



Research Notes Letter

*Research & Innovation for a sustainable
Baltic Sea Region*

Vol. 2, Issue 3, 2019

**Recent research from
BUP Member Universities**



UPPSALA
UNIVERSITET



**The Baltic University
Programme**

Content

Sustainable Economic Development and Greenhouse Gas Emissions: The Dynamic Impact of Renewable Energy Consumption, GDP, and Corruption Authors: Tetyana Vasylieva, Oleksii Lyulyov, Yuriy Bilan and Dalia Streimikiene	4
Ecosystem Services at the Archipelago Sea Biosphere Reserve in Finland: A Visitor Perspective Authors: Elina Viirret, Kaisa J. Raatikainen, Nora Fagerholm, Niina Käyhkö and Petteri Vihervaara.....	6
Management of Waste Collection from Yachts and Tall Ships from the Perspective of Sustainable Water Tourism Authors: Aleksandra Łapko, Roma Strulak-Wójcikiewicz, Marek Landowski and Radosław Wieczorek	8
Challenges to increase the sustainable urban freight transport in South Baltic Region – LCL project Authors: Kinga Kijewska, Stanisław Iwan, Jerzy Korczak.....	10
A New Approach for Investigating the Impact of Pesticides and Nutrient Flux from Agricultural Holdings and Land-Use Structures on Baltic Sea Coastal Waters Authors: Lidia Dzierzbicka-Głowacka, Maciej Janecki, Dawid Dybowski, Beata Szymczycha, Hanna Obarska-Pempkowiak, Ewa Wojciechowska, Piotr Zima, Stefan Pietrzak, Grażyna Pazikowska-Sapota, Beata Jaworska-Szulc, Artur Nowicki, Żaneta Kłostowska, Adam Szymkiewicz, Katarzyna Galer-Tatarowicz, Marcin Wichorowski, Michał Białośkórski and Tadeusz Puszkarczuk	11
Baltic Sea Coastal Eutrophication in a Thousand Year Perspective Authors: Lena Norbäck Ivarsson, Thomas Andrén, Matthias Moros, Thorbjørn Joest Andersen, Mikael Lönn, Elinor Andrén.....	13
Developing the model on the learning for sustainable development in higher education Authors: Liisa Rohweder and Anne Virtanen	15
Advancing Education for Planning Professionals in Estonia—Between New Qualities and Path-Dependency Authors: Antti Roose, Garri Raagmaa and Pille Metspalu.....	16
The marine nano- and microplastics characterisation by SEM-EDX: The potential of the method in comparison with various physical and chemical approaches Authors: Marianna Gniadeka and Agnieszka Dąbrowska	18
Disentangling the impact of nutrient load and climate changes on Baltic Sea hypoxia and eutrophication since 1850 Authors: H. E. M. Meier, K. Eilola, E. Almroth-Rosell, S. Schimanke, M. Kniebusch, A. Höglund, P. Pemberton, Y. Liu, G. Väli, S. Saraiva	19
Cross-Border Politics and Development in the European Union with a Focus on Tourism Authors: Marius Mayer, Wojciech Zbaraszewski, Dariusz Pieńkowski, Gabriel Gach and Johanna Gernert	21
Implementation of EU energy policy priorities in the Baltic Sea Region countries: Sustainability assessment based on neutrosophic MULTIMOORA method Authors: Indre Siksnylyte, Edmundas Kazimieras Zavadskas, Romualdas Bausys, Dalia Streimikiene	23

Beach-cast as biofertiliser in the Baltic Sea region-potential limitations due to cadmium-content Authors: Daniel Franzén, Eduardo Infantes, Fredrik Gröndahl	25
Environmental intensity of economic growth in the Baltic Sea region Authors: E. A. Tretyakova	27
A fragility approach to sustainability – researching effects of education Authors: Joost (Johannes) Platje, Markus Will and Ynte K. Van Dam	28
Process framework for identifying sustainability aspects in university curricula and integrating education for sustainable development Authors: Tove Holm, Kaisu Sammalisto, Thomas S. Grindsted, Timo Vuorisalo	30
A supra-national TSO to enhance offshore wind power development in the Baltic Sea? A legal and regulatory analysis Authors: Kanerva Sunila, Claire Bergaentzlé, Bénédicte Martin, Ari Ekroos	32
The dynamics of the global wood pellet markets and trade – key regions, developments and impact factors Authors: Daniela Thrän, Kay Schaubach, David Peetz, Martin Junginger, Thuy Mai-Moulin, Fabian Schipfer, Olle Olsson and Patrick Lamers.....	34
Promotion of sustainable product development in the Baltic Sea region: Development of a transnational Learning Factory for Ecodesign Authors: Max Marwede, Andre Paukstadt, Florian Hofmann, Christian Clemm and Tapani Jokinen ...	35
Steering sustainable development in higher education – Outcomes from Brazil and Finland Authors: Mervi Friman, Dusan Schreiber, Rilla Syrjänen, Emma Kokkonen, Arto Mutanen and Janne Salminen	36
Lake or Sea? The Unknown Future of Central Baltic Sea Herring Authors: Joachim W. Dippner, Birte Fründt and Cornelius Hammer	38



UPPSALA
UNIVERSITET

Welcome to the BUP Research Notes Letter: Research & Innovation for a Sustainable Baltic Sea Region

In this issue of the Research Notes Letter you can see some contributions that give a glimpse of the width and the depth of on-going research in, and on, the Baltic Sea Region from a sustainable development perspective. Most of the contributions have been submitted to the BUP Research Notes on the BUP web site by the authors. The BUP Research Notes focus on peer review articles, book chapters, conference proceedings, and dissertations regarding the BUP Themes. The aim with the Research Notes Letter is to spread research findings and to spread knowledge on researchers and research groups in the Baltic Sea Region as a service to BUP Member Universities.

We encourage researchers in the Baltic Sea region (BSR) to contribute with research findings to the BUP Research Notes on our web site. Please enter your contribution, preferably within the BUP Themes. Accepted contributions will then also be published in the BUP Research Notes Letter and distributed to the subscribers of the BUP mailing list. For researchers this is an opportunity to both contribute to the development of BUP research and cooperation efforts and to spread research findings and information to a wider audience.

You are welcome to submit your contribution using the Research Notes Form - or if you find it more convenient send a pdf copy of or a link to your article to any of the editors. The contributions should be in English, have a DOI name, deal with any of the BUP Themes, and have a connection with the BSR.

Researchers in the BSR are also welcome to submit their contact information for a Researcher Presentation published under the heading Researchers on the BUP web site. Please see examples on our web site and use the online form to submit your information.

Christian Andersson
Web Master
The Baltic University Programme
Uppsala University
Villavägen 16,
752 36 Uppsala, Sweden
Christian.Andersson@balticuniv.uu.se

Ulrika Jansson Klintberg
Communicating officer
The Baltic University Programme
Uppsala University
Villavägen 16,
752 36 Uppsala, Sweden
Ulrika.Klintberg@balticuniv.uu.se



Sustainable Economic Development and Greenhouse Gas Emissions: The Dynamic Impact of Renewable Energy Consumption, GDP, and Corruption

Authors: Tetyana Vasylieva¹, Oleksii Lyulyov², Yuriy Bilan^{3, 4} and Dalia Streimikiene⁵



Institutional affiliation: 1) Department of Finance and Entrepreneurship, Sumy State University, Sumy, Ukraine. 2) Marketing Department, Sumy State University, Sumy, Ukraine. 3) Department of Management and Human Resources Development, Alexander Dubček University of Trenčín, Trenčín, Slovakia. 4) Faculty of Management, University of Social Sciences, Lodz, Poland. 5) Kaunas Faculty, Vilnius University, Kaunas, Lithuania.

Type of publication: Article peer review

Abstract

The paper investigates the relationships between economic, social, and environmental dimensions of sustainable development. GDP growth represents the main economic dimension, greenhouse gas (GHG) emissions and renewable energy consumption the environmental dimension, and corruption the social dimension of sustainable development. The investigation of these relationships is based on the concept of the Environmental Kuznets Curve hypothesis about the non-linear relationship between economic growth and environmental pollution. The authors used the panel data of EU countries and Ukraine for 2000–2016 years from the Eurostat database. The obtained results confirmed the Environmental Kuznets curve hypothesis for the EU and Ukraine. All the indicators were statistically significant at 1% and 5% levels. The findings proved that increasing renewable energy (RE) by 1% led to a decline of GHG in the interval (0.166103, 0.220551), and an increase of the Control of Corruption Index by 1% provoked a decline of GHG by 0.88%. The conducted study enabled the authors to conclude that Ukraine needs to increase the GDP level per capita given the economy diversification and via the introduction of more effective and “clean” production technologies.

Citation

Vasylieva, T., Lyulyov, O., Bilan, Y., Streimikiene, D. 2019. Sustainable Economic Development and Greenhouse Gas Emissions: The Dynamic Impact of Renewable Energy Consumption, GDP, and Corruption. *Energies* 12: 3289.

DOI [10.3390/en12173289](https://doi.org/10.3390/en12173289)

Ecosystem Services at the Archipelago Sea Biosphere Reserve in Finland: A Visitor Perspective

Authors: Elina Viirret¹, Kaisa J. Raatikainen^{1,2}, Nora Fagerholm¹, Niina Käyhkö¹ and Petteri Vihervaara³



Institutional affiliation: 1) Department of Geography and Geology, University of Turku, Turku, Finland. 2) Department of Biological and Environmental Science & School of Resource Wisdom, University of Jyväskylä, Jyväskylä, Finland. 3) Biodiversity Centre, Finnish Environment Institute, Helsinki, Finland.

Type of publication: Article peer review

Abstract

The United Nations Educational, Scientific and Cultural Organization's (UNESCO's) Biosphere Reserves aim to be flagships of sustainable landscapes. Many of them are important locations for tourism and leisure activities. We explored the perceptions of short-term visitors and summer residents on ecosystem services (ESs) tied to characteristic habitats of the Archipelago Sea Biosphere Reserve in Finland. During holiday season, we conducted structured on-field interviews with 74 Biosphere Reserve visitors. From these data, we gained information on the visitors' appreciation of different ESs and the selected habitats. We also derived habitat-specific ES profiles. Excluding the reedbeds, most habitats were both highly valued and considered as important producers of the listed ESs. The derived ES profiles were partially overlapping and inclined towards appreciation of cultural services, and the importance of scenery was highlighted. Provisioning services were not particularly appreciated. We discovered several linkages among biodiversity, ESs, and recreational land uses. Certain habitats were found to be in need of protection under high recreational land-use pressure, but also potential synergies were found. Our method introduces an important socio-cultural perspective into the region's land management that aims to find a balance between the protection of the Biosphere Reserve's unique biodiversity and the need to support sustainable local livelihoods and tourism.

Citation

Viirret E, Raatikainen KJ, Fagerholm N, Käyhkö N, Vihervaara P. 2019. Ecosystem Services at the Archipelago Sea Biosphere Reserve in Finland: A Visitor Perspective. *Sustainability*. 2019; 11(2):421.

DOI [10.3390/su11020421](https://doi.org/10.3390/su11020421)

Management of Waste Collection from Yachts and Tall Ships from the Perspective of Sustainable Water Tourism

Authors: Aleksandra Łapko¹, Roma Strulak-Wójcikiewicz¹, Marek Landowski¹ and Radosław Wieczorek¹



Institutional affiliation: 1) Maritime University of Szczecin, Faculty of Engineering and Economics of Transport, Szczecin, Poland.

Type of publication: Article peer review

Abstract

This article deals with the issue of waste collection from yachts and tall ships that is important from the perspective of sustainable tourism. There are, of course, procedures that regulate the passing of waste by vessels, which also apply to tourist vessels. However, the authors made an attempt to analyze the process of waste collection carried out under non-standard conditions, i.e., during a mass event held at the port of the Tall Ships Races final, which took place in 2017 in Szczecin. Many yachts and tall ships participated in the event, and in addition, due to the multiplicity of attractions, the event area was very popular among tourists and visitors (over one and a half million people in three days). Due to the safety of the participants, and the need to maintain high aesthetic standards, the procedures for collecting waste from vessels had to be modified. In addition to the preparation of a flowchart on which the existing procedural modifications were presented, based on the source data received from the waste collection company, quantitative and structural analyses of the waste were carried out. The conducted research showed that the waste collection required the coordination of the activities of many entities. This article also draws attention to operational problems that occurred during waste collection from vessels during the Tall Ships Races final. Statistical analysis allowed for the determination of the days where the vessels disposed the most solid and liquid waste, and how the structure of the amount of collected waste was shaped. The Tall Ships Races is the most popular and the biggest event of this type in the world—gathering the largest number of tall ships. They are carried out annually, and their route leads through various ports; however, the regatta final is the culminating point that attracts the largest number of tourists. For this reason, many cities are trying to become its organizers. In 2018, the

finals took place in the Dutch port of Harlingen, and in 2019, the Danish port of Aarhus will be responsible for its organization. Two years later, in 2021, the Tall Ships Races regatta final will be hosted by Szczecin again. The results of the research conducted in this article may be helpful for appropriate preparation by subsequent ports for waste collection, which may contribute to the safety of the participants taking part in the event.

Citation

Łapko, A., Strulak-Wójcikiewicz, R., Landowski, M. and Wieczorek, R. (2018) 'Management of Waste Collection from Yachts and Tall Ships from the Perspective of Sustainable Water Tourism', *Sustainability*. MDPI AG, 11(1), p. 121.
DOI: [10.3390/su11010121](https://doi.org/10.3390/su11010121).

Challenges to increase the sustainable urban freight transport in South Baltic Region – LCL project

Authors: Kinga Kijewska¹, Stanisław Iwan¹, Jerzy Korczak²



Institutional affiliation: 1) Maritime University of Szczecin, Faculty of Economics and Engineering of Transport, Szczecin, Poland. 2) Faculty of Economic Science, Koszalin University of Technology, Koszalin, Poland.

Type of publication: Article peer review

Abstract

Despite the fact that cities differ in size, economy, political and cultural frameworks, the transport sector plays a strong role in all of them. In the European Union, many policy measures have been taken in the last decade regarding urban freight transport. The article presents the first step in the implementation of the Low Carbon Logistics project (LCL). This project is funded under the Interreg South Baltic Region Programme. The project focuses on tourist cities in the Baltic Sea region. This region is distinguished for its unique biodiversity, micro climate that is suitable for the development of recreational tourism and resort zones. However, at the same time this region is mostly affected by high levels of pollution.

Citation

Kijewska, K., Iwan, S. and Korczak, J. 2019. Challenges to increase the sustainable urban freight transport in South Baltic Region – LCL project. *Transportation Research Procedia* 39: 170-179.
DOI [10.1016/j.trpro.2019.06.019](https://doi.org/10.1016/j.trpro.2019.06.019)

A New Approach for Investigating the Impact of Pesticides and Nutrient Flux from Agricultural Holdings and Land-Use Structures on Baltic Sea Coastal Waters



Authors: Lidia Dzierzbicka-Głowacka¹, Maciej Janecki¹, Dawid Dybowski¹, Beata Szymczycha², Hanna Obarska-Pempkowiak³, Ewa Wojciechowska³, Piotr Zima⁴, Stefan Pietrzak⁴, Grażyna Pazikowska-Sapota⁵, Beata Jaworska-Szulc³, Artur Nowicki¹, Żaneta Kłostowska², Adam Szymkiewicz³, Katarzyna Galer-Tatarowicz⁵, Marcin Wichorowski⁶, Michał Białoskórski⁷ and Tadeusz Puszkarczuk⁸

Institutional affiliation: 1) Institute of Oceanology, Polish Academy of Sciences, Physical Oceanography Department, Sopot, Poland. 2) Institute of Oceanology, Polish Academy of Sciences, Marine Chemistry and Biochemistry Department, Sopot, Poland. 3) Gdańsk University of Technology, Faculty of Civil and Environmental Engineering, Gdańsk, Poland. 4) Institute of Technology and Life Sciences, Department of Water Quality, Raszyn, Poland. 5) Maritime Institute in Gdansk, Department of Environment Protection, Gdańsk, Poland. 6) Institute of Oceanology PAS, IT Department, Sopot, Poland. 7) Academic Computer Centre in Gdansk, Gdańsk, Poland. 8) Municipality of Puck, Puck, Poland.

Type of publication: Article peer review

Abstract

Knowledge related to land-use management impacts on the Baltic Sea ecosystem is limited. The constant release of pollutants into water bodies has resulted in water quality degradation. Therefore, only the innovative approaches integrated with research will provide accurate solutions and methods for proper environment management and will enable understanding and prediction of the impacts of land-use in the Baltic Sea region. Modelling approaches have become essential to address water issues and to evaluate ecosystem management. There are many water quality models, but only a few work in the operational mode and only some of them can be used as an interactive tool for environmental management to assess the impact of pollution on water quality. This study presents a new approach for investigating the

influence of pesticides and nutrient fluxes from agricultural holdings and land-use structures on coastal waters of the Baltic Sea. Called WaterPUCK, this method will enable calculation of the sufficient amount of fertilizers, investigation nutrients, and pesticide sources and model: the fate and distribution of nutrients and pesticides in the surface water and groundwater; loads of pollution to surface water and groundwater; fluxes of nutrients via submarine groundwater discharge (SGD) to the Baltic Sea coastal environment; the processes and mechanisms influencing the persistence of nutrients in the environment; and predict the changes in land use and climate change influence on the Bay of Puck ecosystem.

Citation

Dzierzbicka-Głowacka, L., Janecki, M., Dybowski, D., Szymczycha, B., Obarska-Pempkowiak, H., Wojciechowska, E., Zima, P., Pietrzak, S., Pazikowska-Sapota, G., Jaworska-Szulc, B., Nowicki, A., Kłostowska, Ż., Szymkiewicz, A., Galer-Tatarowicz, K., Wichorowski, M., Białoskórski, M., and Puszkarczuk, T. (2019). A New Approach for Investigating the Impact of Pesticides and Nutrient Flux from Agricultural Holdings and Land-Use Structures on Baltic Sea Coastal Waters. *Polish Journal of Environmental Studies*, 28(4), pp.2531-2539.

DOI [10.15244/pjoes/92524](https://doi.org/10.15244/pjoes/92524)

Baltic Sea Coastal Eutrophication in a Thousand Year Perspective

Authors: Lena Norbäck Ivarsson¹, Thomas Andrén¹, Matthias Moros², Thorbjørn Joest Andersen³, Mikael Lönn^{1, 4}, Elinor Andrén¹



Institutional affiliation: 1) School of Natural Sciences, Technology and Environmental Studies, Södertörn University, Huddinge, Sweden. 2) Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany. 3) Department of Geosciences and Natural Resource Management, University of Copenhagen, Copenhagen, Denmark. 4) Department of Electrical Engineering, Mathematics, and Science, Faculty of Engineering and Sustainable Development, University of Gävle, Gävle, Sweden.

Type of publication: Article peer review

Abstract

Sediment cores from three sites along the east-coast of Sweden, north-western Baltic Proper, have been studied with respect to lithologies, geochemistry, and diatom assemblages to trace and date early human impact with emphasis on nutrient discharge. The three sites Bråviken, Himmerfjärden, and Ådfjärden, have been impacted to various degree during the last millennia by multiple stressors like excessive nutrient discharge and hazardous substances, leading to coastal hypoxia, eutrophication, and pollution. These stressors are mainly caused by drivers in the drainage area as increased human population, changed land use, and point sources as industries and a sewage treatment plant. Even though their detailed history differs, the results show similar general patterns for all three sites. We find no evidence in our data from the coastal zone supporting the hypothesis that the extensive areal distribution of hypoxia in the open Baltic Sea during the Medieval Climate Anomaly was caused by human impact. Timing of the onset of man-made eutrophication, as identified from $\delta^{15}\text{N}$ and changes in diatom composition, differs between the three sites, reflecting the site specific geography and local environmental histories of these areas. The onset of eutrophication dates to ~1800 CE in Bråviken and Himmerfjärden areas, and to ~1900 CE in the less urban area of Ådfjärden. We conclude that the recorded environmental changes during the last centuries are unique in a thousand year perspective.

Citation

Norbäck Ivarsson, L., Andrén, T., Moros, M., Joest Andersen, T. Lönn, M. Andrén. E. 2019. Baltic Sea Coastal Eutrophication in a Thousand Year Perspective. *Frontiers in Environmental Science* 7, article 88.

DOI [10.3389/fenvs.2019.00088](https://doi.org/10.3389/fenvs.2019.00088)

Developing the model on the learning for sustainable development in higher education

Authors: Liisa Rohweder¹ and Anne Virtanen²



Institutional affiliation: 1) Haaga-Helia University of Applied Sciences, Finland. 2) Hamk University of Applied Sciences, Finland.

Type of publication: Article peer review

Abstract

The study highlights how higher education institutions could be proactive leaders in promoting societal change for sustainable development. In total, 30 researchers and teachers of Education for Sustainable Development (ESD) from universities in the Baltic Sea Region participated in the development of a model on learning for sustainable development by introducing educational cases and developing the important factors of ESD, based on these cases, their own experience and theoretical knowledge. The critical factors of ESD were re-developed and categorised into contextual (integrative approach, time perspective and spatiality), mental (value clarification, systemic thinking, critical reflection and motivation building) and activity (partnership, cooperation, communication and participation) related aspects. By using these critical factors in higher education, teachers can more likely ensure that the outcome of the learning process will increase competences for sustainability. The development of the model was based on a constructive research approach rarely used in pedagogical research. Therefore, the study increased the understanding of participants about this qualitative research tradition.

Citation

Rohweder. L., Virtanen. A. 2009. Developing the model on the learning for sustainable development in higher education. *Journal of Teacher Education for Sustainability* 11 (1): 31-42.

DOI [10.2478/v10099-009-0030-5](https://doi.org/10.2478/v10099-009-0030-5)

Advancing Education for Planning Professionals in Estonia—Between New Qualities and Path-Dependency

Authors: Antti Roose¹, Garri Raagmaa¹ and Pille Metspalu¹

Institutional affiliation: 1) Department of Geography, University of Tartu, Tartu, Estonia.

Type of publication: Book chapter

Abstract

The chapter examines the factors and drivers influencing planning-related university programs in Estonia. In recent years, both the planning system and academia have been coping with high levels of societal dynamism and transition associated with the assertion of national independence in 1991, while seeking to overcome path-dependencies and to capture and implement innovative planning approaches. A shift from land use to strategic spatial planning requires the introduction of a new knowledge set in respect to balanced interdisciplinary and specialized directions. Results from a survey of planning practitioners illustrate the need for qualified planners, and upskilling of current practitioners who lack of competencies for contemporary planning approaches. Although in the 2000s, the number of quasi-planning degree programs reached a peak at 20 planning-related programs in six universities, the educational provision in the country lacks diversity and remains mostly limited to programs rooted in environmental and engineering disciplines. An alternative model for a cross-university joint planning program advancing the diversity of current programs, widening the array of subjects and depth of scholarship to enhance future qualities of the planning profession for a small European country could not be implemented thus far. However, as a major positive shift in professional advancement, setting professional codes and certification for spatial planners serves as post-curriculum standardization and harmonization of knowledge and skills, as well strengthening planners' position in the Estonian planning scene.

Citation

Roose A., Raagmaa G., Metspalu P. (2018) Advancing Education for Planning

Professionals in Estonia—Between New Qualities and Path-Dependency. In: *Frank A., Silver C. (eds) Urban Planning Education. The Urban Book Series. Springer, Cham*

DOI [10.1007/978-3-319-55967-4_13](https://doi.org/10.1007/978-3-319-55967-4_13)

The marine nano- and microplastics characterisation by SEM-EDX: The potential of the method in comparison with various physical and chemical approaches

Authors: Marianna Gniadeka¹ and Agnieszka Dąbrowska²

Institutional affiliation: 1) Faculty of Chemistry, Laboratory of Theory and Applications of Electrodes, University of Warsaw, Warsaw, Poland. 2) Faculty of Chemistry, Laboratory of Molecular Interactions, University of Warsaw, Warsaw, Poland.

Type of publication: Article peer review

Abstract

The marine microplastic (MMs) is an interdisciplinary problem. The polymer debris are ubiquitous (soil, hydrosphere, atmosphere) and the majority ends, transported by the freshwaters, in the global ocean system: from pelagial waters, surface gyres and benthos up to the animals at different trophic levels. Their quantitative, qualitative and eco-toxicological analyses, based on analytical, physical and chemical methods, are still a challenge due to the complex matrices, materials weathering, limited concentration, and size. Moreover, further fragmentation due to the waves and UV radiation leads to the constant increase of their surface. The aim of this article is to present the advantages, drawbacks and future perspectives of using SEM-EDX method in the analyses of marine polymer debris from macro to the nanoscale. Theoretical issues are presented in comparison to the commonly used approaches. The practical aspects will be discussed based on case studies. Examples of the results, high-resolution SEM pictures are included.

Citation

Gniadeka, M., Dąbrowska, A. 2019. The marine nano- and microplastics characterisation by SEM-EDX: The potential of the method in comparison with various physical and chemical approaches. *Marine Pollution Bulletin* 148: 210-216. DOI [10.1016/j.marpolbul.2019.07.067](https://doi.org/10.1016/j.marpolbul.2019.07.067)

Disentangling the impact of nutrient load and climate changes on Baltic Sea hypoxia and eutrophication since 1850

Authors: H. E. M. Meier¹, K. Eilola², E. Almroth-Rosell², S. Schimanke³, M. Kniebusch¹, A. Höglund², P. Pemberton², Y. Liu², G. Väli⁴, S. Saraiva⁵

Institutional affiliation: 1) Department of Physical Oceanography and Instrumentation, Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany. 2) Department of Research and Development, Swedish Meteorological and Hydrological Institute, Norrköping, Sweden. 3) Climate Information and Statistics, Swedish Meteorological and Hydrological Institute, Norrköping, Sweden. 4) Department of Marine Systems, Tallinn University of Technology, Tallinn, Estonia. 5) Department of Mechanical Engineering, Technical University of Lisbon, Lisbon, Portugal.

Type of publication: Article peer review

Abstract

In the Baltic Sea hypoxia has been increased considerably since the first oxygen measurements became available in 1898. In 2016 the annual maximum extent of hypoxia covered an area of the sea bottom of about 70,000 km², comparable with the size of Ireland, whereas 150 years ago hypoxia was presumably not existent or at least very small. The general view is that the increase in hypoxia was caused by eutrophication due to anthropogenic riverborne nutrient loads. However, the role of changing climate, e.g. warming, is less clear. In this study, different causes of expanding hypoxia were investigated. A reconstruction of the changing Baltic Sea ecosystem during the period 1850–2008 was performed using a coupled physical-biogeochemical ocean circulation model. To disentangle the drivers of eutrophication and hypoxia a series of sensitivity experiments was carried out. We found that the decadal to centennial changes in eutrophication and hypoxia were mainly caused by changing riverborne nutrient loads and atmospheric deposition. The impacts of other drivers like observed warming and eustatic sea level rise were comparatively smaller but still important depending on the selected ecosystem indicator. Further, (1) fictively combined changes in air temperature, cloudiness and mixed layer depth chosen from 1904, (2) exaggerated increases in nutrient concentrations in the North Sea and (3)

high-end scenarios of future sea level rise may have an important impact. However, during the past 150 years hypoxia would not have been developed if nutrient conditions had remained at pristine levels.

Citation

Meier, H.E.M., Eilola, K., Almroth-Rosell, E. et al. *Clim Dyn* (2019) 53: 1145.
DOI [10.1007/s00382-018-4296-y](https://doi.org/10.1007/s00382-018-4296-y)

Cross-Border Politics and Development in the European Union with a Focus on Tourism

Authors: Marius Mayer¹, Wojciech Zbaraszewski², Dariusz Pieńkowski³, Gabriel Gach⁴ and Johanna Gernert¹

Institutional affiliation: 1) Institute of Geography and Geology, Universität Greifswald, Greifswald, Germany. 2) Department of System Analysis and Finance, West Pomeranian University of Technology, Szczecin, Poland. 3) University of Life Sciences in Poznań, Poznań, Poland. 4) LVR-Kulturzentrum Abtei Brauweiler, Landschaftsverband Rheinland (LVR), Pulheim, Germany.

Type of publication: Article peer review

Abstract

This chapter adopts a wider geographical scope to draw attention to the European “project” by analyzing cross-border policies and development of, and in, the European Union with a special focus on tourism. It begins with a general overview of the main objectives and challenges of cross-border cooperation in tourism, before going on to illustrate the goals and structure of cross-border policies in the European Union by emphasizing the role of tourism. At this point, a specific focus is placed on tourism policies in Eastern/Central Europe after the fall of the Iron Curtain. In addition, the history and functions of the Schengen Agreement and its importance for cross-border tourism in Europe are outlined and several of the EU’s instruments and funding programs are discussed with emphasis on the INTERREG Community Initiative and the efforts of Euroregions. Both the opportunities and weaknesses for the development of cross-border destinations are examined. In summary, this chapter addresses the issue of the role that cross-border tourism plays among EU policies and programs, the resources that are invested in tourism projects, and their identifiable impacts.

Citation

Mayer M., Zbaraszewski W., Pieńkowski D., Gach G., Gernert J. (2019) Cross-Border Politics and Development in the European Union with a Focus on Tourism. In: Cross-Border Tourism in Protected Areas. Geographies of Tourism and Global

Change. Springer, Cham

DOI [10.1007/978-3-030-05961-3_3](https://doi.org/10.1007/978-3-030-05961-3_3)

Implementation of EU energy policy priorities in the Baltic Sea Region countries: Sustainability assessment based on neutrosophic MULTIMOORA method

Authors: Indre Siksnyte^{1, 2}, Edmundas Kazimieras Zavadskas¹, Romualdas Bausys¹, Dalia Streimikiene²

Institutional affiliation: 1) Institute of Sustainable Construction, Vilnius Gediminas Technical University, Vilnius, Lithuania. 2) Institute of Social Sciences and Applied Informatics, Kaunas faculty, Vilnius University, Kaunas, Lithuania.

Type of publication: Article peer review

Abstract

The European Union (EU) has set ambitious goals for climate change and energy in its pursued policies (20% of renewable energy until 2020, 27% until 2030, and the aim to become the global leader in energy produced by renewable energy sources). Even more ambitious goals are established in the strategy of Energy 2050. Today European energy policy is oriented towards energy security, expansion of energy markets, energy efficiency, decarbonisation, and scientific research and innovations. The broader aim of this policy is a radical shift away from the current energy system to introduce a new system which would ensure environmental consistency, affordability of consumer prices, and security of supply. The paper analyses the trends of energy development across the eight Baltic Sea Region (BSR) countries. The analysis covers the period of 2008–2015. The main aim of the paper is to compare BSR countries achievements in sustainable energy development. The aggregate measures of energy sustainability are devised utilising multi-criteria decision-making (MCDM) MULTIMOORA (Multi-Objective Optimization on the basis of Ratio Analysis) technique. The paper presents an original framework for sustainable energy development indicators. The EU energy policy priorities govern the choice of indicators of energy sustainability. The comparative assessment of BSR countries, based on neutrosophic MULTIMOORA technique, by applying indicators from the framework, indicated that the best-performing countries regarding the achievement of EU sustainable energy development goals during the research period

were Denmark and Latvia. The findings of this research can give useful information to energy policy decision makers.

Citation

Siksnyte, I., Zavadskas, E.K., Bausys, R. and Streimikiene, D.
2019. Implementation of EU energy policy priorities in the Baltic Sea Region countries: Sustainability assessment based on neutrosophic MULTIMOORA method. *Energy Policy* 125: 90-102.
DOI [10.1016/j.enpol.2018.10.013](https://doi.org/10.1016/j.enpol.2018.10.013)

Beach-cast as biofertiliser in the Baltic Sea region-potential limitations due to cadmium-content

Authors: Daniel Franzén¹, Eduardo Infantes², Fredrik Gröndahl¹

Institutional affiliation: 1) Department of Sustainable Development, Environmental Science and Engineering, KTH, Stockholm, Sweden. 2) Department of Marine Sciences, University of Gothenburg, Kristineberg Station, Fiskebäckskil, Sweden.

Type of publication: Article peer review

Abstract

Macroalgal mass blooms and accumulating beach-cast are increasing problems in many coastal areas. However, beach-cast is also a potentially valuable marine bioresource, e.g. as a biofertiliser in coastal agriculture. One limiting factor in use of beach-cast as a fertiliser is uncertainty regarding the cadmium (Cd) concentration depending on beach-cast composition and location. In this study, chemical analyses were performed on beach-cast from Burgsviken Bay off Gotland, in the Baltic Sea. The results revealed large variations in cadmium concentration depending on sampling location and beach-cast composition, with levels ranging between 0.13 and 2.2 mg Cd/kg dry matter (DM). Of 15 beach-cast samples analysed, one had a cadmium content above the Swedish statutory limit for sewage sludge biofertiliser (2 mg Cd/kg DM) and four had values above the limit suggested by the Swedish Environmental Protection Agency for 2030 (0.8 mg/kg DM). Species-specific analysis revealed that eelgrass (*Zostera marina*) contained significantly higher cadmium concentrations than filamentous red algae species (*Ceramium* and *Polysiphonia* spp.). Avoiding eelgrass-rich beach-cast by seasonal timing of harvesting and monitoring differences in cadmium concentrations between harvesting sites could thus facilitate use of beach-cast as biofertiliser.

Citation

Franzén, D., Infantes, E., Gröndahl, F. 2019. Beach-cast as biofertiliser in the Baltic Sea region-potential limitations due to cadmium-content. *Ocean & Coastal*

Management 169: 20-26.

DOI [10.1016/j.ocecoaman.2018.11.015](https://doi.org/10.1016/j.ocecoaman.2018.11.015)

Environmental intensity of economic growth in the Baltic Sea region

Author: E. A. Tretyakova¹



Institutional affiliation: 1) Perm State National Research University, Perm, Russia.

Type of publication: Article peer review

Abstract

National economic development is subject to a number of restrictions. One of the main constraints is the threat of complete exhaustion of non-renewable resources and environmental pollution exceeding the capacity of the planet. However, the rapid spread of resource-saving technologies is reducing the environmental intensity of economic activities. In this study, I aim to examine the ecological-economic dynamics of the environmental effects of economic development in the regions of Russia's North-Western Federal District (NWFD). I employ an extended version of Peter A. Victor's model to produce a comprehensive evaluation of changes in economic indicators and correlate them with the total and specific environmental impact. I conduct a factor analysis to identify the main effects influencing the ecological-economic dynamics. The use of water resources in the NWFD demonstrates green growth, whereas electricity consumption and wastewater treatment fall into the brown zone and industrial and municipal waste treatment into the black one. The factor analysis has shown that population change has a very weak effect on the situation. Much more influential factors are the income effect (higher incomes translate into greater consumption and thus more significant pollution levels) and the technological effect produced by a decrease in the environmental intensity of production. To promote green development, it is advisable to increase the influence of the technological effect by stimulating resource efficiency and switching to the circular economy model.

Citation

Tretyakova, E. A. 2019. Environmental intensity of economic growth in the Baltic Sea region. *Baltic Region*, 11: 14-28.

PID <https://nbn-resolving.org/urn:nbn:de:0168-ssoar-62503-3>

DOI [10.5922/2079-8555-2019-1-2](https://doi.org/10.5922/2079-8555-2019-1-2)

A fragility approach to sustainability – researching effects of education

Authors: Joost (Johannes) Platje¹, Markus Will² and Ynte K. Van Dam³

Institutional affiliation: 1) WSB University in Wroclaw, Wroclaw, Poland. 2) University of Applied Sciences Zittau/Görlitz, Zittau/Görlitz, Germany. 3) Wageningen University and Research, Wageningen, The Netherlands.

Type of publication: Article peer review

Abstract

Purpose

Management education trainers are increasingly called upon to train students to devise interventions for sustainable development in business settings. Due to the dominant reductionist paradigm, these interventions may lead to unwanted side effects. Teaching students about unacknowledged feedback loops in complex systems should prevent them from choosing “the most obvious” intervention without considering unwanted side effects. The current study aims to report the effects of teaching a systems perspective, applied to transport systems, on students’ opinions and expressed paradigms. The following questions are addressed: Do students adhere to the techno-centric paradigm, believing technology, innovation and growth can solve all types of threats for sustainable development, while neglecting low probability, high impact events? Are paradigms held by students coherent? Can teaching lead to a change in opinions and paradigms held by students?

Design/methodology/approach

Measures for several systems concepts (i.e. functional stupidity, paradigms and fragility) are taken across a wide sample of university students. Posttests of some key items are taken for a subsample that followed a sustainability and systems perspective in a course on transport economics.

Findings

A large share of students think that technology can solve different types of problems in sustainable development (a kind of weak sustainability), but their paradigms tend

to be a mix of conflicting opinions. Though student opinions on topics that were explicitly treated in the course have changed, neither a wider paradigm shift nor significantly more coherent paradigms can be confirmed.

Originality/value

The results show that even though students can be taught about the unwanted side effects and limitations on specific techno-fix interventions, this does not automatically translate into a critical mind-set toward techno-fixing in general.

Citation

Joost (Johannes) Platje, Markus Will, Ynte K. Van Dam, (2019) "A fragility approach to sustainability – researching effects of education", *International Journal of Sustainability in Higher Education*, DOI [10.1108/IJSHE-11-2018-0212](https://doi.org/10.1108/IJSHE-11-2018-0212)

Process framework for identifying sustainability aspects in university curricula and integrating education for sustainable development

Authors: Tove Holm^{1, 2, 3}, Kaisu Sammalisto⁴, Thomas S. Grindsted⁵, Timo Vuorisalo²

Institutional affiliation: 1) Sykli Environmental School of Finland, Finland. 2) Department of Biology, University of Turku, Finland. 3) Novia University of Applied Sciences, Finland. 4) Faculty of Engineering and Sustainable Development, University of Gävle, Sweden. 5) Department of Environmental, Social and Spatial Change, Roskilde University, Denmark.

Type of publication: Article peer review

Abstract

Sustainability aspects in higher education must be enhanced with more concrete actions. Universities are globally required to have quality assurance to secure and improve teaching and learning, and they use management systems to this aim. Integrating education for sustainable development and management systems are alike in that they are based on continuous improvement and systematic thinking; for both processes all stakeholders need to be involved. Although quality assurance is compulsory for higher education, education for sustainable development has barely been examined or integrated in this context.

This article examines how voluntary integration of education for sustainable development into management systems at universities could facilitate a scheme to overcome the challenges to integrating education for sustainable development that were identified in previous research. For this, a process framework for integrating education for sustainable development with management systems was developed in a network of 11 universities in the Nordic countries. The framework included planning, assessment, monitoring, and implementation of education for sustainable development. It was piloted and applied to identify relevant sustainability aspects in different disciplines, examples of which are provided in the article. The framework

can be applied to visualize the implementation of education for sustainable development.

Citation

Holm, T., Sammalisto, K., Grindsted, T.S. and Vuorisalo, T. 2019. Process framework for identifying sustainability aspects in university curricula and integrating education for sustainable development. *Journal of Cleaner Production*, 106: 164-174.

[DOI 10.1016/j.jclepro.2015.04.059](https://doi.org/10.1016/j.jclepro.2015.04.059)

A supra-national TSO to enhance offshore wind power development in the Baltic Sea? A legal and regulatory analysis

Authors: Kanerva Sunila¹, Claire Bergaentzlé², Bénédicte Martin³, Ari Ekroos¹



Institutional Affiliation: 1) School of Engineering, Department of Built Environment, Aalto University, Aalto, Finland. 2) Department of Management Engineering, Denmark Technical University, Lyngby, Denmark. 3) IKEM, Institute for Climate Protection, Energy and Mobility, Berlin, Germany.

Type of publication: Article peer review

Abstract

Offshore wind power development is expected to play an important role in meeting the EU climate targets. To integrate offshore wind power, advanced offshore infrastructures such as meshed grids are suggested to optimise the grid development. Meshed offshore grids refer to integrated offshore infrastructure where offshore wind power hubs are interconnected to several countries as opposed to radial connection linking the wind farm to one single country and market. However, development of meshed architectures is hindered by the legal and regulatory barriers.

Earlier research has identified the lack of cooperation and misalignments in national legal and regulatory frameworks as being the main risk factors in integrated offshore network investments. The purpose of this article is to investigate whether a supra-national TSO could facilitate regional cooperation and coordinated investments to develop meshed offshore grids.

Several studies have discussed the case of North Seas, but the Baltic Sea region has had less attention despite the large offshore wind development potential. In this paper, a multi-disciplinary approach combining legal dogmatics and regulatory economics is used to identify the existing barriers and the possible solutions. The Baltic Sea countries are used as illustration. We suggest legal and regulatory

recommendations that comply with the EU energy policy targets of sustainability, competition and reliability.

Citation

Sunila, K., Bergaentzlé, C., Martin, B. and Ekroos, A. 2019. A supra-national TSO to enhance offshore wind power development in the Baltic Sea? A legal and regulatory analysis. *Energy Policy* 128: 775-782.

DOI [10.1016/j.enpol.2019.01.047](https://doi.org/10.1016/j.enpol.2019.01.047)

The dynamics of the global wood pellet markets and trade – key regions, developments and impact factors

Authors: Daniela Thrän¹, Kay Schaubach¹, David Peetz¹, Martin Junginger², Thuy Mai-Moulin², Fabian Schipfer³, Olle Olsson⁴ and Patrick Lamers⁵



Institutional affiliation: 1) DBFZ Deutsches Biomasseforschungszentrum gGmbH, Leipzig, Germany. 2) Utrecht University, the Netherlands. 3) Technische Universität Wien, Vienna, Austria. 4) Stockholm Environmental Institute, Stockholm, Sweden 5) Idaho National Laboratory, Idaho Falls, ID, USA.

Type of publication: Article peer review

Abstract

The global pellet market is growing but with different characteristics in different countries and regions. In this paper we trace developments between 2008 and 2016. For 2008, production was reported at 9.8 Tg, expanding globally to 14.3 Tg in 2010 and surpassing 26 Tg in 2015. Global hot spots are North America (production) and Europe (consumption). Sustainability certification was applied for about 9 Tg in 2016. Nevertheless, projections for future development are difficult as low pellet prices and uncertain sustainability obligations may hinder further expansion. In general, there is a strong dependency of the pellet market on the policy framework.

Citation

Thrän, D., Schaubach, K., Peetz, D., Junginger, M., Mai-Moulin, T., Schipfer, F., Olsson, O. and Lamers, P. (2019), The dynamics of the global wood pellet markets and trade – key regions, developments and impact factors. *Biofuels, Bioprod. Bioref.*, 13: 267-280.

DOI [10.1002/bbb.1910](https://doi.org/10.1002/bbb.1910)

Promotion of sustainable product development in the Baltic Sea region: Development of a transnational Learning Factory for Ecodesign

Authors: Max Marwede¹, Andre Paukstadt¹, Florian Hofmann², Christian Clemm² and Tapani Jokinen²

Institutional affiliation: 1) Fraunhofer Institute for Reliability and Microintegration IZM, Berlin, Germany

Type of publication: Report

Background

Ecologically aware product design will play a key role in the evolution of consumer habits and a commercial environment that is more sustainable for both our limited resources and our world's climate. Product developers and designers can determine the ecological fate of their output from their original designs across the entire lifecycle of the resulting products and services. The use of secondary materials, the working life expectancy of products, and the ability to maintain, repair, and recycle products are all crucial criteria to be considered when a new product is developed (Umweltbundesamt 2015a, 2015b).

In spite of the proliferation of research projects and initiatives in the field of ecodesign and the circular economy, the concepts and methods that have indeed arrived in corporate practice remain far and few between. One of the steepest challenges seems to lie in the simple lack of applied knowhow in businesses (Maurer 2018; Graulich et al. 2017). This has motivated the German Environment Agency (UBA) to commission the "Development of a Transnational Ecodesign Learning Factory".

Citation

M. Marwede, A. Paukstadt, F. Hofmann, C. Clemm, T. Jokinen. 2019. [Promotion of sustainable product development in the Baltic Sea region: Development of a transnational Learning Factory for Ecodesign](#). Fraunhofer Institute for Reliability and Microintegration IZM.

Steering sustainable development in higher education – Outcomes from Brazil and Finland

Authors: Mervi Friman¹, Dusan Schreiber², Rilla Syrjänen¹, Emma Kokkonen¹, Arto Mutanen³ and Janne Salminen¹

Institutional affiliation: Häme University of Applied Sciences, Hämeenlinna, Finland. 2) Feevale University, Novo Hamburgo, Brazil. 3) National Defence University, Suomenlinna, Helsinki, Finland.

Type of publication: Article peer review

Abstract

Higher education institutes (HEIs) have made a deep commitment to prioritizing sustainable development (SD). Their task is to support practices that improve conditions in societies with respect to ecological, economic, and social issues, e.g., tackling the wicked problems of the world. In this case study, which took place at Feevale University (Feevale), Brazil, and at Häme University of Applied Sciences (HAMK), Finland, the following topics were studied: (1) whether there are international and national SD steering policies that might be relevant to higher education development in these particular universities; (2) whether this steering has impacted HEI's own SD policy and steering; (3) whether such in-house operations are affecting SD content within curricula; and (4) how a pedagogic approach influences the incidence of SD-oriented content at the bachelor's degree level. The analysis of policy level data was based on international and national policy papers recognized separately in both universities. As an indicator of the university's level of commitment to sustainability activities, we measured the incidence level of UNECE's SD themes in the curriculum. A hermeneutical approach was applied to the analysis to demonstrate possible systemic interactions between (inter)national SD policy and SD education at HEIs. At HAMK, some evidence was found of a national level top-down steering process in the university's SD activities. At Feevale, the enhancing of SD education is more of a bottom-up process. International steering appeared to be weak in both universities. The study uses unique quantitative data to show how the incidence of SD content in the curriculum is related to the pedagogical approach in each university [content (Feevale) vs. competence (HAMK)]. It was concluded that differences in national SD steering policy and pedagogical approach in the HEI led to

divergent curricula structures in relation to the volume of the SD education between the two HEIs. Regardless of such a divergence, an appropriate balance between epistemic and ethical SD competences should be guaranteed for all bachelors.

Citation

Friman, M. Schreiber, D., Syrjänen, R., Kokkonen, E., Mutanen, A., Salminen, J. 2018. Steering sustainable development in higher education – Outcomes from Brazil and Finland. *Journal of Cleaner Production*, 186: 364-372.

DOI [10.1016/j.jclepro.2018.03.090](https://doi.org/10.1016/j.jclepro.2018.03.090)

Lake or Sea? The Unknown Future of Central Baltic Sea Herring

Authors: Joachim W. Dippner¹, Birte Fründt¹ and Cornelius Hammer²

Institutional affiliation: 1) Department of Biological Oceanography, Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany. 2) Thünen Institute of Baltic Sea Fisheries, Rostock, Germany.

Type of publication: Article peer preview

Abstract

The understanding of natural variability of harvestable fish stocks is of fundamental interest for their management; however, time series are often biased by the impact of fisheries. Observations suggest that the mean weight of central Baltic Sea herring (*Clupea harengus*), a quantity unbiased by fisheries, is indirectly influenced by the Atlantic Multi-decadal Oscillation (AMO) via a complex mediator chain, in which a transition from a marine to a freshwater state plays a major role. This observed trend is also projected for the future in regional climate change scenarios. The consequence of increasing precipitation is a reduction in the marine habitat, a change in the prey community and a decrease in the mean weight of 3-year-old central Baltic Sea herring from 50 to 70 g in the late 1970s to 25–30 g today. The reduction in weight over this period represents a reduction in landings of approximately one million tons of herring and an economic loss of the order of €100 million.

Citation

Dippner JW, Fründt B and Hammer C (2019) Lake or Sea? The Unknown Future of Central Baltic Sea Herring. *Front. Ecol. Evol.* 7:143.

DOI: [10.3389/fevo.2019.00143](https://doi.org/10.3389/fevo.2019.00143)