solutions, green infrastructure, ecosystem services, European Green Belt

Authors
Petra Schneider, Ph.D. Professor
Department Water, Environment, Civil Engineering, and Safety
Magdeburg-Stendal University of Applied Sciences
Magdeburg, GERMANY
petra.schneider@h2.de

Jörg Slawinski, Dipl.-Geol.
HGN Beratungsgesellschaft
Magdeburg, GERMANY
Regularities of content formation and distribution of phosphorus compounds in the rivers in Ukraine, and decreasing of phosphate content using higher aquatic plants

Olena Skyba & Larysa Fedoniuk

Phosphorus, as one of the most important biogenic elements in water ecosystems, affects on the diversity and productivity of organisms, thereby algae and higher water plants. The aim of the work was to find out mutuality between of the content of phosphorus compounds and the phosphate content using higher aquatic plants in the river ecosystems of the Ternopil region (Ukraine) in the seasonal aspect on the different natured anthropogenic loading.

We investigated the contents of general phosphorus in the dominant representatives of reservoirs of the Ternopil region (Glyceria maxima (C. Hartm.) Holmb. (Lepeshniak large) and Ceratophyllum demersum L. (Kushir immersed). The highest indexes of the contents of phosphorus in G. maxima are recorded in leaves, which decrease from May to September. In a plant the maximum contents of phosphorus in the root, characterized by rapid increase from May to September. It was established that the contents of phosphorus compounds in G. maxima directly correlate with phosphates in water, and C. demersum is inversely correlate, that means their accumulation capacity for phosphates from water and further its transformation in the plant. Nowadays, biological methods of purification, in particular purification of the water with the so-called method of biosorption, are used more often. The essence of the latter is reduced to the removal of dangerous substances and the improvement of the state of reservoirs with the help of water organisms, particularly, plants. Therefore, considering the rich experience of conducted researches in the field of biosorption, we decided to predict the effectiveness of this method with the use of accumulative absorption capacity of phosphates by higher water plants (Myosotis 13 scorpioides (L.) L.), Glyceria maxima (C. Hartm.) Holmb (Lepeshniak large), Nasturtium officinale R. Br. (Nasturtium Medicinal). It was established that M. scorpioides has the highest coefficient of accumulation of phosphorus from water – 33.9 in control and 51.8 in experimental samples, G. maxima – 14.8 and 20.4, and N. officinale – 6.3 and 8.3 accordingly. The most accumulated part of the phosphorus in G. maxima is the root system, and in N. officinale and M. scorpioides is a stem. Therefore, to remove phosphates from the water, it is suggested to cultivate – M. scorpioides.

Keywords
hydroecosystem, phosphorus compounds, higher aquatic plants, biosorption

Authors
Olena Skyba, PhD, Assistant Prof.  
Medical biology department  
I. Horbachevsky Ternopil National Medical University  
Ternopil, UKRAINE  
skyba@tdmu.edu.ua  

Larysa Fedoniuk – Prof., DSc., PhD, MD,  
Head of Medical biology department  
I. Horbachevsky Ternopil National Medical University  
Ternopil, UKRAINE
Practical method of cleaning of waste water left after extinguishing of fire of tires

Rimantas Vaitkus, Eglė Lastauskienė, Adrian Vicent-Claramunt & Evaldas Naujalis

Fire of tire recycling company JSC „Ecologistika“ located in Alytus (Lithuania) became the biggest fire of Lithuania in 2019. This fire lasted more than a week until it was finally extinguished by using plenty of water (more than 50 thousand cubic meters). During the extinguishing process it was possible to reuse the same water. Decomposition of tire materials has emitted a great quantity of polluting compounds into the air, and more than 50 thousand metric tons of polluted water has been left after extinguishing of the fire. Heavy metals, polyaromatic hydrocarbons, as well as other dangerous organic compounds were estimated at relatively high concentrations. Different methods for cleaning of this waste-water has been discussed. Our team has suggested the sedimentation of heterogeneous particles and biological treatment by oil-metabolizing microorganisms as a cheap and effective method to reduce the contamination. The original samples without the additional inoculation were used for the determination of the natural environmental microorganisms’ capability to metabolize water polluants. In order to increase the treatment rate, waste water samples were inoculated with 1 % of Pseudomonas sp., Brevundimonas sp., Brevibacterium sp. and Staphylococcus sp. bacteria isolated from the soil polluted with oil and oil product. Laboratory analysis using gas chromatography - mass spectrometry showed that this suggested method remarkably decreased the contamination level, which could be suitable for common biological cleaning in water treatment plants.

Keywords
water treatment, water pollution, environmental protection, biological treatment, PAH’s

Authors
Rimantas Vaitkus, PhD, Associated Prof., Klaipėda University, Klaipėda, LITHUANIA
rimantas.vaitkus@cr.vu.lt

Eglė Lastauskienė, PhD, Associated Prof., Centre of Life Sciences, Vilnius University, Vilnius, LITHUANIA

Adrian Vicent-Claramunt, Ph. D., Research-Fellow, State Institute of Physical and Technological Sciences, Vilnius, LITHUANIA

Evaldas Naujalis, Ph. D., Head of Metrological Department, State Institute of Physical and Technological Sciences, Vilnius, LITHUANIA
Continuous automatic monitoring as a method of assessing water quality on the example of large water reservoir in Central Poland

Aleksandra Ziemińska-Stolarska & Ireneusz Zbiciński

The paper presents results of water quality monitoring conducted within the frame of the MONSUL project in years 2015-2019. The main goal was to analyse and assess the impact of factors determining the ecological potential of a dam reservoir located in Central Poland. The project implementation plan was based on comprehensive research-based monitoring covered the following parameters characterizing the reservoir: water temperature, pH, oxygen concentration, chlorophyll “a” and blue-green algae, concentration of ammonium ion and conductivity. A stationary monitoring system activated within the project was based on a probe mounted on a buoy anchored in the Reservoir. The system was performing continuous measurements 24/7. During 5 years over 800,000 data items were collected, informing about seven parameters characterizing water quality in the northern part of the Sulejow Reservoir and data on meteorological conditions in the reference time.

The obtained results show that in the analyzed period most parameters exceed the values for class I water quality. Despite the fact that the Sulejow Reservoir is no longer a drinking water reservoir, it plays an important recreational function, but the extensive algae blooms (chlorophyll appearing every year and according to research is in the III water purity class) limits this function nowadays.

In contrast to periodic monitoring, continuous monitoring provides results with an incomparably better time resolution. This allows a more accurate representation of physicochemical parameters in the reservoirs models, gives the chance to detect momentary and fast-changing phenomena.

Keywords
water quality monitoring, dam reservoir, eutrophication

Authors
Aleksandra Ziemińska-Stolarska
Faculty of Process and Environmental Engineering,
Lodz University of Technology,
Lodz, POLAND
aleksandra.zieminska-stolarska@p.lodz.pl

Ireneusz Zbiciński, dr hab. inż., Prof.
Faculty of Process and Environmental Engineering,
Lodz University of Technology,
Lodz, POLAND
ireneusz.zbicinski@p.lodz.pl
4. Urban-Rural Development

The last decades of urbanisation have led to several trends in spatial planning, such as urban growth, densification, uncontrolled sprawl and an on-going discussion about urban-rural interaction. The current discourse on sustainable urban development in the Baltic Sea Region and Europe concerns to a great extent densification of urban populations. Additionally, the densification doctrine has contributed to the focus given to cities and other highly agglomerated areas in the sustainable development discourse. Thus, the sustainable society is being studied mainly from an urban point of view - sustainable cities, eco-cities, sustainable urban development - a perspective often separated from discussions about development in rural areas, farmlands and forests. Planning for urban-rural interactions has not been in and thus cities are supported with food, natural resources and energy mainly from the global market rather than from the immediate surroundings. However, environmental crises claim a new era on how to organise and plan for urban and rural interactions. The development of regional- and local flows and systems is a topical issue in planning of today. Though the number of urban districts with sustainability ambitions is growing, it is not clear to what extent such areas actually achieve environmental and resource efficiency. Academic literature is still inconclusive about how far technological and architectural measures can take us towards global sustainable development. Recently scholars have stressed the importance of human behavioral patterns in reaching sustainability. Investigating the importance of and relation between urban lifestyles and the built environment therefore is crucial for sustainable planning. The UN 2030 Agenda for Sustainable Development stress these issues as well as the BALTIC 2030: An Action Plan for the Baltic Sea Region. Scholars at universities and practicians in authorities and business have a great responsibility when it comes to realization and implementation of current global, regional and local policy.

Coordinator
Henner Busch, Postdoc., Lund University, Lund, Sweden

Scientific Committee
Henner Busch, Postdoc., Lund University, Lund, Sweden
Barbora Čakovská, PhD, Slovak University of Agriculture in Nitra, Slovakia
Madeleine Granvik, Assoc. Prof., Swedish Agricultural University, Uppsala, Sweden
Claudia Fonseca, Postdoc., Malmö University, Sweden

Contributors
Gabriele Cepeliauskaite, Integrated Sustainable Ecosystem Principles: Case Study of Lithuania…..37
Vidhyalakshmi Chandrasekaran, Environmental Life Cycle Assessment of residential buildings…..38
Oleksandra Khalaim, Urban Green Infrastructure Inventory as a Key Prerequisite to Sustainable Cities in Ukraine under Extreme Heat Events……………………………………………………………………39
Malgorzata Luc, Revitalisation of city quarries as a contribution to sustainable urban development – Krakow case study…………………………………………………………………………….40
Helene Martinsson-Wallin, Sustainable and Experience based Cultural- and Natural Tourism in Rural Gotland – The Tjelvar Project…………………………………………………………………………….41
Daiva Verkulevičiūtė-Kriukienė, The depopulation of coastal rural Lithuania – do regional parks stabilise the situation or not?. ……………………………………………………………………………….42
In the face of current environmental challenges, cities are considered as one of the main contributors of climate change acceleration. As the centers of economic activities, cities increase employment opportunities, which determine rapid urbanization and lead to economic growth on the countries. According to United Nations, cities occupy three percent of a land in the World, accommodate more than a half the World’s population and contribute approximately 60 per cent of global GDP in total (2020). However, production and services provision, energy consumption, traffic congestion, inadequate urban infrastructure and other human activities leave a considerable ecological footprint by causing 70 per cent of carbon emissions in the World. Therefore, scientists are investigating the ways for sustainable urban transformation in order maintain a wellbeing of city residents and ensure economic growth and minimize negative environmental impact. From a holistic approach city could be defined as a complex ecosystem, which consists of natural and artificial systems. Natural ecosystems conservation and ecosystem services could be an appropriate solution for climate regulation. The United Nations 2030 Agenda for Sustainable Development (2015) sets interdisciplinary overlapping goals (SDG’s) for global warming limitation to 1.5ºC. SDG 11 (Sustainable cities and communities), SDG 14 (Climate action) and SDG 15 (Protect, restore and promote sustainable use of terrestrial ecosystems), which combination would help to regulate climate change by using ecosystem services in cities. Regarding to urban ecosystems importance in solving climate change problems, the analysis focuses on situation of sustainable urban ecosystems principles integration in Lithuania. Therefore, the main goal of the article is to investigate the current situation of urban ecosystems in Lithuanian cities. Accordingly, the article presents a brief theoretical review of sustainable urban ecosystems principles and its integration into national acts and strategies. The analysis is expanded by presenting a current situation of the main urban ecosystems and its’ condition, highlighting the challenges and recommendations for its improvement.

Keywords
Sustainable development, climate change, sustainable city, sustainable urban ecosystems, ecosystem services

Authors
Gabriele Cepeliauskaite, PhD student. Institute of Environmental Engineering Kaunas university of Technology Kaunas, LITHUANIA Gabriele.cepeliauskaite@ktu.lt
Zaneta Stasiskiene, Ph.D. Prof. Institute of Environmental Engineering Kaunas university of Technology Kaunas, LITHUANIA zaneta.stasiskiene@ktu.lt
Environmental Life Cycle Assessment of residential buildings

Vidhyalakshmi Chandrasekaran, Ausrine Vitkute & Jolanta Dvarioniene

Building and construction reports 36% of global final energy use and 39% of CO₂ emissions related to energy including the power generation. Since the last decade, reducing the environmental impacts in construction sector has gained a focus. Researchers have carried out numerous studies to address and evaluate energy consumption and materials use in different types of buildings. However, most often, the studies spotlight only on energy performance of buildings. Nevertheless, the studies that focus on residential buildings especially existing stocks, or buildings that has been renovated or refurbished/retrofitted is limited.

With growing prominence towards sustainability, the concept of life cycle thinking is highly critical. Although, different methodologies were used to evaluate the environmental concerns, Life Cycle Assessment is considered as the most versatile tool. Therefore, this paper tries to overview the present situation of life cycle assessment and environmental impact of buildings, and residential buildings, particularly. It discusses the importance of usage of LCA within the residential buildings; also, reviews some of the researches that applied to residential buildings (new/existing/ renovated/refurbished/retrofitted), or building materials used across West, Europe and developing nations. It also highlights the gaps and limitation of different existing and new tools of life cycle assessment of buildings. Moreover, the building uses great quantity of raw materials that contributes to high energy consumption. Therefore, the paper tires to evaluate the life-cycle impact assessment of the building materials used in the construction industry in Europe, especially in Lithuania.

Keywords
Life Cycle approach, renovation, environmental impact assessment, residential buildings, Lithuania

Authors
Vidhyalakshmi Chandrasekaran, PhD student
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
vidhyalakshmi.chandrasekaran@ktu.edu

Dr. Jolanta Dvarionienè, Prof.
Institute of Environmental Engineering,
Kaunas University of Technology
Kaunas, LITHUANIA
jolanta.dvarioniene@ktu.lt
Urban Green Infrastructure Inventory as a Key Prerequisite to Sustainable Cities in Ukraine under Extreme Heat Events

Oleksandra Khalaim

A frequency of extreme heat effects, critical in urban areas due to lower surface albedo and less air circulation, has recently increased in big cities of the Baltic region, being enforced by climate change. At the same time, urbanization enlarges the problem of urban-induced warming by massive replacements of natural vegetation with manmade constructions, altering the temperature balance significantly. It raises the importance of sustainable management of urban green spaces, as an essential prerequisite for citizens’ wellbeing in terms of public health, preservation of social and environmental values, finally expressed in economic benefits. In this perspective, an effective inventory system of urban green spaces serves as a critical starting point for climate change adaptation in cities. Addressing this issue, many new local publicly induced initiatives on green spaces’ inventory have appeared in Ukrainian cities recently, as an attempt to raise the efficiency of existing out-of-date solutions provided by municipalities. The paper provides a comparative study of the main types of urban greening inventory systems currently presented in the towns of the Baltic region, with a specific focus on its possible application in Ukraine. Some recent Ukrainian case studies and research initiatives exploring the role of urban vegetation in heatwaves’ mitigation are analyzed. Current barriers and possibilities to set up a community-based approach to urban green infrastructure inventory in Ukrainian cities are elaborated.

Keywords
Urban green spaces, urban green inventory, climate extremes, heat waves, Baltic region

Author
Oleksandra Khalaim, Ph.D.
Visiting Researcher
Swedish International Centre of Education for Sustainable Development (SWEDESD)
Uppsala University - Campus Gotland
Visby, SWEDEN
oleksandra.khalaim@swedesd.uu.se
Revitalisation of city quarries as a contribution to sustainable urban development – Krakow case study

Małgorzata Luc & Jacek Szmańda

Several stages of landscape changes depending on the proportion of natural and anthropogenic elements in the landscape evolution were distinguished. According to the increasing impact of anthropopression on the environment, we suggested to arrange the landscape into a following manner: (1) primary landscape, (2) natural landscape, (3) cultural harmonic landscape, (4) cultural dysharmonious landscape, (5) cultural degraded landscape, and (5) devastated landscape and (6) renaturalized and or recultivated landscapes. The first three, in line with the principles of the sustainable landscape, can be considered being sustainable. One of the goals of the landscape management is its restoration in the meaning of the creation the balance between the natural and anthropogenic components. This occurs through processes of renaturalisation and carried efforts towards recultivation. They result in the creation of renaturalized and recultivated landscape. These landscapes can be included into the category of sustainable landscape. We wish to present a case study from the Krakow city (Poland). The first one is Bednarski Park. This is the oldest in Poland example of recultivation of a former quarry into a city park. The second one is the Zakrzówek Reservoir. This is an example of a quarry that has been renaturalised as a result of being filled with water after the cessation of the limestone mining in the 1970s of the 20th century. Zakrzówek is currently being recultivated into a city swimming pool and a recreation area.

Keywords
landscape, renaturalisation, recultivation, quarry, sustainability

Authors

Małgorzata Luc, Ph.D. with habilitation (Docent)
Institute of Geography and Spatial Management
Jagiellonian University in Krakow
Kraków, POLAND
malgorzata.luc@uj.edu.pl

Jacek Szmańska, Ph.D. with habilitation (Docent), Assoc. Prof.
Institute of Geography
Pedagogical University of Krakow
Kraków, POLAND
jacek.szmanda@up.krakow.pl
Sustainable and Experience based Cultural- and Natural Tourism in Rural Gotland – The Tjelvar Project

Helene Martinsson-Wallin

The Tjelvar project is a destination development project that focus on development of sustainable cultural- and natural heritage tourism in rural Gotland. The project highlights historical monuments and changes in the cultural landscape of Gotland. Our ambition has been to create an awareness among visitors and local actors how humans have shaped and re-shaped and affected the Gotland landscape in a long-term perspective and how, these human actions and natural and cultural processes are important to understand to be able to create a sustainable future. According to the mythology, (Gute Saga) Tjelvar was the first person to discover Gotland and his three sons settled the island. In this project we have used the mythology in combination with new qualitative data from Archaeological and Geological research to build new narratives around two Archaeological sites that are featuring historical monuments and a changing cultural landscape that are unique for Gotland. One site is the stone ship setting called the grave of Tjelvar from the Bronze Age and its relation to an internal waterway (Lina mire) and the Picture Stone and Iron Age Settlement at Buttle Änge. The aim is that the places that already are official visitor’s sites will become important visitor nodes in rural Gotland. The historical moments are used as attractors to create opportunities for local stakeholders to develop small scale and sustainable businesses around the sites, which will assist to create a dynamic tourism and the development of the rural areas of Gotland. Region Gotland, Uppsala University and Swedish Agency for Economic and Regional Growth have supported the initiative.

Author
Helene Martinsson-Wallin, Ph.D, Prof.,
Department of Archaeology and Ancient History
Uppsala University
Uppsala, SWEDEN
helene.martinsson-wallin@arkeologi.uu.se
The depopulation of coastal rural Lithuania–do regional parks stabilise the situation or not?

Daiva Verkulevičiūtė-Kriukienė, Erika Čepienė & Angelija Bučienė

The depopulation is a self-inducing process depending on many factors. The young, mobile people capable of work, usually migrate first, then the young families followed with their children. This eliminates the capacity to reproduce the population, thus many peripheral areas previously populated, continue to become empty. Such a situation is documented in most of the countries and regions, Lithuania is not an exclusion. The regional parks have many tasks and functions, but the main function is to preserve the most valuable physical and cultural components of landscapes including cultural heritage, NATURA 2000 habitats, etc.

The aim of this study was to investigate three Klaipeda county’ regional parks, their settlements and population number in time and space, in order to determine the number of disappeared settlements (with 0 population) and whose which are going to be disappeared (with population <5) in comparison with the situation in local areas without regime of conservation. The research has revealed different situations, where the conservation regime not necessary promotes more attractive and sustainable background for local population. The nearness to the Sea and cities or local urban centers still remain as the factors of first priority searching to choose the living place.

Keywords
depopulation, disappearing villages, regional parks, conservation regime

Authors
Daiva Verkulevičiūtė-Kriukienė, Ph.D. Assoc Prof. Study Centre of Social Geography and Regional Sciences, Faculty of Social Sciences and Humanities Klaipėda University Klaipėda, LITHUANIA verkuleviciute.daiva@gmail.com

Erika Čepienė, assistant lecturer Study Centre of Social Geography and Regional Sciences Faculty of Social Sciences and Humanities Klaipėda University Klaipėda, LITHUANIA erikacepiene@gmail.com

Angelija Bučienė, Ph.D. Prof Study Centre of Social Geography and Regional Sciences Faculty of Social Sciences and Humanities Klaipėda University Klaipėda, LITHUANIA angelijab@gmail.com
5. Sustainable Mobility

In all modern societies, for a number of reasons, people tend to increase their mobility. The functioning of a modern society puts heavy demand on the ability of individuals to be mobile. Economic, political and social factors affect both the total volume of transportation and its different modes.

The sustainable mobility aims at the reduction of adverse effects connected to mobility. This means, above all, promoting co-modality, i.e. optimally combining various modes of transport within the same transport chain, which looking forward, is the solution in the case of freight. Technical innovations and a shift towards the least polluting and most energy efficient modes of transport – especially in the case of long distance and urban travel - will also contribute to more sustainable mobility. A higher share of travel by collective transport, combined with minimum service obligations, will allow the density a frequency of service to be increased. Demand, management and land-use planning can lower traffic volumes. Facilitating walking and cycling should become an integral part of urban mobility and infrastructure design.

Coordinator
Linas Kliučininkas, Dr., Prof., Kaunas University of Technology, Lithuania

Scientific Committee
Prof. Linas Kliučininkas, Kaunas University of Technology, Lithuania
Dr. Dorota Kamrowska-Zaluska, Gdansk University of Technology, Poland
Prof. Remigijus Čiegis, Vilnius University, Lithuania

Contributors
Sven Borén, Challenges and Opportunities for Shipping towards Sustainability. ..........................44
Liliia Hrytsai, The Lublin City Bike program as an example of sustainable urban mobility in the Baltic Sea Region ..................................................................................................................45
Annika Kunnasvirta & Stella Aaltonen, Projects as a vehicle to change mobility and transport in cities - case example CIVITAS ECCENTRIC - project in the city of Turku ........................................................................46
Jari Mustonen, Just-in-time approach - EfficientFlow project as a digital tool in maritime logistics...47
Kamilė Petrauskiene, Comparative Environmental Life Cycle and Cost assessment of Electric, Hybrid and Conventional Vehicles in Lithuania ........................................................................48
Michèle Schaub, Sustainable manouevring of ships through simulation - supported additional information ..................................................................................................................49
Daniel Štraub, The effects of fare-free public transport: a lesson from Frýdek-Místek (Czechia).....50
Franziska Wolf, Sustainable Mobility in Urban Areas – Best practices from the BSR region ..........51
Challenges and Opportunities for Shipping towards Sustainability

Sven Borén

Shipping is contributing to a positive societal development as people can access resources in an energy efficient way when compared to other transport modes. However, shipping accounts for emissions to air in a way that counteracts a societal development towards goals for reducing climate change and other environmental issues. Shipping also has sustainability impacts in the water by fuels and hull painting, agitation of bottom sediment from shallow waterways, noise, and in some cases contributes to structural obstacles to social sustainability due to activities in mining, production, and recycling. Despite efforts made by actors in the shipping industry to become more sustainable, it is still unclear how investments in shipping could be planned to cooperate, rather than counteract one another, and how these measures and goals could be guided by a holistic perspective on sustainability that is sufficiently robust for many generations to come. The framework for strategic sustainable development is designed to guide such efforts, and was in this study applied through literature studies, study visits, workshops, and interviews with Wallenius Marine. This resulted in a developed sustainable vision for Wallenius Marine and their owner Soya AB. Subsequent analyses considered stakeholders, operations, strengths and weaknesses with regards to the vision, and at finally challenges and opportunities towards the vision for Wallenius Marine and shipping in general. The study also suggested further studies about roadmap(s) towards sustainability for shipping in general and certain stakeholders, and also in-depth studies about business models and incentives to power ships by biofuels and/or wind.

Author
Sven Borén, PhD, Researcher, Associated Senior Lecturer
Department of Strategic Sustainable Development
Blekinge Institute of Technology
Karlskrona, SWEDEN
sbn@bth.se
The Lublin City Bike program as an example of sustainable urban mobility in the Baltic Sea Region

Liliia Hrytsai

A large share of European citizens lives in urban areas, from which over 60% live in cities and towns of over 10,000 inhabitants. Urban mobility is responsible for 40% of all CO$_2$ emissions of road transport in the European Union. The EU spends around EUR 100 billion, or 1% of its GDP annually to improve the effectiveness of urban transport. Transport systems in the Baltic Sea Region vary from country to country. In many cases it depends on characteristics of urban area, i.e. size, population, urban planning, etc. The author of this research analyzes the problem of sustainable urban mobility through the example of the city of Lublin. Situated at the Eastern Poland, the city is the capital of Lublin Voivodeship with population of 342,000 habitants and area of 147 km$^2$. The Lublin City Bike program (pol. Lubelski Rower Miejski or LRM) offers to city habitants a simple, affordable and eco-friendly kind of transport. The program provides about 1000 bicycles located in almost 100 stations at the city of Lublin. From the beginning of April to the end of November city bikes are available on a 24/7 basis. The Lublin City Bike program is supported by a promotional campaign delivering information to city habitants about various benefits coming from the use of bicycles. Results of this research show that thanks to bicycles there are less traffic jams in the city, less GHG emissions, and thus better quality of air. Moreover, bicycles users save their time by omitting traffic jams, improve their physical and psychological condition, and reach faster their destinations around the city than they did it by foot or by car during pick hours.

Keywords
Urban mobility, sustainable mobility, urban transport, city bike, GHG emissions, quality of air

Author
Liliia Hrytsai, M.A., Ph.D. Candidate
Faculty of Political Science and Journalism
Maria Curie-Skłodowska University
Lublin, POLAND
LillaHrytsai@gmail.com
Projects as a vehicle to change mobility and transport in cities - case example CIVITAS ECCENTRIC -project in the city of Turku

Annika Kunnasvirta & Stella Aaltonen

In cities, sustainability transitions need to be brought about with great haste. Cities are expressing their commitment to globally agreed climate targets with ambitious goals and targets. The realized actions to address climate change mitigation, however, are often lagging behind. In order to identify transition pathways needed for sustainable mobility transition, the city-specific drivers, challenges and barriers need to be identified, and new policy pathways defined to reduce the impacts of mobility. The city of Turku serves as a good example of goal setting as it has very high ambitions regarding carbon neutrality by 2029 and reaching a 66% share of sustainable transport modes by year 2030. Both of these targets are very challenging to reach from the transport side. The CIVITAS ECCENTRIC project had nine measures that addressed different aspects of sustainable mobility. The focus ranged from stakeholder integration on regional and local level to practical measures for example of winter maintenance on bicycle routes, e-busses and bike sharing system. It also developed the concept of Mobility as a service on local and international level.

Beyond the concrete measure results, it is important to highlight the importance of the process towards system level change facilitated by projects, and their subsequent impacts on transition pathways. This is often overlooked, most likely due to the fact that it is difficult to showcase. The study at hand aims to present both the preconditions for sustainable change in cities in cases when external funding brings opportunities for development, and the external factors affecting the process. The study also highlights the different dimensions of projects that can be reached by adaptive management, extensive networking and persistent efforts to integrate the actions onto system level. Lessons learnt from the CIVITAS ECCENTRIC -project (09/2016-08/2020) are showcased, revealing the key drivers and barriers that have contributed to sustainable mobility transition in the city of Turku. Areas of development that need to be addressed in the future are also discussed in the context of sustainability transition management.

Keywords
sustainable mobility, transition management, carbon neutrality, MaaS, transport modes

Authors
Annika Kunnasvirta, B.Sc., Project manager, Local Evaluation Manager in CIVITAS ECCENTRIC, Researcher, Turku University of Applied Sciences, Turku, FINLAND
Stella Aaltonen, M.A., Site Manager of CIVITAS ECCENTRIC, Coordinator of mobility and transport in the City of Turku, Turku, FINLAND
Just-in-time approach - EfficientFlow project as a digital tool in maritime logistics

Olena de Andres Gonzalez, Heikki Koivisto, Ulf Siwe, Jari Mustonen, Minna M. Keinänen-Toivola, Alberto Lanzanova, Olli pekka Kivin & Anders Berg

In the Baltic Sea region there is the need to improve the quality of both sea freight and passenger transportation. The main objective of the EfficientFlow project is to optimize the flow of goods and passengers at the ports of Gävle and Rauma, as well as in the transport corridor between Stockholm and Turku - by developing the cooperation among sea transport agents and inland stakeholders. To achieve this, the Sea Traffic Management (STM) concept has been identified as the core foundation for the project. EfficientFlow project is the first operational implementation of the STM concept concerning ports.

Within the framework of the project several ICT tools were created to improve the exchange of information between all the stakeholders involved in the process, including ships, ports, port operators and hinterland agents. All developed ICT tools are thoroughly tested and the results of the testbeds are being processed, analysed and evaluated. During the testing phases in the ports of Rauma, Finland and Gävle, Sweden the stakeholders have participated actively into the development of these mobile applications when they released for the last testing phase before the launching. ICT tool is similar but both ports are having their own application with special features asked by the ports for example Port of Gävle planning to have time slots for ships entering the port.

Thanks to the just-in-time approach and to the improvements of the port operation management, the traffic flow will be optimized. This will lead to the saving of fuel and of man-hours, as well as it will decrease the emission of carbon dioxide into the atmosphere. Therefore, the energy efficiency, security of the supply chain and the transport system in general will be improved. The final ICT tool and the results of the STM concept implementation will be disseminated and will serve as best practices examples for other corridors and ports in the Central Baltic area and world-wide.

Keywords
maritime logistics; information exchange; just-in-time approach; sea traffic management.

Corresponding authors
Olena de Andres Gonzalez, Ph.D., Project Researcher
Faculty of Technology
Satakunta University of Applied Sciences
Pori, FINLAND
olenade.andres.gonzalez@samk.fi

Jari Mustonen, B.Eng., Project Researcher
Faculty of Technology
Satakunta University of Applied Sciences
Pori, FINLAND
jari.2.mustonen@samk.fi
Comparative Environmental Life Cycle and Cost assessment of Electric, Hybrid and Conventional Vehicles in Lithuania

Kamilė Petrauskienė & Jolanta Dvarionienė

Electric vehicles (EVs) are promoted as future transport that have potential environmental and economic benefits in order to encourage sustainable urban transportation. The goal of this study is to reveal how environmental and economic performance would change if we switched from internal combustion engine vehicles (ICEVs) to battery electric (BEV) or hybrid electric vehicles (HEV). For this reason, the study presents a comparative environmental life cycle assessment (LCA) from a Well-to-Wheel and Cradle-to-Grave perspectives of BEV, HEV-petrol and ICEVs powered with petrol and diesel. Moreover, LCA of BEV was performed under different electricity mix scenarios, that are forecasted for the years 2015–2050 in Lithuania. From the economic point of view a life cycle cost analysis was conducted of the same vehicles in order to estimate and compare economic impact over the life cycle under Lithuanian conditions. The results reveal that ICEV-petrol has the highest environmental damage in all categories (human health, ecosystems and resources). HEV and BEV with electricity mix of 2015 has the same environmental damage, which is 14% less than ICEV-petrol. Next, comes ICEV-diesel with 10% less impact than HEV. BEVs with electricity mix 2020–2050 scenarios, which are composed mainly of renewable energy sources, have the least environmental impact. As a result, BEV with electricity mix of 2050 has 43, 33 and 27% smaller environmental damage than ICEV-petrol, BEV (electricity mix of 2015) and ICEV-diesel, respectively. Results from economic perspective reveal that BEV and ICEV-diesel are one of the most cost-efficient vehicles, where total consumer life cycle costs are approximately 5 and 15 % less than ICEV-petrol and HEV, respectively.

Keywords
Electric vehicle, conventional car, energy mix scenarios, life cycle assessment, life cycle costs

Authors
Kamilė Petrauskienė, PhD student
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
kamile.petauskiene@ktu.edu

Jolanta Dvarionienė, professor
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
jolanta.dvarioniene@ktu.lt
Sustainable manoeuvring of ships through simulation-supported additional information

*Michèle Schaub, Georg Finger & Knud Benedict*

Maritime transport is facing increasingly stringent emission standards. Adjustments to new regulations are generally very slow in the maritime sector, partly due to the high costs for technical adjustments. However, even with existing technology it is possible to improve manoeuvres which can be executed with varying degrees of sustainability, provided that objective information is available to judge the effects of the manoeuvring decisions taken. The paper presents a fast simulation model, which can predict the ship motions every second over several minutes. The math model of the ship also provides results on fuel consumption: Based on the results from the calculated engine process, an AI method is used to predict emissions, especially particulate matters and NOX, during transient engine operation. The scientific novelty value lies in the detailed investigation of different approaches in the field of AI with the aim of finding a suitable method that describes the dynamics of particle generation in transient engine mode as accurately as possible. Artificial neural networks offer the possibility to solve non-linear and dynamic problems with very short computational times and were therefore used for these investigations. The quality of the results and their application in practice are discussed in the paper. The results are intended to provide the nautical officer with additional and objective information to support in decision finding both in planning and during the execution of manoeuvres with the aim of making maritime navigation more sustainable.

**Keywords**
sustainable maritime transport, efficient manoeuvres, emission prediction, artificial intelligence, artificial neuronal networks

**Authors**
Michèle Schaub, Ph.D. Student, Sc. Assistant Chair of Technical Thermodynamics  
*Rostock University*  
Rostock, GERMANY  
michele.schaub@uni-rostock.de

Georg Finger, Ph.D. Student, Sc. Assistant Department of Maritime Studies, System Technologies and Logistics  
*Wismar University of Applied Sciences*  
Rostock-Warnemünde, GERMANY  
georg.finger@hs-wismar.de

Knud Benedict, Prof. Dr.-Ing. habil. (Emeritus)  
Department of Maritime Studies, System Technologies and Logistics  
*Wismar University of Applied Sciences*  
Rostock-Warnemünde, GERMANY  
knud.benedict@hs-wismar.de
The effects of fare-free public transport: a lesson from Frýdek-Místek (Czechia)

Daniel Štraub

The concept of fare-free public transport (FFPT), whose core principle lies in abolishing fares in public transport, dominantly influences the development in the given transport system in favour of one means of transport. The effects of the FFPT on travel behaviour has been debated among scholars such as Thøgersen (2009), Cools et al. (2016), Cats et al. (2017) or Friman et al. (2019) arguing, the implementation of FFPT causes the increase in ridership of public transport, but the extent varies greatly. This paper follows the previous debate on how the FFPT influences mobility patterns and stretches it with the FFPT impact on the dynamic of the transport system. By analysing the FFPT implementation in Frýdek-Místek using questionnaires with the residents and semi-structured interviews with city planning authorities, this study suggests, FFPT represents a useful tool how to change the travel behaviour and overall dynamic in the transport system. The results indicate that the introduction of FFPT is making the transport system more open and variable. Thus, in the case, when the use of public transport is more effective, people are more likely to do so. This imprints on increased public transport ridership which is not only because the public transport attracts more those who would rather walk or use a bike, but also due to modal shift from car-drivers. Results of the survey also show the public transport is popular and the FFPT implementation has changed the expectations of the users from the service. For the city council is now essential to focus on the other aspects of the public transport, such as comfort, quality or reliability, to improve the overall performance of the service to make out of the ridership increase long-term trend. However, the concept does not represent a universal tool for solving all the transport or urban related problems. City planning authorities should focus on the systematic approach and use the synergic effect of available tools. System-wide challenges, which transport and urban planning with travel behaviour are, have to be addressed with strategies respecting their comprehensiveness.

Keywords
fare-free public transport, FFPT, travel behaviour, public transport policy

Author
Daniel Štraub, MSc
Doctoral School of Social Sciences
Jagiellonian University
Cracow, POLAND
d.straub@doctoral.uj.edu.pl
Sustainable Mobility in Urban Areas -
Best practices from the BSR region

Franziska Wolf, Nicolas Restrepo Lopez & Walter Leal

The transport of goods and passengers within urban environments is a major contributor to not only the emission of greenhouse gases (GHG) but also noise, pollution and road congestion. In order to reduce negative environmental and health related impacts, the EC’s 2011 White Paper on Transport defines the climate-friendly transformation of urban transport systems in Europe, leading to a reduction of GHG in the transport sector by 2050 by 70 % compared to 2008. This paper presents a set of best practices drawing from real-life use cases implemented in the frame of the Interreg-funded project BSR electric. Key findings illustrate how the close interaction of municipalities with further agents within urban transport systems play a key role in achieving this transformation. It does so by providing evidence how these agents can drive and accelerate this transformative change through real-life demonstration projects that serve as inspiring examples of how innovative, climate-friendly modes of urban transport can be integrated into local transport systems. In the course of the project different use cases were implemented into practice in cities throughout the Baltic Sea region, varying from public and cargo transport solutions to electric city logistics and e-scooters for social inclusion, and practice-based recommendations for municipalities are developed on how to increase electric mobility solutions in urban transport systems.

Authors
Franziska Wolf
European School of Sustainability Science and Research (ESSSR),
Hamburg University of Applied Sciences, Hamburg, GERMANY
franziska.wolf@haw-hamburg.de

Nicolas Restrepo Lopez,
INTERREG IVB project BSR electric
Hamburg University of Applied Sciences, Hamburg, GERMANY
Nicolas.RestrepoLopez@haw-hamburg.de

Walter Leal, Prof. Dr.(mult.) Dr.h.c.(mult.)
Research and Transfer Centre “Sustainability & Climate Change Management”
Hamburg University of Applied Sciences
Hamburg, GERMANY
walter.leal2@haw-hamburg.de
6. Circular Economy

Circular economy refers to an economic system built on circular materials flows, instead of the more conventional economic systems where a product is being produced, used and trashed. In a circular economic system, materials produced are used, later to be reused, repaired, repurposed or recycled. The underlying idea with circular economy is to build an economic system which favors a circular economic flow and de-couples the resource use and emissions from the growing economy. Thus, producing systems where the economy is flourishing, without the negative environmental impacts.

Circular economy has already been adapted in a small scale and in a number of sectors through out the region. But in order to truly change the resource extraction and emission patterns on a large scale, the system needs to be up-scaled.

Coordinators
Visvaldas Varžinskas, Assoc. Prof. Dr., Kaunas University of Technology
Markus Will, Dipl.-Ing. (FH), Hochschule Zittau/Görlitz

Scientific Committee
Visvaldas Varžinskas, Assoc. Prof. Dr., Kaunas University of Technology
Markus Will, Dipl.-Ing. (FH), Hochschule Zittau/Görlitz
Tatjana Polajeva, Prof., EuroAcademy, Tallin, Estonia
Jakub Kronenberg, University of Lodz, Poland

Contributors
Jakob Hildenbrandt, *Alleviating the nitrogen overshoot by deploying circular bioeconomy conversion platforms* .................................................................54
Jolita Kruopiene, *Assessing the possibility for a circular economy for phosphorus in Lithuania* ........55
Zita Markevičiūtė, *Circular economy for packaging - replacing plastics to biomass* .........................56
Tatjana Paulauskiene, *Cellulose aerogel from paper waste for crude oil spill cleaning* ...............57
Katarzyna Sadowy, *Potential of post-industrial urban ares to create circular cities. Case of Warsaw* ............................................................................................................58
Živilė Šimkute, *Indicators for Circular economy in City level: Kaunas city experience* ...............59
Ivonne Stresius, *Cooperation for Circular Economy* .....................................................................60
Rasa Viederyte, *Circular economy business modeling for core operations efficiency* ...............61
Analysis of Used Textile Flows for Development of Circular Textile System in Lithuania

Inga Gurauskiene, Viktorija Nausede & Zaneta Stasiskiene

Production and consumption of textile and clothing is on linear economic model, which relies on large quantities of cheap, easily accessible materials and energy. It generates meaningful amounts of used textile, which is mostly treated as waste (incinerated or landfilled). Lack of the recycling technologies (recycling rate is less than 2%), discrete circular economy business models applied for textile and unsustainable consumption patterns lead to increase of the global textile waste problem. Per capita consumption of clothing and footwear in the EU increased in weight by 34% between 1996 and 2012 and global consumption of clothing and footwear is expected to increase by 63% by 2030, from 62 million tones today to 102 million tones. The global or regional figures disclose the scale of the problem. The more explicit analysis is required in order to identify the textile flows within the national context or region. Therefore, the mapping research has been done in Lithuania in order to disclose the state of the art of the external (input – output) and internal (within the country) textile flows. The analysis was made based on the research of statistical data and survey of different stakeholder groups (collectors of used textile (private, charities), regional waste management centers and wholesalers and sorters of used textile). The main results describe the national value chain and textile flows in Lithuania and some relations with the international CE context. The results of the analysis identify Lithuania as textile sorting hub in the European circular economy context, however there is a lack of circularity within the country. The results are analyzed as the bases for the development of Circular textile system within the Lithuania, having in mind that the collection of used textile (required by EU since 2025) cannot ensure circularity by itself. Based on the results, the potential for reuse, sharing, upcycling and recycling activities are identified as the basis for engagement of stakeholders – shareholders of the textile circularity. The research is performed in the framework of the project “Towards a Nordic-Baltic circular textile system” funded by the Nordic Council of Ministers.

Keywords
Circular economy, used textile, flows, circular textile system

Authors
Inga Gurauskiene, Ph.D. Assoc. Prof., Institute of Environmental Engineering, Kaunas University of Technology, Kaunas, LITHUANIA, inga.gurauskiene@ktu.lt
Zaneta Stasiskiene, Ph.D. Prof., Institute of Environmental Engineering, Kaunas University of Technology, Kaunas, LITHUANIA, zaneta.stasiskiene@ktu.lt
Viktorija Nausede, Director/founder, Resources for sustainable development, TEXTALE, Vilnius, LITHUANIA, Viktorija.nausede@textale.lt
Alleviating the nitrogen overshoot by deploying circular bioeconomy conversion platforms

Jakob Hildebrandt

When aiming to harness the full leverage potentials of bioeconomy transformation strategies in closing technical and biological nutrient loops at the soil-water-materials nexus, the high-value added use of products derived from organic residues and fertilizers is a major opt-in playing field. When water bodies become exposed to nitrogen excess critical load may face overshoot and eutrophication impacts cause major threats on aquatic biodiversity, trophic chains and oxygen saturation levels. On the other hand, nitrogen molecules are critical ingredients in the formation of heteromolecular polymers and protein synthesis which offers a potential playing field for deploying biotechnological solutions to recover nitrogen loads from organic substrates in agriculture and in the waste sector. Market pull for low-added value products in the fertilizer segment as envisioned by conventional agricultural players is persistently low, therefore major break-through innovations opening up new markets and positioning strong pull-factors for systems change can only be expected from innovative biotechnology players. Biotechnological product innovations which show good prospects to yield high removal rates of nitrogen and are capable of high-value added conversion of low-cost substrates with high nutrient loads can be found in the domains of chitin-based products, as chitin-polymer chains contain nitrogen atoms and furthermore protein products for food and fodder industries as nitrogen plays a critical role in protein synthesis. The chitin platform, can either rely on insect biotechnology or on fungal biotechnology, whereas the protein platform can rely on both fungal and insect biotechnology or on bacterial processes such as single cell proteins. The pathway of high-value added conversion lies ahead when we start to recover post-harvest and storage losses for producing insect oils for lubricants, insect proteins for livestock fodder and fungal-based chitin polymers for interieur designs, packaging, leather substitutes and many more materials. The future state of ecosystems might depend on these urgent actions in applying both i. systems thinking on these transformative innovations on a systems scale and ii. bottom-up interventions when ecopreneurs start into founding smart biofabrication companies, which produce materials to alleviate the nitrogen overshoot.

Keywords
Circular Bioeconomy, Biotech Conversion Platforms, Organic residues, Nitrogen Overshoot

Author
Jakob Hildebrandt, Prof. Dr.-Ing, Prof.
Faculty of Natural and Environmental Sciences
Zittau/Goerlitz University of Applied Sciences
Zittau, GERMANY
Jakob.hildebrandt@hszg.de
Assessing the possibility for a circular economy for phosphorus in Lithuania

Jolita Kruopienė, Kastytis Pamakštys & Inga Gurauskienė

Phosphorus (P) is a vital nutrient for plant growth. To increase agricultural yields, usage of mineral P fertilisers started in XIX century. Only some countries have reserves of phosphate rocks needed to produce these fertilisers. Phosphate rock and P are included into the list of Critical Raw Materials for EU. Although phosphate rock is non-renewable, P as such is recyclable. Thus, a number of countries started activities to close P cycles.

The aim of the research was to evaluate circular economy possibilities for P in Lithuania. P flows in the country were investigated by Material Flow Analysis. This provided a basis to understand the current situation, assess recirculation potential, and develop possible P management scenarios.

Special features is production of mineral P fertilisers and agriculture with substantial export. The main P inflows are with calcium phosphates (82.3%), food and feed (9%), and fertilizers (8.7%). Lithuania ranks among 5 top countries for global production of DAP. As there are no own reserves, rock is imported mainly from Russia (~ 65%), South Africa, Morocco. There is no possibility to change that big production of mineral P fertilizers for similar volume of P fertilizers from secondary internal sources. Significant domestic processes are related to crop production and livestock farming, with a large share of production exported (meat, cereals). Therefore, P is transported out of the country and cannot be recirculated. P losses occur to surface waters from agricultural areas and WWTP discharges, and with wastewater sludge storage. Mostly P is recovered with manure and slurry, and compost from biodegradable waste and sewage sludge.

Keywords
phosphorus, phosphorus recovery, phosphorus losses, material flow analysis, critical raw materials

Authors
Jolita Kruopienė, Ph.D. Prof.
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
Jolita.Kruopiene@ktu.lt

Kastytis Pamakštys, M.Sc. Jr Researcher
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
Kastytis.Pamakstys@ktu.lt

Inga Gurauskienė, Ph.D. Assoc. Prof.
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
Inga.Gurauskiene@ktu.lt
The European Commission unveiled European Green Deal outlining a list of policy initiatives aimed at putting Europe on track to reach net-zero global warming emissions by 2050. One of main points in the Commission plan is a new circular economy action plan, which will be tabled in March 2020. It will include a sustainable product policy with “prescriptions on how we make things” in order to use less materials, and ensure products can be reused and recycled. The EU Action Plan for the Circular Economy establishes a concrete and ambitious programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials and a revised legislative proposal on waste.

Looking to our shopping basket, we see that there are no products without the packaging and most of the packaging contains plastic. Not only European Commission or other official institutions have to think about waste management and reduction. Producers, retailers and us - consumers have to change our habits.

Consumers can change their consumption behaviour, producers has to look for more sustainable packaging solutions that goes same direction with circular economy principles. Facing the fact that currently potential for recycling plastic waste remains largely unexploited, reuse of end-of-life plastics remains very low, the aim of this research was to find green, sustainable materials to replace plastic used in packaging. This research provided a basis to understand the current situation, assess environmental impact of the alternatives - renewable and biodegradable materials such as paper, sugarcane or bamboo.

**Authors**

Zita Markevičiūtė, Jr Researcher  
Centre for Packaging Innovations and Research  
Kaunas University of Technology  
Kaunas, LITHUANIA  
zita.markeviciute@ktu.lt

Visvaldas Varžinskas, Assoc. Prof. Dr.  
Centre for Packaging Innovations and Research  
Kaunas University of Technology  
Kaunas, LITHUANIA  
visvaldas.varzinskas@ktu.lt
Cellulose aerogel from paper waste for crude oil spill cleaning

Tatjana Paulauskiene, Jochen Uebe, & Ali Ugurcan Karasu

A high volume of shipping traffic including many tankers is responsible for environmental problems caused by oil pollution on the Baltic Sea. This affects the aquatic fauna, flora and atmosphere. Aerogels are particularly suitable for removing oil from the water surface – they have excellent physical and chemical properties, high chemical surface activity as well as they can be reused, thus prolonging their lifecycle.

With globalization and population boom, paper industry has quickly developed, and the global production of paper is expected to increase to 500 million tons by 2020. Waste paper can also be made into adsorbent for the removal of oil pollution. However, the adsorption capacity is low when waste paper is used as adsorbent directly. Waste paper is rich in cellulose fibers, which products possess considerable adsorption capacity for oil through modification or compositing with other materials.

The investigation of paper waste based cellulose aerogel production and its application to oil product clean-up from the water surface was performed in this research work. Six types of aerogel with 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 wt-% cellulose have been produced. Aerogel's sorption capacity as well as its regeneration for sorption of crude oil, marine diesel oil and biodiesel sorption from water surface and mechanical strength were performed. It was found that crude oil sorption capacity rich 29.67±0.39 g g⁻¹, biodiesel – 29.07±0.26 g g⁻¹, while marine diesel oil – 26.26±0.39 g g⁻¹. The best sorption properties after 10 sorption/ regeneration cycles performed aerogel with 0.5 wt-% cellulose.

Keywords
cellulose aerogel, paper waste, waste recycling, oil spills, sorption capacity, regeneration

Authors
Tatjana Paulauskiene, Assoc. Prof., Docent
Department of Engineering
Klaipeda University
Klaipeda, LITHUANIA
tatjana.paulauskiene@ku.lt

Jochen Uebe, Assoc. Prof., Docent
Department of Engineering
Klaipeda University
Klaipeda, LITHUANIA
jochen.uebe@ku.lt

Ali Ugurcan Karasu, MSc
Department of Engineering
Klaipeda University
Klaipeda, LITHUANIA
aliukarasu@gmail.com
Potential of post-industrial urban areas to create circular cities. Case of Warsaw

Katarzyna Sadowy, Dominika Brodowicz & Maciej Czeredys

Circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural system (Ellen MacArthur Foundation). It was defined on EU level as a carbon neutral, resource efficient and competitive economy, which may induce innovations and new jobs. The question to be answered is the role of urban environment in such transition. In Europe we mostly deal with the existing urban structure, part of it constructed due to the industrial revolution and for the purposes of the industrial production happening right in the heart of the urban structure. Today, these post-industrial areas make us ask two questions: how we can use the existing urban environment in a sustainable and circular way? And, second, what kind of circular uses would be the best as new life for these abandoned or even abused sites? Presented research has been conducted for some years now in Praga district in Warsaw, which for decades thrived through a variety of economic ventures, from large scale factories to small scale repair and craftsmen’shops. For last 30 years the area was in decline while other parts of the capital city were being developed and re-developed. Today Praga is undergoing its own transformation. During the analysis a set of existing tangible and intangible assets was identified, namely: the built environment (buildings, sites but also variety of scale, spatial relations between sites and facilities, etc.); social capital (networking, social relations, local identity); skills (repair, craftsmanship, existing production sites and their employees). Re-use of the existing built environment is part of the circular approach in its own right. Heritage values also create good basis for the effort to keep as much of the existing area as possible. Another action consists of the attempt to introduce circular economy aspects such as durable goods, repair and change in consumption behavior. To do so several intertwining elements of urban environment are needed. In Warsaw some of the circular actions may be already be identified, as adaptive re-use of the buildings, increase in repair services, innovative design, but to reach the threshold of circular economy they must interact to create synergies. It is important to provide space for circular small businesses within the city, and post-industrial sites may be successfully adapted for that purpose. Recommendations for such actions are based on the author's own research as well the the preliminary result of the project OpenHeritage which received funding from the European Union’s Horizon 2020, research and innovation programme under grant agreement No 776766. The sole responsibility for the content of this publication lies with the authors. It does not necessarily represent the opinion of the European Union. Neither the EASME nor the European Commission is responsible for any use that may be made of the information contained therein.

Corresponding author
Katarzyna Sadowy, Dr.
Warsaw School of Economics
Warsaw, POLAND
ksadow@sgh.waw.pl
Indicators for Circular economy in City level: Kaunas city experience

Živilė Šimkutė & Visvaldas Varžinskas

Lack of indicators for Circular Economy on city level was identified as one important barrier for cities transition toward circularity. The EU Urban Agenda Partnership on Circular Economy stated that there is no unified system of how cities can assess circularity or match each other. Thus, the assessment of the effectiveness of circular economy measures in cities requires a system of circular economy indicators. The aim of Kaunas city research was to test practically a system of circular indicators, developed by Partnership and propose a model for assessing (or comparing) performance of cities in the European Union in implementing circular economy measures. During the process of testing and implementation of developed circular economy indicator system, an attempt was made to assess the main challenge - how Circular Indicators can be applied in city level (practical approach of simple, not advanced, typical small or middle size EU city management framework).

For the first task researchers made an analysis of all material from Partnership on Circular Indicators. It was decided to use indicator system as a flexible framework, which can be easily adoptable for particular city needs or specific situation. It is clear, that proposed list of indicators by Partnership widely covers and allows to monitor most aspects of Circular Actions and processes. During the implementation of indicator system Kaunas developed a Model for measuring the efficiency of the circular economy in cities. To create this model, we integrated the concept of Environmental performance evaluation system (ISO 14031:2013) together with the idea of Global Reporting Initiative (methodology of measurement of progress in Social responsibility) and everything was connected with Knowledge-based systems engineering approach. The developed performance measurement system allows urban progress to be assessed at levels where the most advanced city in the circular economy is classified as A, and at least D. The efficiency of the system of indicators of circular economy created was checked using Kaunas city data from strategic city documents.

The efficiency of the system of indicators of circular economy created was checked using Kaunas city data from strategic city documents. The data reveal that 10 indicators of the circular economy indicator system was analysed in Kaunas city; therefore, Kaunas is classified as a beginner, least developed city in the circular economy and corresponds to level D. After checking the effectiveness of the indicator system in Kaunas City, recommendations are made for the strategic planning of the city to increase the effectiveness of the circular economy measures and to measure the effectiveness of the city's circular economy measures.

Authors
Živilė Šimkutė, Lector
Institute of Environmental Engineering
Kaunas University of Technology
Kaunas, LITHUANIA
z.simkute@ktu.lt

Visvaldas Varžinskas, Assoc. Prof. Dr.
Centre for Packaging Innovations and Research
Kaunas University of Technology
Kaunas, LITHUANIA
visvaldas.varzinskas@ktu.lt
Cooperation for Circular Economy

Ivonne Stresius, Donald Alimi, Seija Virkkala, Åge Mariussen & Walter Leal

In two European funded research projects, studies about involved stakeholder and their cooperation for circular economy and the value chains were undertaken. In the Horizon 2020 project “FORCE - Cities Cooperating For Circular Economy” the analysis is based on case studies of established “value chain partnerships” in the four European cities of Copenhagen, Hamburg, Lisbon and Genoa. Research findings are derived from online surveys, qualitative guideline-based interviews with local key stakeholders and workshops with the partner cities. In the INTERREG BSR project “LARS – Learning among Regions about Smart Specialisation” the stakeholder analysis is based on a business strategy approach and adapted to value chains, Germany and not just on a single company. The focus in this presentation is on the evaluation of the value chain for electronic and electric devices in Hamburg.

The research results show that the key drivers for cooperation along the value chain vary between the public and private stakeholders. Strong and weak relations of cooperation between the stakeholders along the value chains are observed as attributed to specific framework conditions. Findings suggest the crucial role of public authorities (regional/local) as facilitators of cooperation in particular for closing material loops. Finally, strategic partnerships and cooperation between governmental and non-governmental stakeholders along the value chain can be promoted as a tool or mechanism, which could further steer innovation and launch the “value chain partnership” as a governance approach for the circular economy at the city/region level.

Keywords
value chain partnerships, stakeholder analysis, waste of electrical and electronic equipment

Authors
Ivonne Stresius, Dipl.-Eng. Research and Transfer Centre “Sustainability & Climate Change Management” Hamburg University of Applied Sciences Hamburg, GERMANY Ivonne.stresius@haw-hamburg.de
Donald Alimi (M.Sc.) HafenCity University Hamburg Hamburg, GERMANY donald.alimi@hcu-hamburg.de
Seija Virkkala, Prof. University of Vaasa Vaasa, FINLAND seija.virkkala@uwasa.fi
Åge Mariussen, University of Vaasa Vaasa, FINLAND agemariussen@yahoo.com
Walter Leal, Prof. Dr. (mult.) Dr. h.c. (mult.) Research and Transfer Centre “Sustainability & Climate Change Management” Hamburg University of Applied Sciences Hamburg, GERMANY walter.leal2@haw-hamburg.de
Circular economy business modeling for core operations efficiency

Rasa Viederytė & Vytautas Juščius

The concept of circular economy originates in the inability of linear production models to reconcile current levels of production and consumption with the limited availability of resources. New approach to economy provided the foundation for the main principles: (1) Design out waste, (2) Build resilience through diversity, (3) Rely on energy from renewable sources, (4) Think in systems, (5) Share values (symbiosis). Thus, the need to reshape bussines modelling appears with the strong focus on solutions of the efficiency, productivity, economy as well as reducing waste, lower polution, increased social responsibility and reuse options.

The main purpose of research is to analyse circular economy efficiency parameters in field of new business modelling regards manufacturing industries ‘core operations: design of product/components, manufactruring process management and logistics/supply.

The research covers manufacturing industries ‘economy efficiency parameters analysis, related on the circular economy rechaped business models, regards to capability of business model scale, work procedures, process planning as well as internal and external technologies and organizational relationships.

Several economical frameworks and new practices have been developed to assist organizations in the implementation of circular products and processes: regenerate, share, optimize, loop, virtualize, recycle, parts harvesting, refurbish, transform, upgrade and exchange. Based on systematic scientific literature review, each of these aspects will be provided in more detailed approach from economic perspective evaluation, in particular on main resources management. The shift towards circular business modelling affects decision making, reuse and efficiency in economics of main cycle-processes. Close and open manufacturing systems are taken into account while analysing.

Keywords
circular economy, business models, operations efficiency, optimisation

Authors
Rasa Viederyte, Ph.D. Assoc. Prof.  Vytautas Juscius, Ph.D. Prof.
Department of Economics, Faculty of Social Science and Humanities  Department of Economics, Faculty of Social Science and Humanities
Klaipeda University  Klaipeda University
Klaipeda, LITHUANIA  Klaipeda, LITHUANIA
rasa.viederyte@ku.lt  ek.shmf@ku.lt
7. Sustainable Tourism

Tourism is a dynamic global industry which has grown and changed dramatically over the past twenty years. It is one of the largest resource consuming industries in the world. The growth of travel has led to the concern shown for the environmental, economical as well as social sustainability. It is also the fastest growing and important industry in terms of the number of employees and its potential for the social, economic and environmental impacts. This theme aims at gathering researchers on sustainable tourism from a broad range of fields as well as engage the next generation of tourist research scholars around the Baltic Sea. As a multi-disciplinary endeavor, we explore specifically sustainability issues in hospitality industry such as destination development, tourist attractions, tourist accommodations etc.

Coordinator
Anette Oxenswärdh, PhD., Senior Lecturer, Uppsala University, Sweden

Scientific Committee
Anette Oxenswärdh, PhD., Senior Lecturer, Uppsala University, Sweden
Ulrika Persson-Fischier, Uppsala University, Sweden
Maria Fredriksson, Uppsala University, Sweden
Elena Kropinova, Prof., Immanuel Kant Baltic Federal University, Kaliningrad, Russia

Contributors
Leszek Butowski, Sustainable tourism: A humanistic approach (seen from the outside of mainstream discussion) ................................................................. 63
Sabine Gebert Persson, The tourism industry’s crisis management during the Corona Spring ……….64
Iryna Kriba, Ways of Implementing Sustainable Tourism in the National Parks of Western Ukraine ................................................................. 65
Małgorzata Luc, Jacek Szmańda, ETNOS - portal supporting sustainable tourism …………….66
Marek Nowacki, Experiencing islands: sustainable tourism on Gotland, Bornholm and Wolin. Analysis of TripAdvisor reviews …………………………………………….67
Anette Oxenswärdh, A Learning Journey on problem solving by a Group of Master Students using the Design Thinking Framework ….………………………….68
Ulrika Persson-Fischier, Sustainable tourism through collaboration between community and higher education: The case of the master programme in Sustainable destination development, Uppsala University, campus Gotland, Sweden …………………..69
Marije Poort, Sustainable Destination Development – A comparison between the Baltic and Pacific ……………………………………………………….70
Lyudmila Poplavskaya, New steps towards Sustainable Development Goals in Russia: Biodiversity conservation and Eco-tourism as one of the priority in Russian National Project “Ecology” ………..71
Owe Ronström, "Magical Gotland". Visitors, visited and destinations in tourist brochures ……….72
Diana Šaparnienė, Innovation Leadership for a Sustainable Tourism Development …………………..73
Larysa Satyr, Analysis of tourist flows between Ukraine and countries of the Baltic Sea Region ……….74
Živilė Stankevičiūtė, Designing a sustainable business model for wellness tourism …………………..75
Anna Sörensson, Sustainable Tourism Development in the Shadow of a World Heritage National Park in Sweden – A Case Study in the Baltic Sea Region ………………………………..76
Sustainable tourism: A humanistic approach
(seen from the outside of mainstream discussion)

Leszek Butowski

The purpose of this paper is to present an approach for sustainable tourism – derived from the human-centered perspective as a main reference axis. Given this assumption, the approach has been designed so as to include all groups of tourism stakeholders: tourists, local communities, and local and external tourism businesses. Their attitudes are related to socio-cultural, environmental, and economic assets, which play the role of main resources of touristic areas – including the Baltic Sea regions. The methodology of the research consists of two parts: conceptual and empirical. As regards the conceptual approach, the theoretical achievements related to sustainable tourism are critically analyzed. For this reason, two approaches have been taken into consideration. The first is concerned with the issue of temporary balance in relation to the fulfilling of needs of various groups of tourism stakeholders (intra-generational perspective), taking simultaneously into account existing resources. The second is related to the problem of sustainability understood as a long-term (tourism) development (inter-generational perspective). As a result, a model of sustainable tourism has been created. It consists of two parts and considers the principles of both above-mentioned approaches which are presented in Figure 1 and Figure 2. The proposed model fills the gap in the discussion related to theoretical issues of sustainable tourism. Its novelty is concerned with the fact that the model takes into account the ‘human factor’ expressed by the opinions on tourism development formulated by various groups of tourism stakeholders who act on a given area. As regards the empirical part, the presented theoretical model has been treated as an empirical tool and tested in chosen Baltic Sea regions. During the research the representatives of both main groups of tourism stakeholders (i.e. tourists and local communities) were surveyed about their subjective assessments of temporary advantages and disadvantages in relation to tourism development in their areas.

Keywords
model approach, needs of tourism stakeholders, subjective assessment, temporary balance, long-term sustainability

Author
Leszek Butowski, Ph.D. Assoc. Prof.
Department of Urban Geography and Tourism
University of Lodz
Łódź, POLAND
leszek.butowski@gmail.com

Figure 1. Conditions for the temporary state of balance/imbalance of tourism development

Figure 2. The long-term changes of tourism sustainability/unsustainability
The hospitality industry in Sweden would normally prepare all spring to be able to receive tourists from Sweden and foreigners on holiday. As recently as May 2020, the industry was still facing huge changes. When country after country shut down in February / March this year, banned or advised against travel, the very first to be largely affected by unemployment were employees in hotels and restaurants. Statistics from the Swedish Agency for Economic and Regional Growth regarding the number of overnight stays in Sweden during the month of April show reductions of up to 80 percent. (https://tillvaxverket.se/statistik/vara-undersokningar/resultat-fran-turismundersokningar/2020-06-04-fortsatt-minskning-av-gastnatter-i-april.html). How the hospitality industry reacts in times of crisis needs to be further explored. The organizing of public and private interests in order to transform a place and its characteristics into a destination is a complex process (Raisi et al., 2020). Although complex, cooperation among actors in destination networks, mobilizing joint activities and forming networks has been argued as essential for sustainable destinations within destination management literature (cf. Beritelli, 2011; Presenza, Sheehan, Ritchie, 2005). A reason for the complexity is that research has shown that reciprocal relationships are hard to form with many different hinders of knowledge transfer and collective actions. More research is still needed in order to bring further clarity into factors affecting these types of relationships and networks (de Araujo and Bramwell, 2002) as well as how this affects the actors. This paper sets out to further the understanding of interaction processes in the formation of networks by focusing on a created network where public and private actors attempt to find ways to cooperate on a common issue (cf Brito, 1999) and how this process of forming a network is affected in times of crisis. The focus of the paper is on identifying different phases that can exist in the formation of created networks. This is done through a case taking its point of departure in a decision to build a new quay at a destination in Sweden that in turn resulted in a created network. The attempts to form the network however faces a number of issues that becomes barriers in the formation of the network. Results show that the degree of centralization and urge affects the activities and commitment to cooperation. Preliminary results further indicate that perceived barriers for cooperation decreased as the crisis hit the industry, decisions and actions became centralized and new joint activities were initiated.

Keywords
Network, DMO, crisis

Corresponding author
Sabine Gebert Persson, Senior Lecturer/Associate Prof.
Department of Business Studies
Uppsala University,
Uppsala, SWEDEN
sabine.gebert-persson@fek.uu.se
Ways of Implementing Sustainable Tourism in the National Parks of Western Ukraine

Iryna Kriba, Marta Malska & Yuriy Zinko

National parks in Ukraine are in the vanguard of introduction of ecological forms of tourist activities and technologies oriented at decreasing recreation pressure on the environment. They demonstrate successful models of cooperation with local people when servicing tourist flows. Western Ukraine is characterized by the highest concentration of natural parks, 18 such objects constituting one third of all national parks of Ukraine.

The concept of sustainable development of recreation and tourism in the national parks is a priority in nature conservation and recreation policy. Its elements are specified in strategic objectives and priority activities in 10-year management action plans of the parks development. The action plans for recreation and tourism sphere development take into consideration the specifics of tourism resources, level of recreation activity development, as well as modern trends of tourism development on the territories of nature reserves. Among the main strategic tasks in the context of sustainable development in the national parks of the region, the accessibility of the main attractions of the parks, educational and pro-ecological infrastructure, target programmes for the visitors, new forms of ecological tourist activities are in the focus of attention. By the criteria of the level of tourism infrastructure development and indexes of the quantity of visitors they are divided into two main types: those in an intensive tourism and recreation use and those in an extensive one. In the western region, parks created on the territories with a considerable concentration of tourism infrastructure and high level of tourist movement belong to the parks in an intensive tourism and recreation use. For these parks, emphasis is made on modernization of ecological and thematic paths and by saturating them with informational and educational elements, providing their accessibility and decreasing recreation digression. Parks in an extensive tourism and recreation use, as a rule, cover the territories with well-preserved natural complexes and underdeveloped tourism infrastructure as well as low indexes of visitor activity. For such parks, activities aimed at making complex ecological-educational and specialized (geo-tourist, country-studying, memorial) paths, substantiating and implementation of additional tourist attractions and ecological forms of tourism activities, are the priority.

Keywords
national park, recreation management plans, visitors, tourist activities, ecological tourism, recreational load.

Corresponding author
Iryna Kriba, Lecturer,
Department of Foreign Languages for Natural Sciences
Ivan Franko National University of Lviv
Lviv, UKRAINE
ikriba@yahoo.com
ETNOS - portal supporting sustainable tourism

Małgorzata Luc, Jacek Szmańda, Magdalena Tejwan-Bopp & Clemens Bopp

Sustainability is a commonly desirable concept also in tourism. It is not only associated with limitations of a negative impact on the environment but it is also a part of a few Sustainable Development UN Goals that deal with social and economic aspects. A creation of job opportunities for young people, reduction of inequalities including gender ones and in an education, wasting less food or protecting the environment are just a few potential benefits from supporting local investments and manufacturers. A reasonable management of social and natural resources could take place through a modern geoportal where a sustainable tourism is supported. The idea arose from the combination of a native (ethnic) tourism and electronic tools and was called – native e-tourism. Native e-tourism promotes an approach of giving a chance for local communities to become a service provider without any intermediate party in popular geosites they have a strong connection with.

Authors tried to solve the problem of an access for native e-tourism service providers to individual (slow) tourists. The use of an easily accessible electronic technology (ETNOS geoportal) may help to create a system of private enterprise and remain sustainable in their operations. The suggested theme is a case of an incorporation of a theory into an applied work and takes part in a discussion on the contemporary and future trends in tourism.

Keywords

- e-tourism
- slow tourism
- individual tourism
- geoportal
- sustainability

Authors

Małgorzata Luc, Ph.D. with habilitation (Docent)
Institute of Geography and Spatial Management
Jagiellonian University in Krakow
Kraków, POLAND
malgorzata.luc@uj.edu.pl

Jacek Szmańda, Ph.D. with habilitation (Docent), Assoc. Prof.
Institute of Geography
Pedagogical University of Krakow
Kraków, POLAND
jacek.szmanda@up.krakow.pl

Magdalena Tejwan-Bopp, MSc
Clemens Bopp, MScEng
E-Tourism Native Open Services (ETNOS)
Nürnberg, GERMANY
info@etnos-global.com
Experiencing islands: sustainable tourism on Gotland, Bornholm and Wolin. Analysis of TripAdvisor reviews

Marek Nowacki & Joanna Kowalczyk-Anioł

Islands as tourism destinations are considered in different perspectives including those related to sustainability. However, there is a lack of research that includes experiences reported online. Moreover, the Baltic islands (research subject) have not been covered by any analysis of tourists' experience on online user-generated content so far. The aim of this article is to analyse the experiences gained by tourists visiting Baltic islands. Authors focused on the following questions: What experiences are gained by tourists visiting the Baltic islands? Is the idea of sustainability present in their opinions? Data for analysis — reviews posted by TripAdvisor users — were downloaded from TripAdvisor.co.uk. All opinions from ‘Things to do’ category were collected regarding attractions located on three Baltic island: Gotland (950), Bornholm (373) and Wolin (157). First, experiences / words related to sustainability were sought. It was searched for words related to three fundamental sustainability dimensions (environmental, social, and economic). Then, these words were grouped into subdomains of synonyms and coded. It was found that Gotland's experiences are associated with e.g.: city old town walk and Gotland museum history. Bornholm’s experiences are associated with e.g.: beach & sand, round church. And Wolin’s experiences with e.g.: visiting forest park & bison, or military history german bunker. Then a correspondence analysis was made to visualize association of cases (sustainability subdomains) and vars (islands). Wolin’s experiences are characterized by subdomains: forest and wildlife, Bornholm by environment, atmosphere, authenticity and conservation. Gotland’s experiences by plant, flowers, economy, climate and society. Differences in the frequency of subdomains between the islands were verified using chi-square test. Only four subdomains significantly differentiate the studied islands: plant and flowers in Gotland reviews, wildlife and forest in Wolin reviews. The study identified a number of experiences related to the idea of sustainability, in particular nature-related experiences. Gotland and Wolin stand out here: plants and flowers (for Gotland) as well as wildlife and forest (for Wolin) are specific experiences shared by tourists visiting these islands. The identified sustainability experiences indicate that both of these islands can be interesting destinations for sustainable tourism.

Keywords
Baltic islands, experiences, sustainable tourism, TripAdvisor, Text Mining

Authors
Marek Nowacki, Ph.D., Eng., Prof.
Department of Applied Sciences
WSB University in Poznań
Poznań, POLAND
Marek.Nowacki@wsb.poznan.pl

Joanna Kowalczyk-Anioł, PhD., Assistant Prof.
Faculty of Geographical Sciences, Institute of Urban Geography and Tourism Studies
University of Lodz,
Lodz, POLAND
joanna.kowalczyk@geo.uni.lodz.pl
A Learning Journey on problem solving by a Group of Master Students using the Design Thinking Framework

Anette Oxenswärdh, Camilla Saggiomo, Aida Alonso, Iida Pyykkö, Lena Rothe & Patrycja Metlewicz

In the fast-paced knowledge societies of today, people are constantly confronted with complex problems that involve the design of innovative solutions. To create contextualized knowledge for problematic situations, creating plausible solutions is an important competency required. Education towards innovative problem solving and learning is needed. The purpose of the study is to describe a group of master students’ own experiences over their learning journey in planning sustainable education for Bed and Breakfast providers by using Design Thinking method. The methodology implemented for this study was Action Research in which the learning rationale goes over a cyclical process in different stages and uses Design Thinking - as a structure; empathizing with the target audience by understanding their needs, i.e. interviewing hosts of Bed and Breakfast and gathering data; finding the root causes to the problem; ideating and creating solutions that solve the project’s problem by creating collaborative brainstorming; prototyping a solution that can be implemented in a small scale; testing the created prototype and if necessary finding new improvement opportunities. By applying the Design Thinking methodology and Action Research into the problem statement, enables not only a creative and holistic perspective on how sustainable education can be implemented through an innovative learning process but also learning over the challenges and benefits of working as a group. The results show further that communication between parties is important for learning outcomes. Working with real-life problems that have no given answers and outcomes increases motivation for learning and creates a sense of group affiliation.

Keywords
action research, design thinking method, individual and group learning, higher education, problem solving

Authors
Anette Oxenswärdh, Ph.D., Assistant Prof. Department of Engineering Sciences Uppsala University Visby, SWEDEN anette.oxenswardh@angstrom.uu.se

Camilla Saggiomo, Master Student – Sustainable Destination Development Camilla.Saggiomo.0370@student.uu.se

Aida Alonso, Master Student – Sustainable Destination Development Aidasarai.Alonsoguerrero.6093@student.uu.se

Iida Pyykkö, Master Student – Sustainable Destination Development Iidaeveliina.Pyykko.3513@student.uu.se

Lena Rothe, Master Student – Sustainable Destination Development Lena.Rothe.1210@student.uu.se

Patrycja Metlewicz, Master Student – Sustainable Destination Development Patrycja.Metlewicz.3316@student.uu.se
Sustainable tourism through collaboration between community and higher education: The case of the master programme in Sustainable destination development, Uppsala University, campus Gotland, Sweden

Ulrika Persson-Fischier

This paper discusses sustainable tourism through collaboration between community and higher education. With the example of a master programme in Sustainable destination development at Uppsala University, campus Gotland, it is discussed how higher education and community can collaborate for sustainable tourism development.

The master programme in Sustainable destination development is described and how this programme collaborates with actors in the local community to create sustainable tourism. Internships, thesis and in particular one course “Projects in interdisciplinary teams”, is described, in which students work together with actors from the local community and the sustainability destination development challenges they face, with a design thinking methodology. One example from that course is discussed in particular, in which a student project on how to make cruise tourists care for heritage preservation, resulted in increased collaboration between actors in the community, who did not have any contact prior to the student work.

Some of the experiences on part of both students and local actors are described and the mutual benefits of this collaboration for sustainable tourism are discussed. It is concluded that for students, who are embarking on a long career in sustainable destination development, the experiences of working practically on challenges from the local community in which their education takes place offers them unique insights into sustainable destination development that they will bring with wherever their future careers take them. It is also concluded that the local tourism actors gain from collaborating with higher education. As the students come from different parts of the world, they bring with them a variety of experiences and perspectives, which provide the local actors with new perspectives to old problems, and in this way helps them to solve sustainability challenges.

Keywords
sustainable tourism, higher education, community, collaboration

Author
Ulrika Persson-Fischier, Ph.D.
Department of Civil and Industrial engineering
Uppsala University
Uppsala, SWEDEN
ulrika.persson-fischier@angstrom.uu.se
Sustainable Destination Development – A comparison between the Baltic and Pacific

Marije Eileen Poort, Ulrika Persson-Fischier & Helene Martinsson-Wallin

As visitor numbers on Gotland are growing each year, the island is becoming a more important tourism destination in the Baltic Region. This growing number of (cruise) tourists brings new and enhances old sustainability challenges. Now that Gotland is an example destination for sustainability within the context of the business organization Cruise Baltic, it becomes even more important to focus on how the destination is and can be developed in a sustainable way. This paper attempts to shed light on this by way of juxtaposition, by comparing Gotland with a different tourist and cruise destination, Easter Island, or Rapa Nui in the Pacific. Even if in some ways very different from Gotland and situated in a very different region, we aim to show how this seemingly farfetched comparison in fact is very relevant to understand the Baltic situation. The data show that both Easter Island and Gotland have to deal with a high amount of cruise tourist. The visitor-resident ratio is similar, both islands mostly attract domestic tourists who mainly come for sun, sea and beach instead of cultural heritage and collaboration between stakeholders lacks. An important difference is the outlook on the growth of number of visitors. Easter Island has set a maximum on the number of arrivals per year, while Gotland aims at a continuous growth. These different views on growth have implications for the sustainable development of the island destinations, as number of visitors to small places is generally conceived of as an important factor for sustainable destination development. In this paper we will discuss how these radically different views on number of visitors can be understood, and what consequences they might have for sustainable destination development.

Keywords
sustainable development, de-growth, visitor numbers, island destinations, over tourism

Authors
Marije Eileen Poort, MSc. Ma., Teaching Assistant
Department of Engineering
Uppsala University
Visby, SWEDEN
marije.e.poort@angstrom.uu.se

Ulrika Persson-Fischier, PhD., Lecturer
Department of Engineering
Uppsala University
Visby, SWEDEN
ulrika.persson-fischier@angstrom.uu.se

Helene Martinsson-Wallin, Prof., Senior Lecturer
Department of Archaeology and Ancient History
Uppsala University
Visby, SWEDEN
helene.martinsson-wallin@arkeologi.uu.se
New steps towards Sustainable Development Goals in Russia: Biodiversity conservation and Eco-tourism as one of the priority in Russian National Project “Ecology”

Lyudmila Poplavskaya & Elena Kropinova

Russia pays considerable attention to issues of sustainable development. Since 2018, the National Ecology Project has been developed and is being implemented. The project as a whole is aimed at supporting most of the seventeen SDGs identified in 2030 Agenda for Sustainable Development. In our study, we will focus on the connection channels of Goal 15 - “Life on land” with the specifics of implementing one of the key objectives of the National Project “Ecology” - Goal 5 “Preservation of biodiversity, including the creation of at least 24 new protected natural areas”.

The main attention will be paid to the analysis of the implementation of program activities under this Goal of the National project. So, one of the key indicators for the implementation of this project is as follows: An increase in the number of visitors to specially protected natural areas. The performance of this indicator is a rather controversial issue. On the one hand, the expansion of target groups and the number of ecotourists is undoubtedly necessary, since this meets the principles of sustainable tourism development. Moreover, this helps to increase the socio-economic significance of the direction, the growth of funds allocated to solve environmental problems and to increase biodiversity in national parks that implement these services. On the other hand, an increase in the number of visitors can lead to environmental degradation and a decrease in the natural value of protected natural areas. The article will give possible options for resolving this discrepancy. The case of cross-border natural parks of the North-West Federal District of Russia and their interaction with EU natural parks located on the opposite side of the border will be considered as a case-study.

Keywords
sustainable development, specially protected zones, sustainable tourism, Russian National Project “Ecology”, natural heritage sites, SDGs.

Authors
Elena Kropinova, Dr., Assoc. Prof., Docent
Institute of Recreation, Tourism, and Physical Education
Immanuel Kant Baltic Federal University
Kaliningrad, RUSSIA
kropinova2@mail.ru

Lyudmila Poplavskaya, Head of the Admin Project Office of the Federal project "Preservation of Biological Diversity and the Development of Ecological Tourism"
FSBI "RFI Ministry of Natural Resources of Russia"
Moscow, RUSSIA
poplavskaya.l.79@mail.ru
"Magical Gotland". Visitors, visited and destinations in tourist brochures

Owe Ronström

This paper presents results from the current long-term multidisciplinary research program “Sustainable visits” at Campus Gotland, Uppsala University, Sweden. Gotland, the largest of Sweden’s more than 260 000 islands, is one of Sweden’s oldest and most well-developed tourist destinations and an important part of Sweden’s extensive insular “pleasure peripheries”. By examining tourist brochures from Gotland, the paper analyses how visitors, visited and the destination are constituted in mutual relationships, and how imageries, ideas, perceptions, artefacts and activities structure and shape these relations. How, in which contexts and with which values and expressive forms is Gotland produced as an attractive destination? What the Gotlandic brochures present to the reader is a space disembodied from its local or regional setting, ready for immediate consumption on a global market, a space attributed with the qualities that come with an “island destination”, smallness, boundedness, difference, remoteness, archaism, endemism and magic. In general, ‘the island’ stands out as emptied from its inhabitants, a terra nullius ready to occupy and explore for the visiting tourist. A concluding argument is that tourist brochures must be understood as active agents that contribute to the formatting of island destinations, as well as its islanders and visiting tourists. It is argued that to become sustainable, the tourist industry needs to invite both visitors and the visited to take a more active part in the production of imageries of visitors, visited and destinations, as well as in the discourses and practices that constitute hospitality and tourism generally.

Keywords
Gotland, tourism, tourist brochures, images, imageries, visitors, destination, relations.

Author
Owe Ronström. PhD, Prof. in ethnology
Dep. Of Anthropology and Ethnology
Uppsala University, Campus Gotland
Visby, SWEDEN
Owe.ronstrom@etnologi.uu.se
Innovation Leadership for a Sustainable Tourism Development

Diana Šaparnienė & Daumantas Bočkus

The tourism sector in regions is often known for implemented innovations. Especially when tourism has intention to position itself be sustainable, where innovations relates to an economic prosperity, social cohesion and environmental sustainability. However, innovation without human capital is not in itself the basis for the sustainable tourism development. Human resources and their innovative initiatives are key issues for the development of sustainable tourism. What role of Innovation leadership for the development of Sustainable Tourism Development? The study aims to investigate the role of Innovation leadership for the development of Sustainable tourism, taking case of Baltic Sea Coastal Tourism in Lithuania, and to identify key points and barriers for the development of sustainable tourism innovations from the leadership perspective. The overall aim of the study is to provide a deeper understanding of the concept “Innovation leadership in tourism sector organisation” and its relationship with “Sustainable tourism development”. Multiple data sources, including analyses of documentation, reports, and qualitative semi-structured interviews were used. Empirical research was performed in six Coastal tourism organisations in Lithuania. The study sample includes representatives from national and regional protected areas parks administrations, tourism operators, natural resource management agencies, NGO’s involved with sustainable tourism ecosystem and local innovations. Whilst sustainable tourism development is an overarching goal for the most regions, research showed that relationship between implementation of sustainability in developing tourism innovations and leadership role in that is lacking of attention. Good Innovation leadership in tourism sector is recognized as key for improving performance and achieving sustainability goals. The study identified key points and barriers for sustainable tourism innovations development from the perspective of leadership. Planning and project management, collaboration, ability identify innovations, knowledge transfer, decision-making, putting learning in to practice are the main features of the leader. While lack of such competences as organizational trust, integrity, awareness, ability to recognize opportunities, etc. hinders the development of innovations. This research evaluates the concept of Innovation leadership for sustainable tourism development and lead to rethinking of tourism research and inspiring a new wave of study, especially in nowadays, when tourism industry is facing an unprecedented challenge due to COVID-19.

Keywords: Innovation leadership, Sustainable tourism development, Innovations, Leadership, Sustainability.

Authors

Diana Šaparnienė, Ph.D, Prof.
Department of Sport, Recreation and Tourism
Klaipeda University
Klaipeda, LITHUANIA
diana.saparniene@ku.lt

Daumantas Bočkus, PhD student, lecturer
Department of Sport, Recreation and Tourism
Klaipeda University
Klaipeda, LITHUANIA
daumantas_b@yahoo.com
Analysis of tourist flows between Ukraine and countries of the Baltic Sea Region

Larysa Satyr, Ruslana Zadorozhna & Leonid Stadnik

Gaining independence by post-soviet countries expanded traveling opportunities for their citizens. Among these countries are Ukraine and states of the Baltic Sea Region, namely the Russian Federation, Estonia, Latvia, and Lithuania. The last three countries had a big tourist attractiveness as a domestic tourism destination in the USSR; further, it became international. This paper investigates the peculiarities of inbound and outbound tourism between Ukraine and nine countries located along the Baltic Sea shorelines over 2012-2019. The research question was which tourist flows are prevailing and how has the visa-free regime of traveling to the Schengen Area affected the number of Ukrainian citizens who traveled to the Baltic Sea Region. The informational base encompasses the data of the State Border Guard Service of Ukraine. Statistical methods of grouping, time series analysis and graphical visualization were applied to achieve the aim to discover the trends in tourist flows between Ukraine and countries of the Baltic Sea Region. The results obtained indicate that Ukrainian outbound tourism raised steadily. It increased 1.347 times in 2019 compared to 2012. We don’t observe the change in trend after visa-free regime implementation. But inbound tourism trend has changed in 2014: the number of foreign visitors was 48.5 % less in 2014 compared to 2013. The decline for visitors from the Baltic Sea Region’s countries was 69,1%. Private visit as a purpose of trip is the most popular one for both Ukrainian and foreign travelers. Organized tourism is indicated rarely: for Ukrainians during the whole period; for foreigners from Baltic Sea Region – since 2014. The structure of tourist flows by countries was transformed significantly. The main directions of departures from Ukraine were Russian Federation (48.9%), Poland (47.4%), Germany (3.1%) in 2012. The proportions of these countries equal 24.9%, 67.8% and 4.8% respectively in 2019. Shifts in arrivals structure were similarly: proportion of the Russian Federation decreased from 83.6% to 45.6%. Contrary, Poland’s share increased from 12.3% to 36.6%; Germany’s – from 2.4% to 8.9%. Lithuania’s growth exceeded 8 times. Detailed analysis of these processes will be performed taking into account the new challenges for sustainable tourism in post-COVID-19 circumstances.

Keywords
inbound tourism, outbound tourism, Baltic Sea Region, Ukraine, COVID-19

Corresponding author
Ruslana Zadorozhna, Ph.D. Assoc. Prof., Docent
Department of Entrepreneurship, Trade and Exchange Activity,
Bila Tserkva National Agrarian University
Bila Tserkva, UKRAINE
ruslana.zadorozhna@btsau.edu.ua
Designing a sustainable business model for wellness tourism

Živilė Stankevičiūtė & Eglė Staniškienė

In the recent years, wellness tourism in Lithuania has developed rapidly. Wellness tourism refers to the phenomenon of people travelling to tourist destinations that offer good natural environments and/or particular cultures to preserve or improve their health. Companies operating in wellness tourism apply diverse business models, which describe the rationale of how an organisation creates, delivers, and captures value. Recently more organisations have been changing the way used to run their business focusing of the intersection of economic development, environmental protection and social responsibility. Drivers for such transition from business-as-usual to a sustainable organisation are not limited to government regulations and economic benefits, but also include external pressures such as customers, NGOs, and even internal pressure from employees and from the business sector the organisations are operating in. Although the literature introduces and describes some sustainable business models for the wellness tourism, they still lack a holistic perspective integrating the three sustainability pillars (economic, social and environmental) and the relevant features of the wellness tourism industry. Thus, the paper seeks to close the existing gap in the literature by proposing how wellness tourism could create, deliver, and capture economic, environmental and social forms of value simultaneously. The aim of the paper is to reveal the sustainable business model for the wellness tourism by describing the components and practices that illustrate the attitudes and actions of organisations towards sustainability. The paper is based on the qualitative research method collecting data through semi-structured interviews with representatives of wellness industry companies in Lithuania, which are oriented towards sustainability. The empirical results demonstrated that businesses include sustainability aspects in the customer value proposition and focus on long-term customer relationships. Local suppliers (food, materials) prevail and the interests of local community are taken into account (sponsorship of cultural events). Employees are treated as key asset of companies applying sustainable human resource management practices like flexibility, respect, and work-life balance. Concluding, the empirical results suggest that organisations are on the way to changing their business model into a sustainable one, however these changes need a more integrated approach.

Keywords
sustainable business model, wellness tourism, sustainability, business model,

Authors
Živilė Stankevičiūtė, Ph.D. Assoc. Prof. School of Economics and Business Kaunas University of Technology Kaunas, LITHUANIA zivile.stankeviciute@ktu.lt

Eglė Staniškienė, Ph.D. Prof. School of Economics and Business Kaunas University of Technology Kaunas, LITHUANIA egle.staniskiene@ktu.lt
Sustainable Tourism Development in the Shadow of a World Heritage National Park in Sweden – A Case Study in the Baltic Sea Region

Anna Sörensson & Ulrich Schmudde

This paper examines the issue of a destination that is situated in the shadow from a well-established destination. Shadow destinations are destinations that exist in the shadow of a well-established destination with a main attraction and a strong and well-known brand. The aim with this paper is to study a destination in the shadow of a well-established destination with a famous nature attraction and a strong brand. The study was constructed as a single case study where a shadow destination in a rural setting in Sweden was chosen. The single case selected was the smaller city of Härnösand situated in the shadow from The High Coast in Sweden by the Baltic Sea. Data was mainly collected from semi-structured interviews with representatives from the municipality and county, the destination marketing organization, and private tourism companies. Data was also collected by observations and written materials. The results show that a shadow destination could add value to tourists in a well-established destination by offering attractions that benefit the tourists. It also shows the importance of networking between these destinations and the usefulness of the well-known brand in their communication towards tourists. The shadow destination could also help a well-known destination to become more sustainable when the pressure of too many tourists of the well-established destinations are reduced. This could offer a more sustainable solution to try to release the pressure from the national park. Finally, a shadow destination could create routes that make the tourists choose other ways and therefore experience attractions in the shadow destination.

Keywords
tourism development, rural destination, brand, shadow destination, travel reason

Authors
Anna Sörensson, Ph.D. Assistant Prof.
Department of Economics, Geography, Law and Tourism (EJT)
Mid Sweden University
Östersund, SWEDEN
anna.sorensson@miun.se

Ulrich Schmudde, Ph.D. candidate
Department of Economics, Geography, Law and Tourism (EJT)
Mid Sweden University
Östersund, SWEDEN
ulrich.schmudde@miun.se
Education for Sustainable Development (ESD) is a transdisciplinary research field, studying transformative learning within formal, non-formal and informal settings. ESD works with learning processes in relation to all SDGs in Agenda 2030. ESD is about combining wicked issues such as climate change, disaster risk and overconsumption with teaching and learning frameworks. ESD looks at participatory teaching methods and high-quality learning environments, for learners to co-create their education, their world, and their future. ESD promotes sustainability competencies like critical thinking, action competence and future scenarios skills.

**Coordinators**
Cecilia Lundberg, PhD. Project Coordinator at Åbo Akademi University, Finland
Eva Friman, Director SWEDESD, Uppsala University, Sweden & Adjunct Professor, University of the Sunshine Coast, Australia

**Scientific Committee**
Stefan Bengtsson, Dr., Project Coordinator, SWEDESD, Uppsala University, Sweden
Eva Friman, Director SWEDESD, Uppsala University, Sweden & Adjunct Professor, University of the Sunshine Coast, Australia
Walter Leal, Prof. Dr. (mult.) Dr. h.c. (mult.), Hamburg University of Applied Sciences, Germany
Cecilia Lundberg, PhD. Project Coordinator at Åbo Akademi University, Finland
Shepherd Urenje, Dr., Specialist, SWEDESD, Uppsala University, Sweden

**Contributors**
Larysa Cherniak, *Modern aspects on education for sustainable development in technical higher education institutions* .................................................................................................................. 79
Tiina Elvisto, *Student Awareness of Hazardous Substances in Consumer Products* ........................................ 80
Maria Falaleeva, *Mainstreaming climate change agenda into higher and professional education in Belarus* ........................................................................................................................................... 81
Laima Galkute & Gediminas Capkauskas, *The role of Sustainable Development Goals for transformative learning* ...................................................................................................................... 82
Sean Goodwin, *Connecting socio-ecological values and education on sustainable development: a case study with Swedish primary school students* .................................................................................................................. 83
Elena Kropinova, *New steps for cooperation around the Baltic Sea in high education and research in accordance with the Baltic University Programme development* ........................................................................................................... 84
Jukka Käyhkö, *Climate University: A cooperative approach to sustainability education in Finnish universities* .................................................................................................................................................. 85
Kari Lilja, *Curricula planning and the goals of sustainable development* ................................................................. 86
Irina Martynova, *Towards ecology of education in transformation to sustainable educational environment* ............................................................................................................................................... 87
Julija Melnikova, *Teaching Sustainability in Higher Education: rethinking connections between competences and pedagogical approaches in Lithuanian universities* ................................................................................................................................. 88
Ulrika Persson-Fischier, *Assessment, examination and grading – the last step in the ESD ladder?* .....89
Jaana Ruoho, *Development of a business training programme for green micro entrepreneurs in Baltic Sea Region* ...........................................................................................................................................90
Hanna Saturska, *Teaching and learning of sustainable healthcare in the public health and medical education curricula* .............................................................................................................................................91
Katarzyna Znajdek, *GREEN T: Sustainable Development supportive tools for Design Thinking process* .................................................................................................................................................92
Modern aspects on education for sustainable development in technical higher education institutions

Larysa Cherniak & Margaryta Radomska

Considering the fundamental importance of the ecological way of life it is commonly accepted that all engineering specialties must be provided with equal volume of information on the sustainable development, modern environmental problems and their potential solutions. The role of high school in building of environmental awareness is finalizing and aimed at formation of holistic environmental outlook of students, as a future professional. However, environmental engineers normally get broader perspective of environmental issues and thus are able to implement the principles of sustainability in both professional and everyday life. To evaluate the potential gap in knowledge and skills among the students of non-environmental specialties, the students’ awareness about environmental impacts of people was tested on the example of the environmental impacts of the transport. The results showed a range of important problems and complications for environmental culture formation. In particular, environmental and sustainability information is so disseminated and mentioned so often that it creates the illusion of clear understanding of these issues among common public. Moreover, the most primitive actions are often considered as a big step toward sustainable life style. It is a very dangerous misunderstanding, as it may lead to the underestimation of environmental problems in professional life. The resulted level of environmental processes and sustainable development goals understanding must be of different quality. This paper presents an idea of new course for students of the specialties other than environmental engineering. We believe that general knowledge about the sustainable development and regularities of nature functioning are important, but they are senseless to common people without corresponding professional background. As a result, the competencies, students gain based on this course, are inconsiderable and lost very quickly. The new course about sustainable development for students of the specialties other than environmental engineering was developed. It is life time importance for all trainees independent from their professional activity and it will provide their continuous commitment to sustainability principles.

Keywords
Sustainable development, higher education, environmental protection

Authors
Larysa Cherniak, Ph.D. Assoc. Prof., Docent
Ecology Department
National Aviation University
Kyiv, UKRAINE
specially@ukr.net

Margaryta Radomska, Ph.D. Assoc. Prof., Docent
Ecology Department
National Aviation University
Kyiv, UKRAINE
m.m.radomskaya@gmail.com
Best Practices for Teaching about Hazardous Substances in Consumer Products – What We Are Learning

Tiina Elvisto

We produce and use vast quantities of consumer products that contain synthetic substances. While many of these substances supply desirable properties such as water resistance, antibacterial qualities, or attractive colors, they harm nature and human health. These substances are found in many popular personal care products, household cleaning products, furniture, and toys that we use every day. We also transfer diverse chemical compounds and elements from the lithosphere to the biosphere. The accumulation of hazardous substances, including heavy metals, in soil, waterbodies, and organisms, interfere with ecosystems and is not sustainable.

Tallinn University participated in Think Before You Buy – Baltic Info Campaign on Hazardous Substances – BaltInfoHaz, an EU Life+ project. This project produced information materials (https://thinkbefore.eu/en/) in English, Byelorussian, Estonian, Finnish, German, Latvian, Lithuanian, Polish, Russian, Swedish, including video clips. Among others is the Teacher’s Guide (https://drive.google.com/file/d/0B-pgl7dqEPXTDJJsUUNmdk1pdnc/view), which comprises detailed information about chemical production and consumption, the risks that these hazardous substances have for human health and the environment, and chemical safety control measures. The guide also details teaching-learning methods together with practical exercises for primary, and secondary classes of ordinary school, and college level.

This presentation describes the research that went into producing the teacher’s guide and the other instructional material and the evaluation of their effectiveness. Drawing on our experience with this project, recommendations are offered for effective teaching of this topic.

Keywords
hazardous substances, consumer products, human health, environment, teacher’s guide

Author
Tiina Elvisto, Ph.D. Assoc. Prof., Docent
School of Natural Sciences and Health
Tallinn University
Tallinn, ESTONIA
tiina.elvisto@tlu.ee
Mainstreaming climate change agenda into higher and professional education in Belarus

Maria Falaleeva, Elena Laevskaya & Halina Pilavets

Climate change is a critical threat to the economy and society, and an important strategic factor for development. GHG emission reduction, transition to carbon-neutral economy, and climate change adaptation become essential elements of strategic thinking and planning. The understanding of the climate change and its impacts is an important competence for modern specialists, and a necessary element of life-long professional education.

Nevertheless, mainstreaming climate agenda into higher education remains a challenge because: (1) the cross-disciplinary climate change knowledge does not correspond to subject-oriented education and requires flexibility in teaching and university management; (2) the knowledge integration requires adaptation of information in different areas (climate science, climate finance, climate policy and law) to broader audiences; (3) it varies between the countries depending on the national political and economic agenda.

In Belarus, low political importance of the climate agenda, coupled with low flexibility of the educational system, impedes the integration of climate topics in education. In the absence of national stimuli, international initiatives play an important role, supporting active national universities and lecturers. The first multi-disciplinary course on climate change has been developed by UNDP project “Environmental Security” (2015) and piloted in several universities as an extra-curriculum activity. The international interdisciplinary project “Baltic University Climate Change Curricula” supported by the Swedish Institute (2019-2020) allows continuing the efforts.

This experience allowed identifying the gaps and needs for further steps, and to make practical suggestions for mainstreaming climate education into university curricula and additional education for the practitioners. The next steps include developing special courses and thematic modules for different specialities, trainings and networking for university teachers and students.

Authors

Maria Falaleeva, Ph.D.  Halina Pilavets, Docent
INGO EKAPRAEKT  Chair of Geography, Faculty of Biology
Minsk, BELARUS / Cork, IRELAND  Vitebsk State University
m.falaleeva@ekapraekt.by  Vitebsk, BELARUS

Elena Laevskaya, PhD., Docent  pilovets_galina@mail.ru
Chair of Civic Law, Law Faculty
Belarusian State University
Minsk, BELARUS
evlaevskaya@gmail.com
The role of Sustainable Development Goals for transformative learning

Laima Galkute & Gediminas Capkauskas

Lithuanian general education system is on a way to curriculum reform since 2018. It is concentrated on developing of key competencies in coherence with learning objectives of particular subjects. Transdisciplinary topics related with Sustainable Development Goals (SDG) by the United Nations 2030 Agenda are recognized as significant element within competence-based curriculum because of their global perspective and value-orientation, from one side, and interpretation by different school subjects, from another. Science Curriculum for 5-8 grades was chosen as a pilot project, and currently is implementing by 79 schools in the country. It is characterized by inquiry learning, systems approach in explaining scientifically real-life phenomena, and exploring interplay of natural, technological and social processes, in particular. SOLO taxonomy is considered as a basis for assessment of declared and functioning knowledge in order to reflect complexities of the world. A present research focuses on: inclusion of SDGs as an integral part of the Science Curriculum; development of transformative competencies leading to active citizenship; reflection (both by teachers and students) on educational process and new emerging sustainable development culture. Analysis of the Science Curriculum shows that SDG 3, 6-7, 9, 12-15 could find a relevant place in defining learning outcomes. Students’ activities demonstrate preparedness for responsible actions based on comprehensive analysis of the situation, critical and creative thinking and collaboration. Integrating of SDGs into curriculum represent an important factor in establishing connections between global issues and local transformative actions for sustainability as well as implementing personalized learning strategies as an innovative pedagogical concept.

Keywords
competence-based curriculum, transformative learning, active citizenship

Authors
Laima Galkute, Ph.D., Researcher
Education Academy
Vytautas Magnus University
Kaunas, LITHUANIA
laima.galkute@vdu.lt;

Gediminas Capkauskas, Ph.D., Lecturer
Faculty of Natural Sciences
Vytautas Magnus University
Kaunas, LITHUANIA
gediminas.capkauskas@vdu.lt;
Connecting socio-ecological values and education on sustainable development: a case study with Swedish primary school students

Sean Goodwin, Sara Brogaard & Torsten Krause

Ensuring engagement with the Sustainable Development Goals (SDGs) by younger generations is critical to the transformational change necessary to achieve the goals, both now and after 2030. In encouraging stronger engagement, an understanding of the socio-ecological values held by children towards ecosystems is critical information in constructing effective, science-based policy for education on sustainable development. Innovative educational and research methods are therefore required in order to connect and align policy with these values. In filling this gap, this study focussed on the perception of primary school students in the Gothenburg area (ages 10-12, n=403) of fundamental ecosystem services provided by forests, particularly through the lens of relational values. Relational values were a useful theoretical frame in understanding the unique relationships children develop with forest ecosystems through play and exploration as they include more complex notions of value than previously dominant paradigms involving only instrumental or intrinsic values. Data was gathered within a multi-stakeholder partnership led by the science centre Universeum involving schools, local government, and forestry industry actors with the aim to educate primary school aged children on the importance of forests. The results suggested that the students displayed strong relational and other values towards forest ecosystems, including relational values of care and stewardship, discovery, mental and physical health, among others. In the Swedish context, these results direct where further emphasis could be placed in educational curricula to further underscore positive society-nature interactions to strengthen and maintain the values presented, further bolstering the aims of SDGs 13 and 15.

Keywords
Sweden, school children, forest ecosystem services, values, education

Authors
Sean Goodwin
Institute for Environment Studies (IVM)
Vrije Universiteit
Amsterdam, NETHERLANDS
Sean.goodwin@vu.nl

Sara Brogaard
Lund University Centre for Sustainability Sciences (LUSCUS)
Lund University
Lund, SWEDEN
Sara.brogaard@luscus.lu.se

Torsten Krause
Lund University Centre for Sustainability Sciences (LUSCUS)
Lund University
Lund, SWEDEN
Torsten.krause@luscus.lu.se
New steps for cooperation around the Baltic Sea in high education and research in accordance with the Baltic University Programme development

Elena Kropinova & Eugeny Krasnov

A lot of new steps for Education and Sustainability development were raised during the 7th International Maritime Forum in Kaliningrad (2019) where a special Baltic University Session was presented, including the report about the new directions of BUP activities (by Dr. M. Granvik). This report highlighted the needs for the openness of the education, including mobility both of students and teachers, international conferences, new teaching programme on sustainability in different spheres of universities life. In our paper we would like to concentrated on the following issues: the activity of the Baltic Universities Programme – output and input from 2020 till 2030; the special attention will be paid for the Sustainable development as a subject of both the education and research; and finally, the Russian National Project “Ecology” 2019-2024 in relation with the UN Sustainable Development Goals.

The Baltic Universities Programme (BUP) serves mostly promotion the education for sustainable development in the Baltic Sea Region (BSR). Another issue is the problem-oriented teaching with highlighting best practices implementation in the BSR. One of the programmes of this project called “Clean air” is aiming to “take urgent action to combat climate change and its impacts”. The recent stage of realization of the Russian National project “Ecology” will be presented too.

Among the Baltic universities there is a strong accent on the Innovations for the Blue Economy. It demands the special algorithms of Actions for the Civil Society in accordance with the Helsinki Commission Recommendations (dealing with ecosystem productivity, biodiversity and nature protection, green technologies for economic activities, ecological transport, innovation technologies for sustainable shipping etc.). There is great need for transboundary cooperation in the BSR which also will be discussed.

Keywords
the Baltic University Programme, Economy of Knowledge, Green Economy, Sustainable tourism.

Authors

Elena Kropinova, Prof.
Institute of Recreation, Tourism, and Physical Education
Immanuel Kant Baltic Federal University
Kaliningrad, RUSSIA
kropinova@mail.ru

Eugeny Krasnov, Prof.
Institute of Natural Use, Territorial Planning and Urban Development
Immanuel Kant Baltic Federal University
Kaliningrad, RUSSIA
ecogeography@rambler.ru

84
Climate University: A cooperative approach to sustainability education in Finnish universities

Jukka Käyhkö, Laura Riuttanen, Sari Puustinen, Anna Kirveennummi & Morgan Shaw

A nationwide project Climate University (blogs.helsinki.fi/climateuniversity/) has been established in Finland to tackle the sustainability challenge. The Climate University network is funded by the Ministry of Education and Culture, and consists of 11 Finnish universities, as well as collaborators from government organizations, basic education and the business sector.

The project started with a survey of stakeholder needs regarding the sustainability challenge. The responses unveiled several gaps in knowledge and a clear need for better sustainability education in e.g., the following sectors: multidisciplinarity, holistic understanding, data and statistics, science communication across the society, consumer perspective, plus values and ethics.

Climate University is currently building the following six open access online learning materials to be completed by the end of 2020: Systemschange.now - Systems thinking in global challenges; Sustainable.now - Introduction to sustainability in climate change; Solutions.now - Project course in private sector collaboration; Climate.now for schools - High school level course on basics of climate change; Climate data and statistics - Statistical tools for analysing climate data; and Science communication in climate change.

Open learning principles were piloted already in 2016 in the Climate.now project (www.climatenow.fi). This course (2-5 ECTS) has currently been adopted in the curricula of nine Finnish universities. In addition, Climate University has produced open online courses on the multidisciplinary topics of sustainability leadership (www.leadforsust.fi) and circular economy (www.circularnow.fi).

Collaboration and co-creation between multidisciplinary experts from all across the society has been highly fruitful, and we foresee Climate University to have an important role in advancing the potential to reshape sustainability education in Finland and elsewhere.

Keywords
sustainability, higher education, open access, online, co-creation, multidisciplinarity

Corresponding author
Jukka Käyhkö, Ph.D., Prof.
Department of Geography and Geology
University of Turku
Turku, FINLAND
jukka.kayhko@utu.fi
Curricula planning and the goals of sustainable development

Kari K. Lilja, Sirpa Sandelin & Sanna Lindgren

Sustainable development as an exhaustive concept has been taken into account only in very few education programmes within the higher education institutes in countries around the Baltic countries. The contemporary climate worry and fear of greenhouse phenomena have raised the interest in sustainable development. However, most of the programmes that are stated to follow the theses of sustainable development are approaching the topics like pollution, usage of fossil fuels or micro-plastics of oceans in point of view of only one or some of the 17 goals of sustainable development presented by United Nations Development Programme.

The paper will present some examples of curricula and discuss how to ensure that at least majority of the goals could be taken into account. It will be found out that the more we are concentrating to only the most topical questions, the more difficult it can be to find a solution that would be in line with the principles of sustainable development. For example, on point of view of sustainability it is not worth fighting against climate change if the only thinkable solution increases inequality. Thus, we have to be very careful when designing courses and curricula dealing with the sustainable development.

Keywords
sustainability, education, curriculum, goals of sustainable development

Authors
Kari K. Lilja, D.Sc. (Tech.), Senior Researcher,
Faculty of Technology,
Satakunta University of Applied Sciences
Pori, FINLAND
Kari.lilja@samk.fi

Sirpa Sandelin, D.Sc. (Tech), Principal Lecturer,
Faculty of Technology,
Satakunta University of Applied Sciences
Pori, FINLAND
Sirpa.sandelin@samk.fi

Sanna Lindgren, Project worker
Faculty of Technology,
Satakunta University of Applied Sciences
Pori, FINLAND
Sanna.lindgren@samk.fi
Towards ecology of education in transformation to sustainable educational environment

Irina Martynova & Jekaterina Sadovskaya

Ecology and sustainability are among buzzwords heard in educational settings along with 17 SDGs for post-2015 agenda. Another challenge, Covid-19, has already transformed practices of traditional education, urging the search for new solutions. In light of above, SDG 4 has become even more acute. To make education sustainable in modern conditions, it is critical to incorporate new conceptual interdisciplinary trends of research and education, especially ecology of education. The term “ecology of education” is not clearly defined, particularly beyond the EU borders. Some scholars consider it a human ecology trend, the inter-disciplinary domain integrating natural and social sciences with the humanities, viewing education as facilitator of the process and result of human activity in terms of human-environmental interaction. According to Harvard Graduate School of Education, ecology of education involves the study of educational culture and changes in a broad social context, at macro- and micro-levels. The educational model is viewed as three-dimensional: engaging educational institutions in socio-cultural contexts (relations with communities), promoting relations within an educational institution as a dynamic organism, and fostering interpersonal relationships concentrating as well on tools to analyse socio-cultural aspects of education, e.g. accessibility, impact of race, gender or social status on educational outcomes, fair respectful treatment. A survey carried out among SB BSU students and staff in 2018 proved a rather low awareness about ecology of education in Belarus. A slightly over 73% of teachers admitted familiarity with the term; only 37% reported an understanding and basic awareness. Among the students, 10% knew the term, proved flexible in thinking and had a wider range of associations. Further research shows a slight change, a higher level of awareness possibly due to the growing popularity of the phenomena. The surveyed expressed willingness to implement new models and practices in on- and off-line education. Students have come up with their own ideas of how to make academic processes more ecological. To conclude, BSU needs specific steps to create a sustainable educational environment through implementing education ecology and emphasising its potential to “ensure inclusive and equitable quality education and promote life-long learning opportunities for all”.

Keywords
ecology of education, sustainable education, educational environment, subject of education

Authors
Jekaterina Sadovskaya, Ph.D. Assoc. Prof.
Department of International Business
School of Business of Belarusian State University
Minsk, BELARUS
sadovskaya@sbmt.by

Irina Martynova, Senior Lecturer
Department of International Business
School of Business of Belarusian State University
Minsk, BELARUS
martynova@sbmt.by
Although sustainability has recently become a key focus in Lithuanian higher education, developing a better understanding of how sustainability competences can be cultivated in university courses and programs is still needed. This article argues that learners who are to become capable of affecting holistic sustainable change, transforming values and culture, healing the earth and human communities, and designing creative solutions, must have the opportunity to engage in learning processes that reflect these learning outcomes. The article suggests that Transformative learning theory provides best pedagogical practices for designing of and engaging in holistic sustainability learning. Transformative learning aims to build new cognitive capacities as well the agency to put new knowledge into practice. This learning has the potential to transcend the notorious value/action gap that divides our awareness of current ecological, social, cultural etc. issues from our capacity to take appropriate action. Beyond the mere dissemination of information, transformative learning engages participants in dialogic and experiential learning processes with the aim of creating deep learning experiences. Because the problems with regards to sustainability are both complex and deeply entrenched into our culture, these transformative learning processes are essential for the learning associated with sustainability and responsive education. Consequently, it is important to identify the commonalities of transformative learning, sustainable education and competences frameworks. A key link here is the challenge to transform pedagogy in higher education. This article operationalizes education associated with sustainability and argues that pedagogical approaches should focus on elements relating to the processes of learning, rather than the accumulation of knowledge. Insights from empiric research, carried out in the universities of Lithuania, disclose the importance to develop graduates with capabilities to improvise, adapt, innovate, meanwhile, skills such as interdisciplinary thinking, problem solving, team working, and holistic thinking were mentioned by students themselves.

**Keywords**
sustainability competences, Transformative learning theory, higher education

**Author**
Julija Melnikova, PhD, Senior Researcher
Department of Pedagogy
Faculty of Social Sciences and Humanities
Klaipeda University
Klaipeda, LITHUANIA
Julija.Melnikova@ku.lt
Assessment, examination and grading – the last step in the ESD ladder?

Ulrika Persson-Fischier

The reformation of higher education through implementing Education for Sustainable Development (ESD) is happening all over the world. I started by creating a smaller module to be used within existing courses, then went on to forming full courses and a full master programme. I formed course- and programme expected learning outcomes. This work went smooth. I was able to do it without any resistance, neither from students, teachers, administrative systems or university management.

It seems to me that this forms a kind of ESD ladder; you start with something small, then work with larger entities, and move from changes that are dependent on individual teachers, to structural changes that are not dependent on individuals, for more durable structural change and quality control. So far so good.

I felt the next step in this ladder was assessment, examination and grading. My experience is that the way examination is usually done, and how the administrative systems shape what we can and cannot do, is inadequate for ESD teaching and learning. Because of this, I entered a Change Project Process at SWEDESD in the spring of 2019 with the aim of exploring this. My conclusion was that taking ESD teaching and learning seriously, it is extremely difficult or even impossible to create grading that truly reflect the competences ESD wishes to achieve.

In this paper I will explain why I think this is the case, and also discuss the kind of resistance I have met trying to implement a different grading system. These challenges have both been of administrative kind, and based in emotional responses; it seems grading is deeply rooted in teachers’ conceptions of what we do and why at university, even when irrational. It seems that when you try to take this last step in the ESD ladder, it is the first step where you encounter serious challenges, which risk you being thrown down the ladder altogether. This is because examination and grading direct what we can and must do in the classroom, and if they are not fit for ESD, then implementation of ESD in the classroom becomes very difficult.

Keywords
Education for sustainable development, assessment, examination, grading

Author
Ulrika Persson-Fischier, Ph.D.
Department of Civil and industrial engineering
Uppsala University
Uppsala/Visby, SWEDEN
ulrika.persson-fischier@angstrom.uu.se
Development of a business training programme for green micro entrepreneurs in Baltic Sea Region

Jaana Ruoho

Sustainable development needs entrepreneurs who contribute to environmental and social goals while running a profitable business. Succeeding in green entrepreneurship requires expertise and several types of competences to create value. In an Interreg Central Baltic project named NatureBizz, four universities from Finland, Sweden, Estonia and Latvia started a project to support the competitiveness of green micro business by creating a curriculum and delivering a training programme for the entrepreneurs. First, business skills for green micro business were identified and aligned in the Central Baltic Area, followed with the design of a training programme. The training programme is based on the identified skills and includes eight modules (business planning, understanding of green consumers, building a brand, quality, product development, management of supply chains, communication, internationalization). During the training, participants concentrated on business-related issues in their own companies with support of a handbook that was created for the local piloting in the four countries.

Sustainability can be understood in several ways, and in this project, the concept of sustainability was connected to the content of the United Nation’s (UN) Sustainable Development Goals (the SDGs). Micro enterprises benefit from a framework for sustainability that is common and easy to understand, and in NatureBizz, the SDGs were recommend as a way of understanding sustainability. Micro enterprises can’t approach the goals in the same manner as large ones but regardless of the size of the company, all can contribute to and benefit from the SDGs. As a result, the project promoted to the understanding and applying of the SDG’s in green micro business context.

Keywords
green micro business, training programme, sustainability, SDGs

Author
Jaana Ruoho, MSc (Econ. and Bus. Adm.), Senior Lecturer
Faculty of Service Business
Satakunta University of Applied Sciences
Pori, FINLAND
jaana.ruoho@samk.fi
Teaching and learning of sustainable healthcare in the public health and medical education curricula

Hanna Saturska, Larysa Fedoniuk & Nataliya Potikha

The major challenges in the field of public health and medical services now being faced by many East European countries and Ukraine is not an exception. Leading the growing international recognition of the need for sustainability in Public health and healthcare delivery, medical regulators have mandated that newly qualified doctors and public health masters must be able to apply the principles of sustainability and sustainable healthcare in particular to medical practice. This research investigates how best to incorporate this new learning into the curricula for medical and public health students. In 2019-2020 academic year, a new master program for students of specialty “Public Health” was launched at I. Horbachevsky Ternopil National Medical University (TNMU). The course about the Sustainable Development principles have been included into the syllabus for Public Health masters within the course «The health of the population and its main determinants». This new subject contains a brief factual overview, which is intended to inform students on key health trends in the context of Sustainable Development. Close cooperation is planned to support the sustainable development of universities that have the opportunity to provide educational services, where teachers will receive special skills and effective teaching methods for theoretical material on the foundations of sustainable development. The research has shown that there is continual pressure on space in the medical curriculum, as many theoretical and clinical courses require many credits and practical training of students. The faculty of medical universities experiences lack the knowledge to teach this emerging subject, which is also difficult to examine. Students increasingly demand that sustainability ought to be incorporated in their education and future careers. The medical and public health students of Ukrainian universities need to be taught that sustainable healthcare focuses on the improvement of health and better delivery of healthcare, rather than late intervention in disease, with resulting benefits to patients and to the environment on which human health depends, thus serving to provide high-quality healthcare now without compromising the ability to meet the health needs of the future.

Keywords
Sustainable healthcare, public health, education

Authors
Hanna Saturska, MD, DMSc, Prof.
Head of Department of Public Health and Healthcare Management,
Ternopil National Medical University
Ternopil, UKRAINE
satureska@tdmu.edu.ua

Larysa Fedoniuk, MD, DMSc, Prof.
Head of Department of Medical Biology,
Ternopil National Medical University
Ternopil, UKRAINE
fedonyuklj@tdmu.edu.ua

Nataliya Potikha, MD, PhD, Assoc. Prof.
Ternopil National Medical University
Ternopil, UKRAINE
potikha@tdmu.edu.ua
GREEN T: Sustainable Development supportive tools for Design Thinking process

Katarzyna Znajdek, Anna Laska-Leśniewicz, Aleksandra Jastrzębska, Krzysztof Jastrzębski, Dorota Bociąga, Monika Malinowska-Olszowy & Dorota Kamińska

The paper shows the results of implementation of the new tools, which are to be used in the Design Thinking (DT) methodology of projects’ realization. The aim of the work was to create a toolkit, which would include the most important aspects from the Sustainable Development Goals (SDG), and its application in each stage of the Design Thinking process. Each tool is dedicated to one of the steps of DT process and includes one or more SDGs. All tools were built basing on the authors' experience and effective techniques commonly used in DT methodology. The names and short description of new tools that are assignment to the DT steps are as follows:

1. **Empathy: ‘Shrunk World’**. It means imagining the world where only 100 people live, which allows visualizing the size of ecological crisis that we currently face. The exercise uses statistical data from the United Nations, WHO and other publications relating to climate change and consumption trends.

2. **Definition: ‘Sustainable Development questions’**. Answering the questions in relation to SD issues: How might we? What are the ways we could? What kind of scenarios could we imagine?

3. **Ideation: ‘Three ideas connected with SDGs’ and ‘SDG 2x2 matrices’** for idea evaluation. The first tool comprises 17 slogans representing each SDG. The task of the user is to find the association between particular SDG and the given topic. In the 2x2 matrix, the axes are marked according to the needs arising from the given project. Verifying the same idea several times by adopting different parameters on the axes allows to determine what is most important for a given solution.

4. **Prototyping: ‘How it is made’ – set of worksheets for both careful planning of the prototype and future production and increasing the awareness of reuse/recycling aspect of product and its packing.**

5. **Testing: ‘SDG cups / Green cups’** – promotion of parallel thinking with the modification of the Six Thinking Hats originated by Dr Edvard de Bono.

The added value of these tools is their universality; therefore, they can be implemented in any topic undertaken within the projects using DT process, but not only. The idea behind is to increase the awareness about SDGs among academic community (students, teachers) but also among participants of workshops, projects, etc. Summing up, GreenT tools extend the well-known Design Thinking methodology to sustainable development issues. Using the tools teams may have wider perspective during some creating process.

**Keywords**
Design thinking, sustainable development, project methodology, education

**Corresponding author**
Katarzyna Znajdek, Ph.D., Assistant Prof.
Lodz University of Technology
Lodz, POLAND
katarzyna.znajdek@p.lodz.pl
9. Sustainable Food Systems

Key challenges of our time are to sustain the management of agricultural land and develop more resilient food systems to feed a growing world population. It is envisaged that agricultural production will be increasingly impaired due to climate change and the ongoing degradation of natural resources, and due to increasing environmental externalities. Environmental impacts concern land, soil, water, deforestation, and biodiversity loss. In the same time the food system is the leading cause of these negative effects.

Increased effort has to be given to establish clear link between producers, processing and consumers to either increase accessibility of food resources globally and not harming environment by excessive logistic and distribution of it. Present state of the knowledge allows us to develop almost waste free production chain, where each by-product could be further used or processed. Proper management of local plant and animal biodiversity is one of the essential points for establishment of such a chain and achievement of sustainable development.

Citizens lost connection to the agriculture and production of food resources. Education of people, implementation of science in everyday life and change of conventional patterns of management of resources are essential on the path towards sustainability in food systems.

Coordinator
Radovan Kasarda, Prof. Dr. Ing., Slovak University of Agriculture in Nitra, Slovakia

Scientific Committee
Radovan Kasarda, Prof. Dr. Ing., Slovak University of Agriculture in Nitra, Slovakia
Madeleine Granvik, Assoc. Prof., Swedish Agricultural University, Uppsala, Sweden
Kristina Candrakova, PhD. Slovak University of Agriculture in Nitra, Slovakia

Contributors
Pontus Ambros, Trends and impacts in the agricultural landscapes in the Baltic Sea Region and its correspondence with climate change and food security.................................................................94
Sara Brogaard, Food systems and farmers’ behavior during an extreme event: an analysis of actions and governance following the 2018 drought in Sweden.................................................................95
Kristina Candráková, The role of a gene-diet interaction in susceptibility to human obesity........96
Eric Clark, Transitioning to sustainable agriculture: small-scale agroecological farms in the Swedish food system..................................................................................................................97
Nina Moravčíková, Advanced genomic tools in the sustainable management of natural resources........................................................................................................................................98
Trends in Agricultural Land in EU Countries of the Baltic Sea Region from the Perspective of Resilience and Food Security

Pontus Ambros & Madeleine Granvik

Agricultural land is crucial for the production of food and is, thereby, directly connected to food security. Agriculture is threatened by a multitude of hazards, such as climate change, peak oil, peak soil and peak phosphorus. These hazards call for a more resilient food system that can deliver food security for the global population in the future. In this paper, we analyse the Baltic Sea region’s ten European Union (EU) member states, investigating which trends are to be found in statistics between 2005 to 2016 on the development of agricultural land. In our paper, we analyse these trends of agricultural land by looking at three categories of data: (1) utilised agricultural area, (2) number of farms and (3) agricultural labour input. The results showed a trend that agricultural land is increasingly dominated by large farms, whilst over 1 million predominantly small farms have disappeared, and agricultural-labour input has dropped by more than 26%. These trends point towards a mechanisation of production, where larger and less labour-intensive farms take over production. This could partly be due to the EU common agricultural policy, which tends to favour large farms over small. Further, we argue for the importance of farm-size diversity, and about the dangers to food security that a system that is dominated by large farms possesses. Lastly, we conclude that the concept of resilience needs to be better included in policy development and foodsystem planning, and that more research needs to be done, analysing how existing agricultural policies impact the parameters studied in this paper.

Keywords
agricultural land; food security; farm scale; Baltic Sea region; EU; resilience; farm labour; industrialised farming; climate change

Authors
Pontus Ambros, MSc.
The Baltic University Programme, Natural Resources and Sustainable Development, Department of Earth Sciences,
Uppsala University
Uppsala, SWEDEN
pontus.ambros@balticuniv.uu.se

Madeleine Granvik, Assoc. Prof.
The Baltic University Programme, Natural Resources and Sustainable Development, Department of Earth Sciences
Uppsala University
Uppsala, SWEDEN
madeleine.granvik@balticuniv.uu.se
The extreme weather in terms of drought and heat, which prevailed in Northern Europe during the growing season 2018, had serious consequences for food production and farmers in southern Sweden. Many questions regarding farm production came to a head as drought struck directly against farmers land, economy and wellbeing and hence created vulnerability. This paper analyzes how farmers experienced the turbulent time of a climate extreme and focuses on how they related to the societal institutions that generally govern the agricultural sector. The course of events showed how the existing agricultural institutions were struggling with the situation and partly lacked the capacity to handle a crisis of this kind. By studying more closely how farmers in this situation solved the problems, among other things through increased collaboration, measures to improve adaptability can be identified.

In the paper we relate to the distinction in climate literature between autonomous and planned adaptation. Autonomous adaptation is understood as more improvised adaptation measures taken by individual actors (e.g. farmers) to deal with changing demands and conditions, while planned adaptation refers to the deliberate creation and implementation of policies to deal with the impacts of climate change. Our empirical material consists of in-depth interviews with farmers in southern Sweden and a larger survey material collected during 2019.

From these concepts and by studying these challenges from the land users' perspective, we gain an expanded understanding of needed governance interventions for increasing the resilience in modern agriculture.

Keywords
Extreme event, southern Sweden, drought, farming, adaptation,

Authors
Sara Brogaard, Ph.D. Senior Lecturer
Lund University Centre for Sustainability Studies
Lund University
Lund, SWEDEN
sara.brogaard@lucsus.lu.se

Tomas Germundsson, Prof.
Department of Human Geography
Lund University
Lund, SWEDEN
tomas.germundsson@keg.lu.se
The role of a gene-diet interaction in susceptibility to human obesity

Kristína Candráková, Anna Trakovická, Michal Gábor, Martina Miluchová, Radovan Kasarda & Nina Moravčíková

The prevalence of adult and childhood obesity is increasing worldwide. It is affected by various factors, including those of nutritional and non-nutritional origin (genetic, lifestyle, age, gender). This study aimed to analyse the role of LEP, MTHFR and FTO genes in the prevalence of obesity in the Slovak population. Biological samples collected from 205 participants (88 males and 117 females) were genotyped for polymorphisms in FTO (rs8050136, rs9939609, rs1121980), MTHFR (rs1801133) and LEP (rs7799039) genes by ARMS-PCR and PCR-RFLP methods. Several indexes and biochemical parameters connected to obesity, mainly body mass index (BMI), were tested in genome-wide association analysis. The prevalence of the LEP rs7799039 G allele was found in the analysed population. The LEP rs7799039 G allele was significantly associated with higher BMI, waist to hip ratio and levels of triacylglycerol, sodium, chlorides in blood compared to others. The impact of MTHFR rs1801133 alleles was non-significant due to the low frequency of T allele typical for the Caucasian population, but gender-dependent. Generally, the MTHFR rs1801133 C allele increased the levels of sodium, potassium, chlorides and glucose in the blood. In the case of the FTO gene higher frequency of rs8050136 C and rs9939609 T allele compared to A allele was obtained. In both polymorphisms was the AA genotype predominantly associated with high levels of HDL and LDL cholesterol, triacylglycerol, insulin, BMI and waist to height ratio. The most frequent FTO rs1121980 T allele increased BMI and levels of HDL, LDL and triacylglycerol significantly. Obtained results indicated genetic linkage among polymorphisms studied that can decrease the cost and time of lab analyses in the future. This study was supported by the Slovak Research and Development Agency (project no. APVV-17-0060).

Keywords
Body mass index, Caucasian population, gene polymorphism, human disease

Corresponding author
Ing. Kristína Candráková, PhD.
Project Grants and Lifelong Learning Center
Faculty of Horticulture and Landscape Engineering
Slovak University of Agriculture in Nitra
Nitra, SLOVAKIA
kristina.candrakova@gmail.com
Transitioning to sustainable agriculture: small-scale agroecological farms in the Swedish food system

Eric Clark & Annika Pissin

As the largest driver of global environmental change and most affected by these changes, agriculture is key to securing basic human needs while living sustainably within planetary boundaries. There is growing scientific consensus for ‘a rapid and significant shift from conventional monoculture-based and high-external-input-dependent industrial production towards mosaics of sustainable, regenerative production systems’ (UNCTAD 2013), i.e. a ‘paradigm shift from industrial agriculture to diversified agroecological systems’ (IPES-Food 2016). This has yet, however, to significantly shape agricultural policies and practices. This paper reports preliminary analyses from a research project focused on obstacles to and facilitators of diversified small-scale agroecological farming in Sweden. Drawing on fieldwork in the counties of Blekinge, Skåne and Värmland – including interviews with farmers, politicians and civil servants, document analyses and secondary sources – relations between food producers and consumers are examined in order to identify obstacles to and (potential) facilitators of transitioning to mosaics of sustainable, regenerative, diversified, small-scale agriculture. More specifically, the analysis focuses on the strategies of farmers to connect to local communities and consumers; the role of distribution, wholesale and retail structures and practices; strategies (or lack thereof) of municipalities and county governments; the role of social media and educational programs; and more broadly, the role of national and supranational agricultural policies. The paper concludes with a set of normative indications of how producers, consumers, and policy-makers at local, regional, national and supranational scales can reduce obstacles to and facilitate the transition to the paradigm shift needed to achieve sustainable food systems.

Keywords
conventional, agroecological, local communities, policy

Authors
Annika Pissin, Researcher
Centre for East and South-East Asian Studies
Lund University
Lund, SWEDEN
annika.pissin@ace.lu.se

Eric Clark, Prof.
Department of Human Geography
Lund University
Lund, SWEDEN
eric.clark@keg.lu.se
The aim of this study is to introduce advanced methodological approach and bioinformatics tools to increase the accuracy of biodiversity parameters estimation in order to the sustainable use of natural genetic resources in the genomics era. The Slovak Warmblood horse as important part of the cultural heritage of small homelands in Slovakia was used as a model population. The biological material for DNA analysis was sampled from 37 stallions originating from several herds spread across Slovakia to precise describe the gene pool of the breed. All of the animals were genotyped by GGP Equine70k chip included information of 71,947 SNP markers. The intra- and inter-population structure and gene flow were tested using a Bayesian clustering approach and discriminant analysis of principal components. The Arabian horse genomic data were used to describe the inter-population genetic structure. Even if Arabians participated in the grading-up process of Slovak Warmblood horse, the analyses revealed two separate genetic clusters. The closer look on intra-population genetic structure allowed for the assessment of genetic network and rate of migration among herds. The impact of selection on the genome structure was expressed by Wright F-statistic, genomic inbreeding resulted from the distribution of runs of homozygosity (ROH), effective population size derived from linkage disequilibrium ($N_e$) and haplotype structure. The proportion and average length of ROHs spread in the genome was not uniform and varied across chromosomes. It was shown that the majority part of ROHs resulting from historical inbreeding. The high selection pressure was evident mainly on chromosome 1, 2, 6, 9, 11, 15 and 16. Both, the current inbreeding ($F_{ROH>160kb}=1.03\pm0.30\%$) and $N_e$ estimates (45.35 animals) pointed out that the genetic diversity should be monitored continuously to prevent the loss of biodiversity and prepare management strategy for its sustainable use in the future. This study was supported by the Slovak Research and Development Agency (project no. APVV-17-0060).

**Keywords**
Animal genetic resources, diversity, local population, Slovak Warmblood horse

**Corresponding author**
Nina Moravčíková, PhD. Ing.
Dept. of Animal Genetics and Breeding Biology
Slovak University of Agriculture in Nitra
Nitra, SLOVAKIA
nina.moravcikova1@gmail.com

Radovan Kasarda, PhD., Prof. Ing.
Department of Animal Genetics and Breeding Biology
Faculty of Agrobiology and Food Resources
Slovak University of Agriculture in Nitra
Nitra, SLOVAKIA
radovan.kasarda@uniag.sk