BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: T20

Advancing Health Equity and Environmental Justice through Ecosystem Service Research

Hosts:

	Name	Organisation	E-mail
Host:	Francesc Baró	Vrije Universiteit Brussel (VUB)	francesc.baro@vub.be
Co-host(s):	Johannes Langemeyer	Universitat Autònoma de Barcelona (UAB)	johannes.langemeyer@uab.cat
	Brenda Maria Zoderer	University of Natural Resources and Life Sciences	brenda.zoderer@boku.ac.at
	Felipe Benra	Leuphana University of Lüneburg	felipe.benra@leuphana.de

Abstract:

In recent years, the ecosystem service (ES) research field has increasingly considered and focused on the multiple equity and justice implications attached to ES assessments (see for example the systematic review by Calderón-Argelich et al., 2021). This includes important work recognizing the (un)equal provision and distribution of ES and their benefits across space and time, the need for disaggregation across different socio-economic and demographic beneficiary groups with differing needs and vulnerabilities, the relevance of (un)balanced power relationships, institutional arrangements, and individuals' capabilities in driving (un)equal access to ES, and the importance of considering procedural and recognition justice components to address these imbalances. Despite these advancements, more research is needed to understand how ES research can advance health equity and environmental justice issues in its multiple dimensions.

This session proposal hence seeks to delve into the complex dynamics between ES, health/wellbeing equity, and environmental justice. It aims to foster a deeper understanding of

how disparities in access to and benefits from ES contribute to health inequities and social-ecological injustices. Therefore, the session will feature a diverse range of contributions addressing the main objectives of the ESP working group on "Justice in ES research", including:

- Explore the linkages between ES and justice outcomes in its multiple dimensions and criteria.
- Develop methodologies for the research on justice and equity in relation to ES, including assessments of unequal production and distribution of ES among different groups of stakeholders and on how inequalities in needs and capabilities might hinder access to those ES.
- Explore social differences in needs, values, and knowledge systems to better understand the conditions under which unequal ES production and distribution leads to inequitable health and well-being outcomes.
- Bridge the gaps between different disciplinary backgrounds, as well as learn from different geographical contexts (e.g. urban and rural studies), with a focus on European case studies.
- Reflect on the justice implications of doing ES research (e.g. how different methodological choices might produce (un)equal ES outcomes or hide existing injustices).

References:

Calderón-Argelich, A., Benetti, S., Anguelovski, I., Connolly, J.J.T., Langemeyer, J., Baró, F., 2021. Tracing and building up environmental justice considerations in the urban ecosystem service literature: A systematic review. Landscape and Urban Planning 214, 104130.

Goals and objectives of the session:

The session is meant to keep fostering a community of researchers who are addressing justice and equity considerations in ES research (ESP Thematic working Group on "Justice in ES research"), including European collaborations and networks, and plan future outcomes in the frame of the working group. The session also aims to provide contributors to the ongoing Special Issue on "Equity and Justice in ES research" (Ecosystem Services journal) a platform to share and discuss their findings/advancements.

Planned output / Deliverables:

There is no a specific output planned, but potential synergies in the dissemination of the research contributions (beyond the ongoing Special Issue) will be explored during the session.

II. SESSION PROGRAM

Room: Expert Street 2

Date of session: 18th of November 2024

Time of session: 11h – 15:30h

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	**Francesc**	**Baró**	**VUB (session host)**	**Session introduction: Part I**
11:05	Felipe	Benra	Leuphana University Lüneburg	Diverse framings of equity and justice in ecosystem services research
11:15	Carl	Anderson	Leibniz University Hannover	Urban green space visitation for cooling off from extreme heat: A justice assessment using public participation GIS (PPGIS)
11:25	Helena	Duchková	Global Change Research Institute CAS; Charles University	Winners and losers of urban spatial design: Heat exposure and microclimate cooling across population groups
11:35	Anna Giulia	Castaldo	Politecnico di Milano	Evaluating heat mitigation inequities: a case in the federal district of Brasilia
11:45	Kate	Farley	UK Centre for Ecology & Hydrology	Comparing socioeconomic variation in greenspace benefits in two European cities
11:55	**Johannes**	**Langemeyer**	**ICTA-UAB (session host)**	**Panel discussion I**
12:30				**LUNCH BREAK**
14:00	**Francesc**	**Baró**	**VUB**	**Session introduction: Part II**
14:05	Elsa	Gallez	VUB	Assessing inequities in children's use of green spaces after school hours using participatory GIS
14:15	Elsa	Gallez	VUB	Schools Staff's Enablers and Barriers to Support Children's Equitable Use of Green Infrastructure in Brussels

Time	First name	Surname	Organization	Title of presentation
14:25	Yuxin	Pu	VUB	Assessing Inequalities in Exposure and Accessibility to Urban Nature-based Solutions for Older Adults Living in Long-term Care Facilities.
14:35	Divya	Subramanian	DS Urban Analytics	Evaluating menstrual hygiene practices, participation in recreational ecosystem services, and health equity: A case of Bhopal, India
14:45	Ernesto	López Morales	Universidad San Sebastian	Eco-gentrification in Patagonia: Environmental Justice in urban-to-rural Urbanization
14:55	**Felipe**	**Benra**	**Leuphana University Lüneburg (session host)**	**Panel discussion II**
15:10			**All hosts**	**ES Equity WG outlook/discussion**
15:20				**End of session**

III.ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Urban green space visitation for cooling off from extreme heat: A justice assessment using public participation GIS (PPGIS)

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Extreme heat in urban areas is projected to increase due to climate change and characteristics of individuals can increase their vulnerability. Understanding how residents are adapting in urban spaces is important for promoting equitable and environmentally just adaptation planning. Public green spaces (PGS), a type of urban green infrastructure (UGI) under the

nature-based solutions (NbS) umbrella, reduce temperatures in cities and provide cooling oases for visitors on hot days. Green spaces and associated benefits have varying degrees of availability, access, and quality within different neighborhoods and for different people. We conduct a survey using the public participation geographic information system (PPGIS) platform Maptionnaire to explore the degree of equitable use of green spaces as cooling oases in Bochum, Germany. We assess equity as the condition that capacity for green space use matches residents' reliance (assessed according to stated demand, risk perception, and vulnerability to heat) . We find that 1) cooling is a valued ecosystem service and visitation motivator; 2) future planning should prioritize elderly and lower-income residents/visitors; and 3) neighborhood green space access is rated highly but availability and quality show some spatial inequity. Our findings can inform environmentally just adaptation planning in Bochum and provide a methodological template for researchers and other global cities facing extreme heat.

Keywords: climate justice, social vulnerability, risk perception, ecosystem services, urban green infrastructure (UGI)

2. Evaluating heat mitigation inequities: a case in the federal district of Brasilia

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Paranoá (Brazil) is a small city near the primary urban area of Brasília, exhibiting an urban pattern characterized by extensive soil sealing and limited vegetation cover. Urban planning regulations have historically lacked any context-requirements for permeable land. Nevertheless, the area plays a crucial role in mitigating environmental risks for the whole urban context, as it is located upon one of the primary aquifer recharge areas. The present study uses bivariate Pearson's correlation to evaluate how the heat mitigation index's spatial patterns of the InVEST Urban Cooling (UC) model differ for vulnerable groups based on socio-demographic factors in Paranoá. By evaluating the nighttime heat mitigation index for both Paranoá and Brasília, which captures the variability in surface thermal response, the results reveal a significant disparity in urban cooling capacity between the two areas. The UC model, in line with increasingly common findings that highlight differences in how wealthy and poor cities address climatic hazards, underscores this inequality: Brasília benefits from a higher provision of cooling, while Paranoá exhibits a markedly lower cooling capacity. The study then explores Paranoá, which records a

higher number of vulnerable socio-demographic groups. The findings uncover further inequalities in the distribution of the ecosystem service benefits among the most vulnerable groups, emphasizing the need for the stratification of inequalities into ecosystem service studies when designing Nature-based Solutions strategies. Finally, the study examines the implications of the urban morphology and the social structure and proposes potential Nature-based Solutions to mitigate heat and provide further ecosystem services.

Keywords: heat mitigation, inequality, vulnerable groups, ecosystem services, nature-based solutions

3. Winners and losers of urban spatial design: Heat exposure and microclimate cooling across population groups

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Extreme heat has become an exacerbating issue for many cities and their residents. The growing effects of climate change combined with the trends in urban expansion, development and other anthropogenic pressures are increasing urban temperature, further threatening residents' wellbeing and health. Urban heat can be mitigated by cooling services of ecosystems, but these are usually not evenly distributed within a city. The spatial design of cities can thus lead to disparities in exposure to extreme heat and the provision of ecosystem benefits such as microclimate cooling. This raises questions such as: Who are the beneficiaries of urban ecosystem cooling benefits? Who remains exposed to the impacts of heat?

This study investigates the distribution of microclimate cooling benefits among urban residents in Prague, Czech Republic. We employed the Urban Cooling InVEST model to estimate heat mitigation and identify areas with cooling benefits and areas of heat exposure during the day and night. These were then correlated with residential data to establish the average and identify deviations among various demographic and socio-economic population groups. The analysis did not indicate any outlying beneficiaries. However, some groups (non-Czech nationalities, ethnic minorities) receive fewer cooling benefits in their place of residence and surroundings. These groups are thus disadvantaged within the spatial design of the city. This study provides insights into intra-urban disparities in the provisioning of microclimate cooling by ecosystems. The findings can support adaptation planning that promotes equity and resilience to climate

change. The presentation also addresses limitations related to data, scale, methods, uncertainties in results, and discusses accessibility to benefit areas and the need for interventions to bridge the gap in cooling provision among different population groups.

Keywords: heat exposure, microclimate cooling, distributive environmental justice, urban planning, socio-economic disparities

4. Comparing socioeconomic variation in greenspace benefits in two European cities

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Socioeconomically deprived populations are at greater risk from adverse health outcomes relating to air pollution and often bear the additional burden of living in areas with higher exposure to pollution. The emerging 3-30-300 urban-greening rule provides guidance to improve equitable access to trees and greenspace but has not been tested.

We modelled how the rule could reduce PM2.5 exposure in two socioeconomically contrasting cities, Paris and Aarhus, compared with current land use. We used air quality models and socio-economic data to measure disparities in initial exposure to pollution across population subgroups, and exposure to reduced PM2.5 concentrations provided by greenspace. Socioeconomic data were disaggregated to residential buildings: households in poverty, age group, citizenship and education. Population-weighted averages for PM2.5 concentration and area of trees (m2) were compared across baseline and 3-30-300 scenarios.

Under the rule improvements in air quality were identified for all socioeconomic groups in both cities. In Paris, at baseline, more vulnerable populations were exposed to higher concentrations of PM2.5. Application of the rule improved air quality for these populations but did not reduce the gap in exposure between more and less privileged groups. In contrast, for Aarhus, where baseline exposure was higher for higher-income and other privileged groups, the greatest improvements were indicated for the lowest income populations.

Implementation of the 3-30-300 rule could potentially improve air quality and reduce adverse health outcomes. However, equitable outcomes of the rule are dependent upon existing spatial

distribution of socio-economic groups. Thus, the gap between PM2.5 exposure for high- and low-income groups is not always decreased and could widen inequalities depending on the existing quantity and type of green space (e.g., trees vs grass). Co-benefits arising from green infrastructure such as mental health and social connectedness should also be considered and integrated analysis of multiple ESS benefits should be conducted.

Keywords: Urban, health, equity, air quality, green infrastructure

5. Schools Staff's Enablers and Barriers to Support Children's Equitable Use of Green Infrastructure in Brussels

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Because school environments are usually evenly distributed across urban areas, they can play a key role in mitigating children's inequitable access to residential green infrastructure (GI) and related benefits. The availability and increasingly promoted use of school-related GI (i.e. green schoolyards and off-site natural areas visited during school hours) offer various opportunities for children to engage with nature through formal or informal learning. By providing recreational and educational services, school-related GI is known to positively contribute to children's emotional, cognitive, social, and physical development.

However, many studies report that school staff experience a set of physical (e.g., distance, road safety), personal (e.g., fear of nature, lack of time or funding), and institutional (e.g., curriculum requirements) barriers to organizing nature-based outdoor activities in and outside the schoolyard. Integrating outdoor learning into the curriculum and allocating more time and funding for nature-based activities appear as potential solutions. To date, no studies have analysed how these enablers and barriers are perceived differently depending on schools' socio-demographic characteristics.

To fill this research gap, our study aims to examine school staff's enablers and barriers to support children's use of school-related GI, considering an equity perspective. To this end, a participatory GIS (PGIS) survey was disseminated to all preschool and primary schools (targeting

school directors and teachers) located in the Brussels Capital Region, complemented by several semi-structured interviews in disadvantaged schools.

The study reveals that most schools organize short visits to off-site GI at least once a month and day-long visits at least once a year. Trees and vegetable gardens are present in most schoolyards but are rarely used for educational purposes. Time constraints, lack of financial resources and limited staff are reported to be the main barriers to organizing off-site visits. More preliminary findings, especially on the equity analysis, will be presented at the conference.

Keywords: nature-based solutions; outdoor learning; children; environmental justice

6. Diverse framings of equity and justice in ecosystem services research

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Ecosystem services (ES) are integral to environmental justice, in particular because they unevenly contribute to the well-being of different communities. Effective ES management and governance can promote equitable access and ensure that marginalized groups are not excluded from ES benefits, while recognizing the interests of multiple stakeholders and fostering fair decision-making. Although environmental justice is a multifaceted concept encompassing distributive, procedural, and recognition dimensions, most research on justice in ES has focused primarily on distributional aspects. Recent reviews indicate a growing interest in integrating environmental justice concerns with ES, but also highlight gaps in understanding how justice and equity are framed and addressed in different contexts. We systematic reviewed the scientific literature to identify the major framings of the relationship between ES and justice. Through qualitative and quantitative analysis of 217 papers from an environmental justice perspective, we identified five distinct framings, i.e. particular conceptualizations of the relationship between ES and justice that ultimately influence what (in)justices can be rendered visible or invisible. Each of the framings ´Space´, ´Access´, ´Values´, ´PES´ (Payments for ES), and ´Instruments´ is associated with specific research questions and methods on ES, which determine environmental justice judgements. The plurality of framings identified in this paper highlights the complexity of environmental justice as a concept and underscores the

importance of considering diverse viewpoints and experiences in addressing injustices in relation to ES.

Keywords: justice; equity; fairness; framings; systematic review

7. Assessing inequities in children's use of green spaces after school hours using participatory GIS

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Due to the multiple ecosystem services they supply, exposure to and use of green spaces can have positive impacts on children's mental, physical, cognitive, and behavioral development. Despite these benefits, there are well-documented inequities in the provision of green spaces, leading to limited access for children in deprived urban areas. Understandings of these inequities remain incomplete, as there is insufficient research on the actual use of green spaces by children and the factors influencing their usage. This research aims to better understand parents' perceptions of the factors that enable and limit children's use of public green spaces after school hours. It further aims to identify how use of green spaces by children varies based on a combination of 1) the location of the child's school in relation to the green spaces most frequently visited, 2) parents' socio-demographic status, and 3) parents' orientations toward nature. To study these factors, a participatory GIS survey was launched in the Brussels Capital Region, Belgium, targeting parents of children aged 3-12. The survey asked parents how often their children visit green spaces on weekdays, which enablers and barriers their children experience in using green spaces, and to locate the green spaces their children use most on a map. Respondents also identified the cultural ecosystem services provided by green spaces that they consider most important for children. Results reveal that a lack of time is a significant barrier for children who do not visit green spaces after school, while having accessible green spaces and no private garden are strong enablers. Preliminary findings also suggest that children from higher-income families visit green spaces after school less frequently than those from lower-income families.

Keywords: children, schools, urban green spaces, environmental justice, PPGIS

8. Assessing Inequalities in Exposure and Accessibility to Urban Nature-based Solutions for Older Adults Living in Long-term Care Facilities

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Cities worldwide are increasingly facing the interconnected challenges of climate change and ageing populations, with older adults being especially vulnerable to climate-related extreme environmental events. In this context, Nature-based Solutions (NbS) have been proposed as actions that can tackle such challenges by contributing to urban climate change adaptation and providing multiple ecosystem services to the older population, including social interactions and recreational opportunities enhanced physical and mental health.

Aware of the multiple benefits of NbS for older adults, an increasing number of studies have investigated the equity implications in older adults' exposure and access to urban NbS. However, most studies lack a focus on older adults living in long-term care facilities (e.g., rest homes, senior centers, services flats). Because of the high vulnerability of this older population group in terms of health condition and mobility limitations, access to NbS and ecosystem services must be provided within or in the immediate surroundings of these facilities.

This research assesses the spatial patterns of older adults' exposure and access to NbS within and around long-term care facilities located in the Brussel Capital Region, also considering potential equity implications using socio-economic indicators at the neighborhood and facility levels.

The preliminary findings indicate that publicly owned care facilities have larger NbS within the compound area and easier access to nearby public green spaces, while those operated by private companies and non-profit organizations are mostly located in greener neighborhoods where the proportion of NbS is higher in a certain buffer distance. Higher exposure to NbS from care facilities for older adults also shows a negative association with neighborhood vulnerability indicators (e.g. low-income population), but not with care facilities' affordability (daily/monthly package price).

Keywords: socio-environmental equity, nature-based solutions, older adults, care facilities, urban green space

9. Evaluating menstrual hygiene practices, participation in recreational ecosystem services, and health equity: A case of Bhopal, India

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Access to menstrual hygiene management (MHM) along with clean water and sanitation facilities is a fundamental right for menstruating persons across the globe. In the global south, many women and girls from the lower income groups practice poor MHM on account of resource shortfall. Inadequate MHM along with myths and taboos regarding menstruation further hinder women's access to education, occupation, and recreation. The 'male' coded gendered cities seldom provide safe avenues for women's participation in navigating the city. Additionally, poor MHM during menstruation can significantly reduce women's mobility. To evaluate the factors impacting women's participation in recreational ecosystem services (RES), a survey of fifty women belonging to the lower income groups was conducted in the urban areas of Bhopal, India. The survey questionnaire was designed to gather information regarding personal MHM practices, access to clean water and sanitation resources, socio-economic profile, MHM products awareness, daily routines including recreational activities data, along with physical movement and RES use patterns. The survey participants included women who were in the age group of 18 years to 50 years. The survey highlighted severe lack of awareness regarding good MHM practices among the participants. Instances of unavailability of clean water and sanitation facilities specifically during menstruation leading to severe health impacts were recorded. The survey revealed a significant negative impact of menstruation and MHM practices on women's mobility and participation in the RES. This study further identified policy recommendations that could help mobilize women towards a more active lifestyle and follow good MHM practices during menstruation.

Keywords: Menstrual Hygiene Management, Recreational Ecosystem Services, Physical Activity, Health Equity

10. Eco-gentrification in Patagonia: Environmental Justice in urban-to-rural Urbanization

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This study delves into the intricate relationship between gentrification and ecosystem services (ES), proposing that variations in ES and social displacement indicators can be correlated and observed qualitatively. This research case study is Patagonia, a significant, barely urbanized region in South America. Its focus on urban-to-rural migration and low-density urbanization is novel, as they have not been extensively explored in ecological gentrification research so far.

Human well-being in Patagonia has a rich history deeply rooted in utilizing natural capital and ES for employment and sustenance. These include water, air, wood, livestock, plant production, ecosystem management, cultural identity, and recreational activities. However, the recent influx of new residents seeking these benefits has significantly strained these resources.

Gentrification is widely accepted as changes in the built environment resulting in socioeconomic upward mobility and various forms of displacement, exclusion, and home loss. This eco-gentrification approach allows for the assessment of unequal co-production and distribution of ES. It examines how inequalities in needs and capabilities may hinder access to these essential services and well-being by the less affluent population.

The first part of this study involves mapping and valuing ES using official environmental data. This information is compared spatially with a visualization of the increase in land and property prices as an indicator of gentrification. Additionally, the study examines residents' socioeconomic changes using a Displacement Index based on 2002, 2017, and 2024 census data to understand population turnover trends.

The second part of the research is equally significant. It involves consulting with local communities to understand the changes in access to ES since 2019. This participatory approach delves into distributional, procedural, and recognitional aspects of planning and decision-making regarding the urbanization of this area. The paper critically reflects on the implications of justice and the contribution of eco-gentrification research to ES analysis.

Keywords: Gentrification; Ecosystem services; Eco-gentrification; Patagonia