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The dark matters: dark-sky leisure events as regenerative spaces for climate justice

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ABSTRACT

Globally, the unprecedented brightening of the night sky poses severe consequences for all living things (Kyba et al. 2023). The call to protect dark skies has led to an increase in national parks hosting leisure-based festivals to raise awareness about the impact of light pollution. Taking an ecological justice lens that recognises environmental crises are deeply intertwined with social challenges, this paper contributes new knowledge by exploring the experiences and benefits of human and non-human stakeholder engagement in dark-sky festivals. Conducted during the North York Moors National Park, United Kingdom, Dark-skies Festival in February 2024, a novel methodology using sensory ethnography identified regenerative stakeholder practices and behaviours. The significance of this research is evident in the heightened ecological awareness of stakeholders participating in dark-sky festivals and the sustainable practices that are helping to mitigate light pollution in response to the climate crisis.

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Introduction

In the last century and a half, the rise of light pollution has significantly altered our night skies, negatively affecting human health, wildlife, and ecosystems. In the Western Hemisphere, only 10% of the population experiences dark skies, with pollution levels increasing annually by up to 10% (Kyba et al. 2023). Global activists DarkSky International (2024) spearhead a global initiative, 'Unit to Protect the Night!' to restore the nighttime environment. Despite this work, the impact of dark-sky public engagement and tourism remains a neglected topic (Collison and Poe 2013), and the limited scholarship exploring the effectiveness of visitor interventions (Avery 2023; Bjelajac, Đerčan, and Kovačić 2020) is notable. Although a small body of research explores dark-sky places as visitor destinations (Barbosa et al. 2021; Soleimani et al. 2018), this focuses on the management, sustainability and economic impact of dark-sky tourism (Beeco et al. 2023; Escario-Sierra et al. 2022; Jacobs, Du Preez, and Fairer-Wessels 2019; Mitchell David and Gallaway 2019; Smith et al. 2023). There is a lack of understanding about the

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social, environmental, and cultural impacts of dark-sky festivals on reducing light pollution in dark-sky (or astrotourism) destinations (Hvenegaard and Banack 2024; Khetrapal and Bhatia 2022; Rodrigues and Loureiro 2024; Silver and Hickey 2020). Scholars emphasise that to achieve equity in sustainable tourism (Blundell, Schaffer, and Moyle 2020), research is required that explores justice for all living beings in natural environments.

This study underscores how festival tourism (defined as formally organised public events/festivals) can help regenerate dark-skies in national parks by raising stakeholder awareness and engagement in conservation, promoting ecological justice for all living beings. The UK has several dark-sky reserves, including the North Yorkshire Moors National Park (NYMNP, which was designated a National Park in 1952), and covers 1,436 km^2. As one of seven International DarkSky Reserves in the UK, NYMNP recognises the critical need to protect dark-skies for human and ecological health and is a priority in nature recovery efforts. NYMNP have adopted regenerative tourism principles to enhance public engagement and raise ecological awareness. A key initiative is the Dark-Sky Festival, designed to increase visitor awareness and involvement in conservation (Figure 1).

Following posthumanist approaches (Ingold 2000), this study draws from ecological justice theory, which recognises justice is embedded in real-world experience, relational and fully entwined with the condition of nonhuman entities (animate and inanimate) (Schlosberg 2014, 75). As such, the study adopted an immersive sensory ethnographic approach, utilising film, to conduct an in-depth analysis grounded in real-world experiences (Pink 2009). Following Sarah Pink's (2009) theorisation of sensory ethnography, a methodology was designed to explore multisensory human and nonhuman interconnections that researchers and research participants experienced during dark-sky festival events. Pink's (2009, see methodology) posthumanist conceptualisation recognises the interrelatedness of mind–body-environment and how this is productive of space and place. This methodology expanded sensory data collection, including feeling the



Figure 1. Sensory ethnographic field research. Photo credit: Authors' own.

uneven terrain while walking and night vision. It helped to understand how people reconnect with nature and address the climate crisis by building dark-sky awareness and practices through engagement in dark-sky festivals (Edensor 2013).

This paper highlights the impact of dark-sky festivals in national park DarkSky Reserves on conservation goals. The significance of this research is evidenced through three critical themes: firstly, how dark-sky festivals improved critical thinking, knowledge capacities and awareness of ecological harm caused by light pollution; secondly, how the engagement of businesses and visitors led to regenerative action; and thirdly how dark-sky festivals in national parks can contribute to regenerative policy that address the challenges of the climate crisis (Figure 2).

Literature review

Light pollution and the climate crisis

Being naturally diurnal, humankind has catastrophically extended daylight by illuminating the night with artificial light, which represents 1% of global emissions (Charlton 2025; Jägerbrand and Spoelstra 2023). Research into the amount of wasted light suggests that approximately thirty per cent of outdoor lighting in the United States – equivalent to 9.5 million cars on the road – is wasted (Mitchell and Gallaway 2019) with research into wasted light in the European Union suggesting an annual cost of 23.5 billion kg of CO2, which contributes to the climate crisis (Morgan-Taylor 2023). As the global climate changes, hotter daytime temperatures may encourage more human nighttime activity (Fan et al. 2023), resulting in more energy consumption, more artificial light at night (ALAN) and impacting the health of all living things (Table 1).

Anthropogenic light pollution, or ALAN, harms ecosystems because the central role light regimes play in the timing of biological systems is disrupted (Sanders et al. 2020).

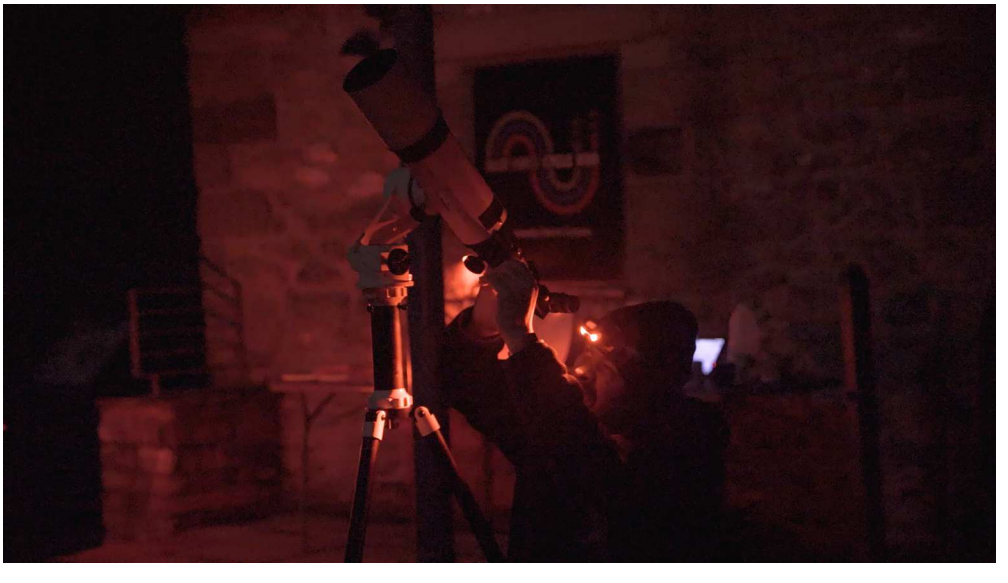


Figure 2. Star bathing. Photo credit: Authors' own.

Table 1. Research participants (Authors' own, 2024).

Participant	Description
B1.1	Sole Trader x 1
V1.1 – V1.24	24 Visitors
B2.1 & B2.2	Sole Traders x 2
V2.1 – V2.14	14 Visitors
B3.1	Sole Trader x 1
V3.1 – V3.18	18 Visitors
B4.1 & B4.2	Small Business x 2 owners
V4.1 – V4.24	24 Visitors
B5.1 & B5.2	Sole Traders x 2
V5.1 – V 5.14	14 Visitors
PO1	Public Official
PO2	Public Official

Globally, nearly a quarter of all land is artificially lit, polluting nighttime skies, and the growth of anthropogenic light is estimated to be circa two per cent per year (Sanders et al. 2020). Scientists warn that pressure on ecosystems can lead to an insect apocalypse, resulting from habitat loss, pesticides, invasive species, and light pollution (Owens et al. 2019). Since 1992, light pollution has doubled in biodiversity-rich areas, disturbing habitats for small animals. Owens et al. (2019) note that a third of insects attracted to artificial light die before morning. Moths, crucial for pollination, are particularly affected, as are bats with shrinking feeding grounds. Dill (2024) highlights that artificial light at night (ALAN) hinders forests' carbon sequestration, exacerbating climate change. Overall, light pollution disrupts navigation, physiology, and health in wildlife, contributing to the climate crisis (DarkSky International 2024).

Advancements in lighting technology have made artificial light more prevalent, extending beyond urban areas into natural environments (Gaston and Holt 2018). The blue spectrum of light emitted by newer car headlights dazzles vertebrates, causing collisions and disrupting circadian rhythms (Outen 2002). Street lighting exposes organisms to unnatural light regimes that disrupt seasonal patterns, contributing to biodiversity loss. The research team examined how dark-sky festivals could aid in nature recovery through the lens of ecological justice and regeneration (Figure 3).

Ecological justice

Ecological justice theory recognises that social justice and environmental issues are deeply intertwined; as Schlosberg (2014, 75) notes, the liberal notions of justice have 'always been based on human exceptionalism and separation from the rest of the natural world'. The sensation that we are somehow distinct/separate from the nonhuman plant and animal world – that sustains us – is, as Schlosberg (2014, 75) asserts, the normative grounding of a milieu of 'ethical constructions of justice'. He argues that taking responsibility for holistically considering human integration within broader ecological systems has reached a critical point, requiring consideration of both human and nonhuman communities and practices (Schlosberg 2014). The anthropogenic climate crisis threatens the functioning of ecological systems, in which justice is deeply entwined with living and non-living entities like dark-skies (Schlosberg 2014). Schlosberg (2014) emphasises the importance of fostering an openness to a broader understanding of the connections between animal ethics and ecological politics. For example,



Figure 3. Walking under dark-skies. Photo credit: Authors' own.

groundbreaking scholars like Nussbaum (2006) shifted from anthropocentric views on justice, emphasising that all nonhumans deserve to thrive with dignity appropriate to their species (Nussbaum 2006).

Although it is not possible to comprehensively discuss the approaches to justice here, it is acknowledged that theoretically, justice has a long heritage in political philosophy and is dominated by a moral frame asserted in concepts of impartiality, duty, obligation, morality, and fairness. The distributive paradigm and capabilities approach share this frame, which has been critiqued as 'pre-democratic' (Forst and Cronin 2014, 4) because often those subject to the values of social order are not the authors of what is perceived as just. Some philosophical approaches emphasise the connection between concepts of justice and the everyday experiences of injustice, which are not based solely on formal principles and procedures. In this view, justice is ever-present, with its boundaries expanding due to tensions between emerging struggles for justice and established justice systems. Jacques Derrida (1992) noted that these tensions often stem from the experiences of those unrepresented within existing justice systems.

Contemporary environmental movements highlight the tensions within established theories of justice (Rawls 1971; Sen 2009). For instance, ecological justice theory recognises that justice is rooted in real-world experiences and encompasses both human and nonhuman struggles for equity (Yaka 2018). Environmental movements advocate for expanding traditional justice theories to include nonhuman entities, sparking productive discussions among scholars such as David Schlosberg (2007) and Gordon Walker (2009). They argue for an alternative moral framework that prioritises environmental commons over the private ownership of natural resources. By combining theories of ecological justice with regenerative tourism, we can deepen our understanding of how destinations, such as dark-sky reserves, can restore biodiversity and ecological health through public engagement, such as festivals.

Ecological justice and regenerative tourism

Contemporary environmental movements, such as ecological justice and the environmental commons, are crucial in the fight against the expansion and extractive colonisation of nature and its resources (Yaka 2018). As one of the largest neoliberal extractive global industries, tourism is deeply implicated in the struggle for ecological justice (Higgins-Desboilles 2020). The industrialisation of tourism by corporate interests has resulted in ecological destruction, economic failure and social inequalities, with little attention paid to building healthy ecologies, including nature-based and ecotourism products that conceal contradictions of capitalism (Duffy 2015).

Yaka (2018) highlights that environmental movements often frame the environment as a social justice issue. To address the intersecting justice claims within these movements, Yaka (2018) integrates concepts of redistribution, recognition, and representation with economic, cultural, and political aspects of social justice, aligning with regenerative thinking. Regenerative tourism aims to sustain local cultures and natural systems by redistributing resources and recognising the ecological rights of all entities to exist with dignity (Becken and Kaur 2021). Informed by Western science and Indigenous knowledge systems, regenerative tourism offers a just approach to managing tourism destinations (Ateljevic and Sheldon 2022; Paddison and Hall 2024). Building on this to explore dark-sky conservation, the study captured the emergent struggles of the NYMNP and key stakeholders to identify the 'not-yet-captured dimension of justice' such as regenerative approaches to conserving dark-skies through festivals (Yaka 2018, 356).

Regenerative tourism advocates that host communities are empowered to build capacity by evolving roles as active stewards of the environment that work towards distributive social justice (Bellato and Cheer 2021; Duxbury et al. 2020). The conceptual foundation of regenerative tourism is informed by ecological justice and Indigenous peoples' worldviews, knowledge and cultures (Matunga, Matunga, and Urlich 2020). Conceptually new, regenerative tourism has no conclusive definition and attempting to address this Bellato et al. (2022) advocate that regenerative tourism is a transforming force that enables communities to thrive through restoring and developing healthy ecosystems. This turn to holistically appreciating life as a complex living system echoes the call of ecological/environmental movements and scholars to achieve ecological justice for human and non-human entities as one living system (Bellato and Cheer 2021; Pollock 2019). We argue that regenerative tourism practices signal a just approach to mitigating ecological impacts arising from social issues and, in this case, 'not yet captured dimensions of justice' in dark-sky places.

Festivals, regenerative tourism and dark-skies

Although a comprehensive review of the environmental impact of festivals and related justice issues is beyond the scope of this paper, it is important to note that formally organised contemporary festivals can no longer be viewed simply as interruptions in daily life. They are complex events shaped by socio-economic tensions between neoliberal commercialisation and the cultural needs of communities to celebrate (Finkel and Platt 2020).

Although perceived as hedonistic, festivals have a long history of promoting awareness, environmental and ecological sustainability (Bendrups and Weston 2015), and can

encourage pro-environmental behaviour in natural settings (Lee et al. 2021). However, Mair and Smith (2022) emphasise the need for scholars to examine the environmental and economic interconnections of officially organised public events to gain a deeper understanding of their role in sustainable development. They critique the use of social sustainability as a framework for assessing the social impacts of events and highlight a gap in research concerning how festivals contribute to sustainable development (Mair and Smith 2022). Therefore, establishing a sustainability paradigm that integrates social, ecological, and economic issues aligns well with the concept of ecological justice.

Building on Lefebvre's 'Rights to the City,' Mair and Duffy (2021) explore who has the right to rural spaces, illustrating how local festivals engender a sense of belonging, collective identity, and rich social meanings through public engagement. However, the influx of visitors and migration to rural areas, drawn by festivals, can lead to exclusion, as the tourism generated may not benefit local communities. Mair and Duffy (2021) argue that the growing social desire of visitors to seek 'refuge' in rural areas produces socio-ecological exclusion. By expanding the concept of rights, they stress that rural festivals should be socially just, equitably distribute benefits, while mitigating any negative impacts. Similarly, from a regenerative perspective, Bellato and Cheer (2022) discuss how festivals can contribute to community regeneration by building local capacity. Their paper is unique, as few studies have explored festivals as tools for regenerative tourism development, and none have investigated how dark-sky festivals in national parks achieve ecological justice through stakeholder engagement in conservation practices.

Scholars claim that globally dark-sky tourism destinations could be classified as places for last-chance tourism as anthropogenic light obscures access to dark-skies (Blundell, Schaffer, and Moyle 2020; Falchi et al. 2016). Demand for dark-skies tourism to protected and unpolluted skies through events and festivals is increasing (Blundell, Schaffer, and Moyle 2020; Wen 2017). However, achieving ethical and sustainable ways to facilitate access to dark-skies is a challenge for national parks globally. Regenerative tourism policy is emerging as a potential solution in public authorities across the UK, including national parks (Galvin 2024). For such programmes to be successful, they must be packaged in positive messaging that offers visitors a cultural opportunity to learn about environmental heritage, cosmology, biodiversity, and how different communities continue to use and connect with the stars, such as navigation (Asmelash and Kumar 2019; Choi and Sirakaya 2006). However, little research exists that explores how dark-sky festivals foster behavioural change, positive environmental impact and ecological justice for human and non-human inhabitants of nocturnal environments.

Although previous research has focused on dark-sky designation (Collison and Poe 2013; Derrien, Stokowski, and Manning 2015; Loveridge et al. 2014; Weaver 2011), Indigenous People's sociocultural experiences of dark-skies (Mathisen 2017), experiential qualities of communities and practices (Dunn and Edensor 2023: Edensor 2013), visitor experiences of outdoor adventure, night walks and cycling (Beeco et al. 2011; Cook and Edensor 2014; Mace and McDaniel 2013; Rodrigues and Loureiro 2024), and astronomy tourism and well-being (Derrien and Stowkowski 2020; Jacobs, Du Preez, and Fairer-Wessels 2019; Petrevska, Bjelajac, and Djercan 2021), few consider the interconnections between human and nonhuman entities. Indeed, despite a small number of studies that explore dark-sky tourism in Aldeias do Xisto in Portugal and County Mayo, Ireland, which highlight how voluntary citizen science and astro-tourism have become central

to the protection of the night-sky (Barbosa et al. 2021; MacMillan et al. 2023), very few scholars have explored visitor experiences (Derrien and Stowkowski 2020), and little attention has been paid to visitor experiences of dark-sky festivals in national parks (Breukel and Cieraad 2024; Hvenegaard and Banack 2024). Moreover, there is a paucity of research that demonstrates the extent to which dark-sky public engagement events and festivals facilitate reciprocity for the nocturnal ecosystem (MacMillan et al. 2023), particularly research that explores social and environmental recovery through an ecological justice lens. Thus, research that explores how the impact of light pollution is mitigated through leisure engagement, such as festivals, to achieve conservation goals in national parks, is timely.

Bringing together regenerative tourism with ecological justice offers a novel approach to exploring the impact of festivals on public awareness and the behaviour of tourism stakeholders. Furthermore, we argue that dark-sky tourism in national parks has a unique position for leading a global response to conserve naturally dark places and preserve 'The Rights of the Dark-Sky' (after Lefebvre 2003), to exist. As such, researching Dark-Sky festivals provided an effective mechanism to critically assess whether pro-environmental behaviours and ecological justice emerge during Dark-Sky events in national parks.

Methodology

The North York Moors Dark Sky Festival is an annual 17-day celebration of the night sky and nocturnal biodiversity in the North York Moors National Park, an International Dark Sky Reserve. The event features stargazing, workshops, and outdoor adventures, catering to a diverse range of visitors and delivered by local businesses.

The research team investigated the impact of the NYMNP Dark-sky Festival on local tourism businesses and visitors in February 2024. Using a sensory ethnographic methodology, the researchers engaged in participatory field research to explore the rich sensory experiences of human and non-human interactions. Capturing, through in-situ filmmaking, verbal and nonverbal behaviours, attitudes, and practices was reflexively analysed, highlighting the social, environmental, and political relationships that arose in dark-sky festival public engagement.

Sensory ethnography involves researchers assuming a participant-observer role to engage deeply with participants' environments and practices (Pink 2009). This approach facilitates strong connections with the social and environmental experiences of the participants, making it effective for capturing often-overlooked emotional, non-verbal, and sentient experiences (Pink 2009). The researchers' commitment to reflexivity acknowledged their positionality, allowing for a critical examination of how sensory subjectivities influenced data collection and analysis. The goal was to prioritise participants' sensory experiences, enhancing the understanding of co-produced lived experiences. While we cannot fully detail how sensory ethnography shaped our research, we briefly address it in the 'Ecological Justice: Educative Regenerative Practices' section.

The researchers attended five events over three days, including moorland walks, one of which involved a silent disco, and sessions in both indoor and outdoor observatories. The qualitative field research involved researchers collecting film data wearing GoPro Hero 9 body-mounted cameras, which were less intrusive than wearing head cameras (over eight

hours of footage were collected). The researchers conducted twelve mobile semi-structured interviews (lasting one to five minutes) while walking or participating in activities, along with several hours of non-interview footage. Working with a professional filmmaker enabled the research team to collect and capture high-quality film data for analysis and to produce a short film (nine and a half minutes, available on YouTube) that disseminated the findings to both public and academic audiences.

Participants

Participants included five tourism businesses (eight individuals), two representatives from NYMNP and ninety-four visitors (domestic and international) participating in the festival events, accompanied by two researchers and one filmmaker.

Ethics

Ethical approval was obtained from the university ethics committee, and researchers secured informed consent from each tourism business to attend their events. As gatekeepers, the tourism businesses briefed visitors in advance of the events, and visitors were briefed again at the start of each event by the researchers, who also secured informed consent and filming rights. During the events, participants were guided by experienced festival business providers. One researcher, a qualified mountain leader and member of Mountain Rescue, conducted dynamic risk assessments throughout the field research. All audio data was pseudo-anonymised, and for video data that could not be pseudo-anonymised, consent to share and publish filmed data was secured. Data is kept securely in the University's password-protected OneDrive folder, in line with the requirements of the GDPR.

Analysis

Sensory ethnography, underpinned by reflexivity, offered a posthumanist approach for exploring a diversity of human and nonhuman interactions and interconnections (Adams 2024; Braidotti 2013). Treating reflexivity as central and an ongoing process provided a framework for engaging in a 'research imaginary', which enriched and deepened research, from design to fieldwork and write-up (Blackman and Commane 2012, 229–231).

Throughout this process, reflexive analysis ensured methodological rigour and trustworthiness by triangulating various data sources, including film, field notes, audio recordings, and audio field notes. Post-event reflexive field notes supported the analysis and were iterative, informing experiential actions in the field. By triangulating field notes with re-watching GoPro footage in NVivo 12+, researchers could recall the 'research imaginary' and identify key sensory practices. For example, they observed the importance of 'using moonlight and shadows to navigate with natural light in the dark' and 'using ground feel to traverse moorland terrain,' which ultimately enhanced the trustworthiness of the data. This process emphasised the value of reconnecting with often-overlooked sensory practices, such as night vision and touch (field note, February 26, 2024).

Using thematic analysis in NVivo 12+, selective coding identified twenty-three themes, including ecological awareness, outdoor access, educational engagement, connecting

with nature, well-being, and behavioural changes, through a reflexive process of open and axial coding to identify emerging patterns. All data were reflexively and sensorially analysed through listening, tasting, watching and feeling the nighttime to identify bodily movements, actions, emotions and practices.

Findings and discussion

Festivals and events have been slow to address sustainability challenges, focusing more on reducing negative impacts rather than 'giving back more than they take away' (Mair and Smith 2022, 1). While some research examines social issues in events, a notable gap remains in addressing sustainability and environmental justice, with only a few scholars critically assessing the 'social sustainability of events' and 'environmental and economic interrelationships' (Mair and Smith 2022, 1). We draw a parallel between regenerative tourism and its role in promoting ecologically just development to illustrate how dark-sky festivals can contribute to ecological justice for both human and nonhuman entities.

Ecological justice, capacities and knowledge

In its ninth iteration, the 2024 Dark-skies Festival in NYMNP has evolved from being a tourism product to counter seasonality in the shoulder months of early winter and spring to become a primary mechanism for delivering a critical message concerning biodiversity loss and the climate crisis. The strain on public finances requires innovative solutions to deliver the festival, and building partnerships with local tourism businesses is crucial to its delivery. Local tourism businesses independently curate a variety of activities under the festival umbrella, with limited involvement from NYMNP. This interconnectivity fosters a symbiotic relationship that enhances capacity and promotes economic and environmental sustainability while supporting conservation goals. Additionally, collaboration among stakeholders is fostering a culture of active stewardship that aims to develop and manage tourism in ecologically just ways within the NYMNP. As one respondent reflected,

> when we first started, the objective was mainly around tourism and benefits to the rural economy. [now], a lot more of our work is about conserving dark-skies and conserving nocturnal habitats. […] the ultimate aim is that […] when they come to an event, they take away a message […] that fundamentally changes their behaviour (PO1)

The festival raises awareness about the negative impact of light pollution on dark skies and informs visitors about biodiversity loss and ecological harm. The NYMNP has launched a scheme to encourage tourism businesses to become ambassadors for dark-sky conservation, with their influence extending beyond the park's boundaries. Crucially, this increases the capacity of NYMNP to affect change, as one respondent reflected: 'I actually do think people take home a lot. So, what's happening here with the festival in North York Moors is doing the hard yards, so one day we'll have […] a better kind of lighting across the country, not just here, but where people live' (B1). Tourism businesses are demonstrating regenerative stewardship by raising awareness beyond the National Park, showing they contribute more than they take. They recognise the need for a positive approach to environmental education that effectively communicates the climate crisis without deterring visitors.

> there's no point preaching to people […]. So, it's all about entertaining people and making them amazed, which is not difficult when you have a sky full of stars and the Milky Way's arching across […]. So, […] if you want to get a […] wider environmental message across, you've got to stay positive (B1)

Although in its infancy, this demonstrates that dark-sky festivals have the potential to promote ecologically just tourism by connecting host communities and visitors. However, the challenge lies in balancing the festival's promotion as a neoliberal hedonistic experience with the serious issues of environmental and biodiversity loss. Understanding visitor expectations and experiences before, during, and after the festival is critical for determining if messages of ecological justice are effective.

For example, many visitors attending the festival were doing so for the first time, despite the festival being in its ninth year, suggesting that widespread knowledge of this, and other dark-sky festivals, were limited,

> it's just nice to have this freedom, […] we didn't even know we could do this for a start, […], just to come out on an evening and do a walk and see what the countryside looks like in the dark, which is completely different to the day (V3.1)

The festival's effectiveness in providing accurate ecological education is uncertain due to the lack of a formal mechanism at NYMNP for ensuring businesses provide a consistent message. Yet, some businesses successfully raised awareness, for example, during a stargazing event at the NYMNP Observatory visitors noted increased awareness, 'it gives me existential thoughts, […] you know, it makes me think about the daily worries of life, work, because, you know, we're not even a speck of dust in the whole universe' (V1.2). Similarly, despite experiencing a starless night punctuated by strong winds, fog and rain, visitors were not discouraged from wanting to return: 'I think we are very quickly looking at the next one. […] last night it was […] gorgeous, and then tonight, fog […], but you know, we're not going to be put off by that. I'm going to come back and try again' (V1.2). As such, there is a lack of consistency in the content and educational methods used by businesses, as NYMNP does not provide formal training or guidance. This leads to significant variation in educational interpretation at different events. Whilst visitors had some knowledge, before the festival, about the impact of light pollution it was often limited, one respondent reflected that it was the 'first time, but it won't be the last time. We are from Sheffield, which one of the one of the worst areas with the worst lights' (V1.4). The festival helped respondents to recognise how polluted their home locations were,

> It was the first time I quite enjoyed it. […] Thanks to our friends, I know about the festival, […] I didn't know it happened, so it's pretty cool to raise awareness, especially on light pollution. I drive from Manchester to Sheffield through the Peak District, as soon as you get [off the] top of the peaks and start coming back down to Sheffield, you can see the light pollution from Sheffield, and it's horrible. I knew about its effects on wild animals, but I had no idea how much it affected astronomy (V1.3).

This study found that after attending the festival, visitors leave better informed about the negative impact of light pollution on biodiversity and the environment. We argue that public engagement in dark-sky festivals can lead to behavioural change in visitors and rural tourism businesses. In this case, the dark-sky festival has empowered tourism businesses to become advocates and educators for the climate crisis, leading to positive

environmental outcomes. Moreover, NYMNP's partnership with rural tourism businesses engenders economic sustainability in the rural economy while raising ecological awareness.

This study highlights how recognising regenerative practices can inform how ecological justice gains traction and builds capacity for active stewardship. Through positive education, businesses are delivering key messages that visitors take home. The research evidenced how crucial tourism businesses are for establishing 'that connection between enjoyment and leisure and connecting with that message around controversial' (B1) topics such as light pollution. This was highlighted by visitors reflecting that 'I know and we sort of get sucked into our homes and you know like going out at night it doesn't seem so appealing, but I think it's changed my perception' (V1.2). Visitors also demonstrated regenerative actions such as 'putting the lights on timers, […] I got interested in working [with] the batline, we did a bat survey recently, so we're very much engaging with that area' (V1.1), influenced by being immersed in festival events.

Ecological justice: educative regenerative practices

The partnership between NYMNP and tourism businesses has built a regenerative symbiotic relationship, enhancing the capacity to deliver immersive environmental education that helps achieve ecological justice. Experiencing walking in natural darkness was new for most visitors, which meant many lacked the experience, skills and confidence, as one participant reflected 'I have wanted to do this sort of thing for a while and then yeah I just thought I'm not really that knowledgeable anyway so it's probably a bit too much to think I have [the skills to walk alone]' (V3.6). The businesses leading dark-sky walks on the moors and coast were aware of visitors' lack of experience, skills, and anxieties about safety. To alleviate anxiety, walk leaders offered specialised guidance and taught visitors walking skills so they could walk safely in the darkness. For example, one walk leader periodically invited participants to walk in silence and reflected, 'when we're busy talking, […] we don't notice the miracle that's actually happening […], and we start to look closer at things, […] it actually makes me feel [the cosmos is], much bigger than just ourselves'. She invited participants to engage in other sensory skills explaining that the walk was 'a sensory meander', that helped participants open 'the senses […] to the present moment, […] which means that you are then much more open to […] having a deeper experience of life and connecting with this amazing [dark-sky]' (B2).

Sensory ethnography enabled researchers to observe and walk silently with visitors, enhancing concentration and physical skills and improving the body's ability to navigate unfamiliar terrain. One moorland walk was particularly muddy and hazardous underfoot, and when asked how they felt about it, one visitor reflected, 'it's kinda like connecting to things. Yeah. Yeah. takes you out of your everyday, doesn't it' (V3.4). Visitors appreciated the extraordinariness of walking in the moors at night through muddy terrain, which produced a multitude of sensory and emotional responses, like 'horror and hilarity as we slipped and struggled to stay upright – one participant became a casualty to a cow-churned deep bog, which produced humorous reflections of childhood escapades of being in forbidden places and getting dirty' (fieldnote, 25 February 2024).

Practising walking in silence encouraged participants to engage less prominent senses and use sight differently. The senses that dominate diurnal life – talking and vision – gave

way to hearing, smell, touch, and new ocular sensations of night vision. For example, on one walk as we transitioned from dusk to darkness and walked silently for considerable periods in the growing gloom, participants observed how diurnal birdsong gradually ceased and nocturnal animal sounds emerged, making one participant feel, 'that we are part of nature […] makes us […] appreciate the wonder of the way the world works' (V.2.4). Participants were encouraged to develop the skill of walking in natural darkness without artificial light, which facilitated new ocular sensations of walking *with* darkness, several participants commented that walking without light 'was good. […] walking wasn't as bad as I thought' (V3.2). Walking without light, and at times in silence, helped build a deeper connection with the nocturnal environment and embodied recognition that being 'in the dark just for that, […] moment of peace, and just to listen and tune in to this environment' (B5.1) was a privilege and something to conserve.

These non-verbal sensory practices, including walking, being silent, and seeing in natural darkness, developed new sensory skills and practices for some visitors. By the end of the walk, some visitors (when on relatively easy ground) were happy to switch head torches off and enjoy feeling immersed within the nocturnal landscape. One commented, 'I find walking at night with a full moon is really quite a magical experience' (V2.5). The feeling of immersion produced a sense of wonder and enjoyment that built a deeper sensory connection with nighttime ecologies. For example, as other senses gained centre stage, hearing and feeling mud suck or rocks crunch underfoot became a way to navigate potential hazards. As one participant reflected, 'everything is multiplied much more, like that little stream that we pass, you will not notice that during the day. Because it's night and everything else is quiet, you hear this little rustling in the bottom, and you think crikey, it's a torrent and it's just a little tiny stream' (B3). Fundamentally, the walk leaders educated visitors in a broader range of sensory and physical skills and practices to ensure their safety and enjoyment, which we argue is regenerative because it attunes visitors to nocturnal environments. For example, walking silently without artificial light enabled participants to be *with* the environment in a way that is sensitive to nocturnal habitats, producing a *just* way to visit dark-sky places. Switching off head torches reduced the pulse of light and, thus, the impact on nocturnal habitats. Building such skills enabled deeper connections and understanding of how to protect and conserve our dark-sky places, and 'makes a huge difference in [our] daily lives […] I've done lots of things at nighttime but not as part of the dark-skies, it's all kind of new things for me so yeah, fascinating' (V2.4).

Businesses were acutely aware of the impact they had and believed that 'you feel like people are taking that message away, because it's something that we can all do, isn't it?' (B1). Businesses also appreciated that ecological messages had to be wrapped 'up in some fun […] experiences. I mean, I call this star bathing […], just go, then immerse yourself even on a cloudy night. It's a different kind of place to come', and creating sensations of anticipation helped people feel they could come back if 'it's quite exciting, and so even if you don't see anything the expectation is that next time you might' (B1).

Furthermore, the immersive nature of dark-sky festivals, we argue, is regenerative because they trigger reflexive processes that lead visitors to take positive regenerative action,

> Yeah, my neighbours have got a conservatory with the lights on […] all night […] I don't know why they have it on, I'm gonna try and say that 'you realise that […] for the animals for the bats […], this could be quite bad for them, so maybe you could turn that off?' I

> don't know why they keep it on, […] it's the sort of false security thing, so yeah, I should certainly sort of [start] leaning on my neighbour (V1.1)

The study evidences the regenerative potential of festivals to change visitors' home environments beyond the National Park, as one respondent expressed, 'we […] try to be careful. […], we don't have any outside lights for example, […] and we try to use yellow lights within the home, but yeah, it raises awareness, right?' (V1.2). We argue, this heightened awareness suggests positive behavioural change through collaboration between visitors, businesses, and the National Park.

Engaging in nocturnal environments requires practices that enhance our connection to these ecosystems. How businesses educate visitors in dark-sky areas is crucial for shifting views on light pollution. Festivals serve as a public engagement strategy, promoting stewardship and behavioural change for sustainable dark-sky tourism in National Parks. However, NYMNP acknowledges that access to these festivals is often limited to those who can afford it, with the majority of those living in urban, light-polluted areas unable to participate.

Ecological justice and the regenerative potential of festivals

Dark-sky festivals can be a powerful way for visitors to access nocturnal environments; however, the National Park acknowledges a deficit in who has the resources to benefit from what could be described as neoliberal consumerism. The challenge is how to address dark-sky poverty experienced by those living in urban environments, particularly in areas of urban deprivation where residents rarely, if ever, experience dark skies. The loss of dark skies is a pressing political issue, as 80% of the global population is unable to see the Milky Way (Falchi et al. 2016). Public policies protecting nightscapes are mainly driven by NGOS, which struggle to combat light pollution beyond dark sky reserves (Alva et al. 2025). This 'extinction of experience' (Soga and Gaston 2016) means only 5% of the UK population can enjoy starry nights, diminishing our ability to connect with dark landscapes (CPRE 2023). Two participants reflected,

> We come from a city […], so we don't see anything like that. Very rarely will we get anything as glorious as this phenomenal clear night-sky because of light pollution. So, the fact that we've had to drive over an hour and a half to come [for these] experiences just means obviously we want to preserve that. I remember as a child I'd see similar stuff from a city [and that] sort of thing, and now we're doing whatever we can do to save things like this (V3.1).

The rapid rise of the deleterious effects of light pollution has manifested in less than a lifetime, and the sense of loss and anxiety about preserving what we have left is acutely evident. Geographically, access to dark-sky reserves is limited for urban populations across the UK, acknowledged by one participant who expressed how there is 'too much light down […] south of the Peak District – […] you can't [access dark-skies]. Even if you go to a park, there's still gonna be [light pollution] unless you find yourself in the middle of the Cotswolds, you don't get [this] sort of thing there' (V4.1).

Participants' access is not just limited to dark-skies but a deficit in an opportunity to access the outdoors 'No one brought me up on the outdoors? Yeah. No one really told

me about the outdoors before' (V2.1), and 'I've always wanted to do a bit of a dark-sky [walking], because I've seen it' (V3.5). Participants felt accessing dark-sky places was empowering, and found walking in the dark created a sense of freedom, appreciating that it was a privilege, 'it's just nice to be able to [come out] normally [I would] be tucked up at home in bed […]. So, it's just nice to have this freedom. Like we didn't even know we could do this' (V2.5). However, this sense of freedom was punctuated with frustration at the lack of transport to be able to access dark-sky places, with two participants who had travelled by public transport from Leeds commenting: 'if it's a Sunday or something, you could end up waiting two hours for the bus' (V2.6).

Mobility issues concerning access were not limited to public transport, but also included psychological aspects related to feeling safe. Feelings of safety constrained participants' confidence to walk alone in natural darkness, which was evidenced by feeling safer walking in a group, as one respondent described: 'Yeah, we were just talking about like if we, if we do it on our own or if we want to do it as a group again, first [its] confidence. But definitely more confident about going out on an evening' (V3.1). Such perceptions, we argue, constrain not just physical but perceptual access to the importance and value of dark-skies in the wider population. Inequality of access to dark skies affects public awareness of the role of light pollution in the climate crisis, which could be addressed through public policy.

NYMNP and businesses recognise that to effect significant and widespread change, public policy is needed, 'I think the trouble is there's no national legislation' and that presently the only course of action is to initiate change from the grassroots upwards 'So, it's up to educating people, I can't tell people to stop shining the horrible light in everybody's garden, unless it's a nuisance, you know, […] we could do with strengthened law.' The businesses acknowledge that 'for the time being, we're gonna have to do this organically to convince people from the bottom, that it's worthwhile changing behaviours' (B1). The UK Government recognises the need to recover lost landscapes and biodiversity. It is funding a national programme to effect large-scale land-use change, producing environmental and climate outcomes through habitat and ecosystem restoration. However, these policies do not explicitly cite national (dark) skyscapes as a beneficiary. In response, National Parks UK is driving a strategy for landscape recovery through their 'Green Recovery' programme 'Recover with Nature', which aims to 'grow well-being through doing the right thing by nature' (National Parks 2024). The National Landscape Association (NLA) promotes the regenerative principles of co-producing land management plans through partnerships, volunteering, community ownership and stewardship (National Landscapes 2024).

To address access issues and achieve strategic conservation goals, NYMNP is implementing a regenerative approach to tourism and has recently appointed a Regenerative Tourism Manager. The recent shift towards regenerative tourism is reflected in national and regional policies, with government agencies, including Local Visitor Economy Partnerships and National Parks UK, recognising that tourism development needs to 'give back more than it takes' (National Parks 2024). At a regional level, NYMNP's drive to establish a Northern England Dark-Sky Alliance to halt the growth of light pollution outside the park boundaries along with the A1 motorway will not only restore natural darkness for nocturnal migratory species but also access for human populations. Taking a regenerative approach to reduce light pollution beyond the NYMNP boundaries opens possibilities for achieving ecological justice for all living entities. It also signals an urgent call for a policy to

'restore nature' that creates access to natural dark-skyscapes in urban and rural places. As Roberto Trotta (2023) warns, light pollution is a tragedy of the commons that we can all do something about: small changes can lead to significant improvements and achieve ecological justice that restores access to dark-skies.

In sum, our findings demonstrate five key regenerative impacts from Dark-Sky festivals: firstly, through the way NYMNP co-creates and empowers local businesses to curate the Dark-Sky Festival, which builds capacity that supports the local rural tourism economy; secondly, how tourism businesses have become stewards, advocates, educators and in some cases activists for reducing light pollution; thirdly, how tourism businesses impart skills and knowledge to visitors that lead to behaviour changes – research participants reported changing light bulbs, engaging in citizen science and not lighting up their external properties (which are often located beyond the National Park); fourthly, how education bleeds out beyond the boundaries of the National Park and helps to contribute to restoring our dark-sky commons; and lastly, that the National Park recognises it cannot affect a Dark-sky commons alone and is working with tourism businesses and external public authorities to restore dark-skies at a regional/national level through influencing policy and strategy. This is regenerative tourism in action and ecological justice in the making, representing how *The Dark Matters*.

Conclusion

This research explores how dark-sky festivals raise awareness about the detrimental effects of light pollution on ecological systems within national park Dark-sky Reserves and their impact on visitor perceptions and behaviours. Efforts to promote sustainability in tourism have often fallen short, highlighting the challenges and the urgent need for innovative approaches in the sector. Emerging theories, such as regenerative tourism (Bellato et al. 2022), signal the ongoing tensions and struggles for improvement. Bringing regenerative tourism together with ecological justice theory offers a way to advance how tourism can explicitly commit to addressing issues arising from the climate crisis. Regenerative tourism chimes with posthumanism, which aims to rebalance the importance of non-human beings, both animate and inanimate, *with* human beings to address environmental inequalities to answer, 'how might we resist the inhuman aspects of our era' (Braidotti 2013, 3). This research demonstrates how dark-sky festivals provide a regenerative pathway towards environmental commons and ecological justice, which necessitates recognising how redistribution and representation, as well as production and reproduction, are dynamically and inextricably intertwined (Yaka 2018). Dark-sky festivals signal a tentative turn to regenerating natural ecosystems in contrast to neoliberal extractive forms of festival tourism.

Building ecological awareness depends on effective communication that leads to positive regenerative action. The aim is to integrate these principles into our future leisure and tourism initiatives. Festivals and events are effective at raising public awareness concerning social and environmental issues, and dark-sky reserves are starting to benefit from this powerful public engagement tool (Bendrups and Weston 2015). However, further research is required to expand this initiative beyond national parks. This can be achieved through global partnerships with public agencies to innovate new forms of dark-sky festivals in virtual realms, for example. The goal is to identify effective ways to represent and

redistribute power and to implement changes that promote ecological justice. Ultimately, we urge scholars to explore new methods for conceptualising, reimagining, and managing tourism in a regenerative manner, with an emphasis on integrating ecological awareness into tourism attractions, such as dark-sky festivals.

To explore this complexity, we need to go beyond traditional verbal methodologies and use our bodies to sense non-human knowledge (Pink 2009). Shifting away from anthropocentric models enables innovative pathways to knowledge that can inform policymaking and legislation aimed at protecting our cherished environments, whether urban, rural, or wild. Reflexivity enabled us to capture the struggles for environmental justice that highlight how dark-sky festivals contribute to managing tourism regeneratively. Moreover, reflexivity provided the critical foundation for identifying and validating sensory knowledge that underscores the way bodies can reconnect and build empathetic appreciation with the natural environment and the impact of light pollution. Dark-sky festivals effectively build ecological awareness and empower stakeholders to protect the night sky. Evidenced by respondents noting that the skills and knowledge gained would help them educate others and take action to reduce light pollution in their communities.

Whilst research has notable merits, several limitations should be acknowledged. Data collection during the February 2024 festival limits its temporal and geographic scope, suggesting that additional research throughout the year could improve data quality. Expanding studies to various environmental, cultural, and geographic contexts would also be beneficial. Additionally, the sample may be biased since dark-sky festivals tend to attract individuals with prior interests in conservation and astronomy, resulting in a non-representative sample. Further research that engages a broader range of respondents, including those who may not participate for various reasons, would yield more representative insights into the issues discussed in this study.

Our insatiable desire to illuminate the night is an encroaching ecological disaster, creating inequalities for all living things, whether human, nonhuman, animate, or inanimate. We urgently need policy and governance to recover our global commons that include not just green and blue but also dark-skyscapes. We argue that national parks through dark-sky tourism festivals are in a unique position to call for a global response to conserve naturally dark places and preserve 'The Rights of the Dark-Sky' (after Lefebvre 2003) to exist. Transforming NYMNP tourism policy from purely an economic tool to one founded upon regenerative principles represents a turn to ecologically just ways to conceptualise, reimagine and manage festivals in national parks.

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