RESEARCH NOTES LETTER

The Baltic University Programme

3 – 2018

UPPSALA
UNIVERSITET

RESEARCH NOTES LETTER
Issue 3-2018

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

This is the third issue of The Baltic University Programme Research Notes. Letter A lot of interesting research on sustainable development is going on in the Baltic Sea region. The Research Notes focus on peer review articles, book chapters, conference proceedings, and dissertations regarding the following Themes: Climate Change, Renewable Energy, Sustainable Food Production & Consumption, Sustainable Water Resources, Urban-Rural development, Sustainable Transport, Circular Economy and Education for Sustainable Development (ESD).

The aim with the Research Notes Letter is to spread research findings and to get the knowledge on researchers and research groups in the Baltic Sea region as a service to BUP Member Universities, Participating Universities and different stakeholders in society. We want to encourage you to contribute with your research findings to the BUP Research Notes Letter. This is an opportunity to both contribute to the development of BUP research efforts and co-operations, as well as a way for You to spread your research findings and information on you as a researcher/your research group.

You are very welcome to submit your contribution using this form:
http://www2.balticuniv.uu.se/bup-3/index.php/51-reseach-notes-form

Enjoy!

RESEARCH NOTES LETTER

The Baltic University Programme

Issue 3-2018

CONTENT

RESEARCH NOTES LETTER
Issue 3-2018
The Baltic University Programme

Evaluation of agriculture eco-efficiency in Latvia

Authors
Agita Gancone, Jelena Pubule, Marika Rosa, Dagnija Blumberga

University
Riga Technical University, Riga, Latvia

OPEN ACCESS

Type of publication
Peer review

Abstract
Agriculture is the second most significant source of greenhouse gas (GHG) emissions, with approximately 24 % of Latvia's total GHG emissions in 2014. Emissions from agricultural soils contributed major share of the total emissions – 59.6 %, enteric fermentation emissions was second largest source – 32 %. The share of manure management emissions was evaluated as 7.5 % of total emissions in the sector, remaining 0.9 % of emissions refer to liming and urea application. GHG emissions increased in 2014 by 3.3 % comparing to 2013 due to increase of cattle, sheep and fur animal numbers. Statistics also showed increase of synthetic N fertilizer consumption approximately by 4.6 %, sown area by 0.3 % and lime application to soils 42.9 % [1]. Bearing in mind significant share of agricultural emissions in total GHG emissions in Latvia and the growing emission trend the additional attention is necessary for evaluation of impacts of agriculture on the environment.
The purpose of this study is to explore indicators for assessing eco-efficiency in the Latvian agriculture sector. First the paper describes methods which can be used for measuring eco-efficiency, second availability of activity data and third, presents calculations of selected indicators for eco-efficiencies.

Reference
Energy Procedia. Volume 128, September 2017 , Pages 309-315
open access
https://doi.org/10.1016/j.egypro.2017.08.318

Link
https://www.sciencedirect.com/science/article/pii/S1876610217338389

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Ecosystem Provisioning Services Automated Valuation Process Model for Sustainable Land Management

Authors
Jurijs Holms(1), Irina Arhipova(1), Ildiko Tulbure,(2) Gatis Vitols(1)

OPEN ACCESS

University
(1)Latvia University of Agriculture, Jelgava, Latvia, (2)University "1 Decembrie 1918", Alba Iulia, Romania

Type of publication
Peer review

Abstract
For effective management of natural capital, it is necessary to identify all ecosystems provisioning services (supply of food, wood, etc.), evaluating each of them. The article presents ecosystem provisioning services' automated valuation process model. As data sources are proposed to use information from the European Union member states institution's data registers, integrating it using classical data base, XML schema definition and geographic information systems technologies. The proposed model provides industry professionals with the opportunity for online decision making, that is based on actual data, and as well fuzzy logic based assessment method for sustainable land management. The article defines the data sources that are available for modeling and describes the specific problems with data integrating. As a result of the study information system architecture for ecosystem provisioning services' valuation for land management is developed.

Reference
Procedia Computer Science. Volume 104, 2017 , Pages 65-72
open access
https://doi.org/10.1016/j.procs.2017.01.063

Link
https://www.sciencedirect.com/science/article/pii/S1877050917300649

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Improvement of Sustainability Definition Facilitating Sustainable Development of Public Transport System

Author
Antons Patlins

University
Riga Technical University, Riga, Latvia

OPEN ACCESS

Type of publication
Peer review

Abstract
In the frame of current article it is researched the definition of sustainability facilitating sustainable development of public transport system. This research will give a new look to definition of sustainability, will be the source of new scientific ideas and ways of thinking about the public transport system and its sustainable development. Analysis of definitions and interpretations of sustainable development and sustainability and summarizing of principles of sustainability and sustainable transport system, as well as definition of indicators of environmental sustainability in transport system and assessment of environmental impact indicators for transport in smart city era, which can help to formulate improvements of sustainability definition facilitating sustainable development of transport system, will give a huge positive impact to development of transport area using sustainability principles. Solutions for sustainability are also offered in the article. It is the first article in the new cycle with research and discussions about sustainability and improvement of its definition, about transport system sustainability and related topics.

Reference
Procedia Engineering. Volume 192, 2017 , Pages 659-664
open access
https://doi.org/10.1016/j.proeng.2017.06.114

Link
https://www.sciencedirect.com/science/article/pii/S1877705817326607

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Low carbon municipalities

The impact of energy management on climate mitigation at local scale

Authors
Agris Kamenders, Marika Rosa, Kristaps Kass

University
Riga Technical University, Riga, Latvia

OPEN ACCESS

Type of publication
Peer review

Abstract
Energy planning in municipalities in some EU countries was introduced some two to three decades ago. In 2008 a wide European initiative – Covenant of Mayors – for local governments was launched to initiate their commitment towards energy and climate targets. Municipalities are considered among the main stakeholders to foster and implement energy saving and climate measures through their local Sustainability Energy Action Plan (SEAP). More than 6000 municipalities have developed and approved their SEAPs, however only part of them are successfully implemented. The article proposes and describes integrated approach to motivate municipalities to engage and apply a systematic approach towards energy reduction. Through implementation and continuous improvement of energy management systems in public buildings and infrastructure, municipalities are able to tackle further challenges across different fields of interest in the whole territory of the municipality. Article provides the most important motivators, challenges and advantages of the approach based on the assessment of 41 municipalities around Europe.

Reference
Energy Procedia. Volume 128, September 2017, Pages 172-178
open access
https://doi.org/10.1016/j.egypro.2017.09.038

Link
https://www.sciencedirect.com/science/article/pii/S1876610217338808

RESEARCH NOTES LETTER
Issue 3-2018
The Baltic University Programme

Comparison between passive remediation and bioremediation for the hydrocarbons contaminated soil clean up

Authors
Vilma Zivelyte(1), Karlis Valters(2), Saulius Vasarevicius(1)

OPEN ACCESS

University
(1)Vilnius Gediminas Technical University, Vilnius, Lithuania, (2)Riga Technical University, Riga, Latvia

Type of publication
Peer review

Abstract
This paper provides some information about mathematical modelling that was prepared for natural attenuation of petroleum hydrocarbons contaminated soil. Concentration of initial contamination with hydrocarbons and time that is needed to degrade it was compared with the results that were received from experimental research of the bioremediation of hydrocarbons in soil by the use of silica nanocomposite. The aim of the mathematical modelling was to check if microorganism that was used in previous research was effective enough when their effectiveness is compared with natural attention effectiveness. The results of natural attenuation shows that in some cases in-situ remediation might be more effective than ex-situ bioremediation, however the effectiveness of natural attenuation depends on many factors and due that the results might vary in different areas.

Reference
Energy Procedia. Volume 128, September 2017, Pages 339-344
open access
https://doi.org/10.1016/j.egypro.2017.08.322

Link
https://www.sciencedirect.com/science/article/pii/S1876610217338420

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Educating Professionals for Sustainable Futures

Authors
Hille Janhonen-Abruquah, Jenni Topp and Hanna Posti-Ahokas

OPEN ACCESS

University
University of Helsinki, Helsinki, Finland

Type of publication:
Peer review

Abstract
The recent discourse on sustainability science calls for interdisciplinary research. The home economics science approach ranges from individual actions to the involvement of communities and societies at large, and thus it can provide important perspectives on cultural sustainability. The aim of the research is to study the linkage between cultural sustainability and service sector education to support the creation of sustainable professions. In the present small-scale empirical study, the food service degree curriculum of a Finnish vocational college and teachers' group interview data were analyzed to find how cultural sustainability is presented in the curriculum and how it is understood by teachers and integrated into teaching practices. Previous cultural sustainability research identifies four perspectives of cultural sustainability: (1) vitality of cultural traditions; (2) economic starting point; (3) diversity together with maintenance of local culture; and (4) possible influence on the balance between human actions and environment. Findings indicate that sustainability, including cultural sustainability, is integrated in the curriculum and considered important by teachers. Translating these into practice remains a challenge. The balance between human and nature was mostly understood as recycling, use of public transport, sustainable consumption, and taking trips to the nature nearby. Cultural sustainability as a concept is not well known, although themes such as multicultural issues, equality, charity, and environmental responsibility were included in teachers' practical lessons daily. Feasts and celebrations in learning were opportunities to view cultural sustainability widely. This paper provides a way forward for the teachers to develop further their pedagogical practices.

Reference
Janhonen-Abruquah, H.; Topp, J.; Posti-Ahokas, H. Educating Professionals for Sustainable Futures. Sustainability 2018, 10, 592. doi:10.3390/su10030592

Link
https://www.mdpi.com/2071-1050/10/3/592

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Indicators of climate change adaptation from molecules to ecosystems

Authors
Ülo Mander(1,2), Ivika Ostonen(1) and Ülo Niinemets(3,4)

OPEN ACCESS

University
(1)University of Tartu, Tartu, Estonia, (2)National Research Institute of Science and Technology for Environment and Agriculture (Irstea), Antony, France, (3)Estonian University of Life Sciences, Tartu, Estonia, (4)Estonian Academy of Sciences, Tallinn, Estonia

Type of publication:
Peer review, editorial

Abstract
Adaptation of biological systems to current climate change is one of the leading research topics worldwide (Visser 2008; Karhu et al. 2014). Due to the hierarchy of different biological processes operative from molecules to biomes, the rate of biological adaptation is difficult to predict. While molecular and physiological processes can occur within minutes to days and months, biome-level processes typically take tens of years to even millions of years (Kowalchuk et al. 2004; Gienapp et al. 2008; Carroll et al. 2016). The crucial question is whether biological adaptation is fast enough to cope with global climate change (Stocker et al. 2013). From the human perspective, a key challenge is to adapt social systems and food security to recent rapid changes in both environment and population size; this becomes especially problematic if ecosystems fail to adapt to globally changing conditions, leading to destruction of habitats and decline of ecosystem services (Lobell et al. 2008; Kates et al. 2012; Pittelkow et al. 2015; Lesk et al. 2016). Several studies on adaptation to environmental changes have been dedicated to the processes at molecular and genetic levels (Ehrenreich and Purugganan 2006; Gienapp et al. 2008; Moeller and Tiffin 2008; Scheffers et al. 2016) whereas a limited number of them deal with adaptation at population (Etterson and Mazer 2016) and ecosystem level (Graham et al. 2015; Urban et al. 2016; Pecl et al. 2017). Most studies of ecosystem-level adaptations have considered forest ecosystems because ongoing climate change will likely expose trees and forests to new stresses and disturbances (Littell et al. 2010; Niinemets 2010) and fewer studies have looked at adaptation of grasslands (Arnone et al. 2008) and aquatic ecosystems (Niinemets et al. 2017a; Niinemets et al. 2017b). Adaptation capacity of forests is largely unknown; however, several models have been created to predict spatial shifts of treeline and forest productivity in response to global warming (Seppälä et al. 2009; Berdanier 2010). From the practical point of view, more attention has been given to the adaptation of forestry practices to global changes (Locatelli et al. 2010).

Reference
Mander, Ü., Ostonen, I. & Niinemets, Ü. Reg Environ Change (2017) 17: 2055.
DOI 10.1007/s10113-017-1215-4

Link
https://link.springer.com/content/pdf/10.1007%2Fs10113-017-1215-4.pdf

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Influence of building shape and orientation on heating demand: simulations for student dormitories in temperate climate conditions

Authors
Martyna Mokrzecka

University
Wroclaw University of Science and Technology, Wroclaw, Poland

Type of publication:
Conference proceeding

Abstract
The aim of this paper is to investigate the impact of preliminary design decisions such as building shape and orientation on its heating demand. After analysing plans of forty student dormitories located in heating dominated climate (Dfb and Cfb), eight typical plan layouts were identified and chosen for further analysis. Eight buildings were modelled using these plans and uploaded to dynamic simulation tool, Sefaira. Buildings have the same characteristics (surface, height, thermal properties, location etc.). The next step was to rotate the buildings at 45° intervals and simulate the annual heating demand for each case. The results show that the shape influences the heating energy consumption. The difference between minimum and maximum heating demand in the chosen sample was 50%. The square – shaped buildings have advantages in terms of heating energy consumption over L, U and C-shaped buildings as well as over rectangles with different shape factor. Orientation does not substantially influence the consumption in well insulated buildings. Last step of the research was to analyse the influence of functional layout on heating energy and internal comfort in a square-shaped building

Reference
Martyna Mokrzecka. 2018. Influence of building shape and orientation on heating demand: simulations for student dormitories in temperate climate conditions. E3S Web Conf. 44 00117 (2018)

Link
https://doi.org/10.1051/e3sconf/20184400117

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

The Influence of Phosphogypsum Addition on Phosphorus Release in Biochemical Treatment of Sewage Sludge

Authors
Yelizaveta Chernysh(1), Magdalena Balintova(2), Leonid Plyatsuk(1), Marian Holub(2) and Stefan Demcak 2)

University
(1)Sumy State University, Sumy, Ukraine, (2)Technical University of Kosice, Kosice, Slovakia

Type of publication:
Article peer review

OPEN ACCESS

Abstract
The paper is focused on the research of biochemical treatment of sewage sludge and phosphogypsum under sulphate-reducing conditions with a phosphorus release process. The theoretical foundations of the work were based on the biochemical formalization using the principles of autocatalysis of natural systems. During the experimental research for the control of physicochemical parameters of the process spectroquantic, X-ray fluorescence analysis and other techniques were used. A schematic model of the dephosphatation process under anaerobic stabilization of sewage sludge and phosphogypsum was developed. The increase of phosphogypsum dosage had a close correlation with the release of phosphate ions. At the stimulating action of the phosphogypsum additive, a 2.5 5.0-fold increase in soluble phosphate concentration was observed. The rational dose of phosphogypsum was determined. Along with an increase the ratio of COD (Chemical Oxygen Demand)/phosphogypsum to 0.1, an increase in the phosphate ions in solution was observed. A further increase in the ratio of COD/phosphogypsum did not affect the concentration of phosphate ions in solution.

Reference
Y. Chernysh, M. Balintova, L. Plyatsuk, M. Holub, S. Demcak (2018), 'The Influence of Phosphogypsum Addition on Phosphorus Release in Biochemical Treatment of Sewage Sludge', International Journal of Environmental Research and Public Health, Vol. 15(6), 1269
doi: 10.3390/ijerph15061269

Link
https://www.mdpi.com/1660-4601/15/6/1269

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Bioaccumulation and toxicity studies of macroalgae (Charophyceae) treated with aluminium

Experimental studies in the context of lake restoration

Authors
Michał Rybak(1), Agata Kołodziejczyk(2), Tomasz Joniak(1), Izabela Ratajczak(3), Maciej G bka(1)

University
(1)Adam Mickiewicz University, Pozna, Poland, (2)European Space Research and Technology Centre, Noordwijk, Netherlands, (3)Pozna University of Life Sciences, Pozna , Poland

Type of publication
Peer review

Abstract
The objective of this study was to examine the impact of aluminium on the perennial macroalgae Chara hispida L. and its bioaccumulation capacities. Aluminium (Al) was introduced into the environment in the form of polyaluminium chloride, an agent utilized in the restoration of waterbodies. Research was conducted in an experimental setting using mesocosms (volume 0.8 m3) placed in the littoral zone of a lake with C. hispida. Three doses of the coagulant were applied, each with a different volume: low – 6.1 g Al m−3, medium – 12.2 g m−3 and high – 24.5 g Al m−3. A significant acidification of environment was determined, which would imply the presence of toxic Al3+ ions. It has been demonstrated that aluminium penetrates and accumulates in the cells of the charophyte. This caused damage to the thalli, which manifested itself in chloroses, necroses, flaking of the cortex cells and softening of the thallus, whose severity was proportionate to the dose of the coagulant. The first negative signs were observed after 24 h. The study shows that C. hispida is a poor accumulator of aluminium (bioconcentration factor < 200), while bioaccumulation capacity was inhibited at the concentration of approx. 2.0 mg Al g−1 d.w. Accumulation in the thalli of the charophytes accounted for 58% of variation following removal of aluminium from the environment. The results of the experiment demonstrate a negative impact of aluminium on charophytes at concentrations used in aggressive restoration of lakes.

Reference
Ecotoxicology and Environmental Safety. Volume 145, November 2017, Pages 359-366

Link
https://www.sciencedirect.com/science/article/pii/S0147651317304694

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Smarter cities in post-socialist country
Example of Poland

Author
Dorota Sikora-Fernandez

University
University of Lodz, Lodz, Poland

Type of publication
Peer review

Abstract
Currently, when discussing the development of urban areas in post-socialist countries, it is common to highlight a new stage of urbanisation known as smart city creation. Nowadays, increasingly more cities are labelled as intelligent or smart; however, there is no clear-cut definition that specifies the criteria for considering a city as intelligent or smart. The existing sets of criteria are relatively ambiguous and have different priorities depending on the region. The socio-economic transformation of post-socialist countries generated new circumstances in terms of managing cities, especially in social and governance aspects. European funding allows for building smart infrastructure. Thus, it is essential to determine whether, to what degree and on what grounds post-socialist cities may be considered smart in the entire context of their human and technical dimensions.

Reference
Cities: Available online 16 March 2018. In Press, Corrected Proof
https://doi.org/10.1016/j.cities.2018.03.011

Link
https://www.sciencedirect.com/science/article/pii/S0264275117306601

RESEARCH NOTES LETTER
Issue 3-2018
The Baltic University Programme

Social learning research in ecological economics

A survey

Authors
Bernd Siebenhüner(1), Romina Rodela(2,3), Franz Ecker(4)

University
(1)Carl von Ossietzky University of Oldenburg, Oldenburg, Germany, (2)Wageningen University and Research Centre, Wageningen, The Netherlands, (3)Södertörn University, Huddinge, Sweden, (4)University of Freiburg, Freiburg, Germany

Type of publication
Peer review

Abstract
Social learning studies emerged as part of the ecological economics research agenda rather recently. Questions of how human societies and organisations learn and transition on the basis of environmental knowledge relate to the core ideas of ecological economics with its pluralistic understanding of human behaviour in contrast to the limited focus on incentive-driven behaviour. Our study analyses the emergence and thematic foci of social learning studies within ecological economics over the past 15 years. We selected and analysed 54 articles published after peer review in established journals adhering to the epistemological tradition of ecological economics. This study is guided by the interest in how social learning is conceptualised, how this research is positioned in terms of process dynamics, causal factors and outcomes of learning. Results show, that the number of related papers grew substantially in recent years. Also the role of formal or informal institutions has been found to be a strong causal factor for social learning and change processes vis-à-vis technological, economic or political factors. In addition, there is a growing awareness of social learning processes in various environmental policy fields such as biodiversity governance, water and land management, fisheries, and climate adaptation. We conclude that these insights can give new impulses to research on socio-ecological transition and to the related debate on societal change and transformation processes as core topics for ecological economics.

Reference
Environmental Science & Policy. Volume 55, Part 1, January 2016, Pages 116-126
https://doi.org/10.1016/j.envsci.2015.09.010

Link
https://www.sciencedirect.com/science/article/pii/S1462901115300794

RESEARCH NOTES LETTER
The Baltic University Programme
Issue 3-2018

Total carbon and benzo(a)pyrene in particulate matter over a Polish urban site

A combined effect of major anthropogenic sources and air mass transport

Author
Patrycja Siudek

University
Adam Mickiewicz University in Pozna , Pozna , Poland

Type of publication
Peer review

Abstract
Anthropogenic sources have a significant impact on air quality in urbanized areas and can contribute to large variability of atmospheric particle sizes, its matrix composition and potential for toxicological effects on environment and public health. This paper presents data from one-year measurements of total carbon (TC) and particulate phase benzo(a)pyrene (BaP) in aerosol samples collected at the urban site in central Poland, in 2014. The role of meteorological conditions and different local/regional sources in the intraannual variability of TC and BaP in total suspended particles was examined. Atmospheric concentrations of TC and BaP were higher during the cold sampling period (winter and fall) than in summer, suggesting significant contribution of local combustion processes (mostly related to industrial activities, coal/wood burning for residential heating, traffic emission) to wintertime aerosol loading. Also, high TC and BaP concentrations in particulate matter during wintertime observations were forced by specific meteorological conditions, i.e. below zero ambient air temperature, lower solar radiation, lower height of urban mixing boundary layer, stable atmospheric conditions. In contrast to the winter study period, in summer the particulate phase BaP showed small variation and lower concentrations, probably as an effect of considerable reduction in emission related to residential sector, photochemical reaction with oxidizing agents, higher partitioning towards the gas phase and higher precipitation height.

Reference
Atmospheric Pollution Research
Volume 9, Issue 4, July 2018, Pages 764-773
https://doi.org/10.1016/j.apr.2018.01.001

Link
https://www.sciencedirect.com/science/article/pii/S1309104217305615

The carbon footprint of business travel in the knowledge-intensive service sector

Authors
Age Poom(1), Kati Orru(1), Rein Ahas(1,2)

University
(1)University of Tartu, Tartu, Estonia and (2) Ghent University, Ghent, Belgium

Type of publication
Peer review

Abstract
We explore the travel needs and patterns, and the corresponding carbon footprint, of small service organizations during different phases of knowledge-intensive business processes, and compare the results with the priorities given to travel-related goals by staff. We apply a combination of focus group data, mobile positioning, and individual follow-up interviews as study methods. The need for physical travel is determined by a combination of the perceived potential for knowledge creation and transfer offered by each trip, the strength of interpersonal relationships in business networks, and the significance of the travel goal in terms of economic sustainability. The priorities given to travel goals reflect the environmental load of business travel only in domestic contexts, where executing core business processes accounted for the highest carbon footprint. We propose the ways in which the management of business interactions could take into account sociotechnical environment and social recognition of low-carbon communication and travel modes.

Reference
Transportation Research Part D: Transport and Environment
Volume 50, January 2017, Pages 292-304
https://doi.org/10.1016/j.trd.2016.11.014

Link
https://www.sciencedirect.com/science/article/pii/S1361920916308653

Attached to or bound to a place? The impact of green space availability on residential duration: The environmental justice perspective

Authors
Edyta Łaszkiewicz(1), Jakub Kronenberg(1) and Szymon Marci czak(1,2,3)

University
(1)University of Lodz, Lodz, Poland, (2)University of Estonia, Estonia (3) University of Johannesburg, South Africa

Type of publication
Peer review

Abstract
Socioeconomic inequalities in residential duration may be a reflection of uneven opportunities to develop place attachment thanks to green space availability. This article evaluates the impact of urban green space availability on residential duration, and shows that this impact varies among socioeconomic groups. We used an econometric model to study relationships between geolocalized residential quality survey data and the objective measure of spatial availability of urban green spaces in Lodz, Poland. The results indicate that the length of residential duration of the wealthier residents is not affected by the availability of nearby green space, while the length of residential duration of the less socioeconomically privileged residents is affected negatively by the availability of nearby green space. The abovementioned findings may be a signal of unequal opportunities to develop a relationship with the residents' place of living thanks to the availability of green spaces. Interestingly, inequalities related to residential duration, and their linkages with the strength of place attachment are less explored in the literature, compared to uneven access to other environmental benefits. This study supplements the traditional perspective of environmental justice with the context of residential duration and place attachment.

Reference
Łaszkiewicz, E., Kronenberg, J., Marci czak, S., 2018. Attached to or bound to a place? The impact of green space availability on residential duration: The environmental justice perspective. Ecosystem Services 30, 309–317.
https://doi.org/10.1016/j.ecoser.2017.10.002

Link
https://www.sciencedirect.com/science/article/pii/S2212041617302139?via%3Dihub