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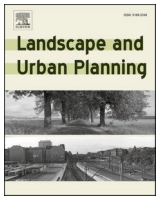

Mindful engagement, psychological restoration, and connection with nature in constrained nature experiences

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HIGHLIGHTS

- We examine mindfulness in urban nature, restoration, and nature connection.
- We synthesise mechanisms underpinning mindfulness in nature and positive outcomes.
- We identify three mechanisms: perceptual sensitivity, decentering, and non-reactivity.
- We apply a model of mindful engagement in nature to constrained nature experiences.
- Understanding these mechanisms can inform nature experience interventions and design.

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ABSTRACT

Research indicates that heightened individual engagement in nature can improve psychological benefits of nature experiences, yet the current literature lacks robust consideration for how this occurs. Constrained nature experiences – such as busy, noisy urban environments – may undermine individual capacities to engage with nature, prompting the question of how engagement functions across different nature experiences. To address this gap, we draw on mindfulness as a framework to examine the pathways in which engagement in nature supports psychological restoration and connection with nature. We appraise existing literature and identify three key mechanisms underpinning mindful engagement in nature: perceptual sensitivity, decentering, and non-reactivity. This new framework provides a basis to examine mindful engagement in constrained nature experiences, where we find that the self-regulatory mechanisms of mindful engagement have a more direct role in supporting outcomes.

1. Introduction

A growing body of research indicates that the benefits derived from nature experiences partly depend on how we cognitively engage with nature. Psychological restoration - as described in attention restoration theory (ART; Kaplan & Kaplan, 1989) - and connection with nature (Mayer et al., 2009) are known outcomes of nature experiences and are important for psychological wellbeing (Capaldi et al., 2014; Hartig et al., 2014). The psychological benefits of *nature experiences*, the subjective experience of all forms of the natural world (Hartig et al., 2014), will certainly be influenced by environmental attributes (Hartig, 2004), but also by an individual's perspective, including how one engages with their experience (Clayton et al., 2017). Everyday nature experiences, such as in urban areas or near one's home, offer opportunities for spending time in nature. However, these contexts may also be a source of *constrained nature experiences*, where psychological outcomes are limited or even negatively impacted. The built environment, work stress, individual attitudes and other factors potentially constrain the benefits of these experiences (Bonnes et al., 2004; von Lindern et al., 2016). The role of individual engagement in constrained nature experiences is worth considering, where higher levels of engagement may improve the benefits of everyday nature.

Cognitive engagement in nature has been explored in several studies, and is defined by a range of concepts that include awareness of both

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sensory, externally oriented experience (Korpela et al., 2017) and mental, internally oriented experience (Lumber et al., 2017). We use the term 'engagement' in nature experiences to refer to conscious awareness of experiential phenomena, including attending to vegetation or noticing sounds. Existing studies have demonstrated that psychological restoration and connection with nature are impacted by one's level of engagement in nature (for example, Duvall, 2011; Lin et al., 2014; Nisbet et al., 2019). While these findings are promising, further development is hampered by the wide array of concepts used to portray engagement, and heterogenous empirical approaches. This literature would benefit from a synthesis of relevant theoretical interpretations. In this paper we draw together existing lines of thought to focus on the potential mechanisms underpinning engagement in nature experiences and psychological outcomes.

We draw on the concept of mindfulness to help to interpret existing concepts of engagement and more clearly explain how heightened engagement in nature leads to psychological benefit. In this paper we consider mindful engagement in nature experiences to encompass a form of mindfulness known as open monitoring, a practice that has previously been applied in nature experiences (Lymeus et al., 2018). In this form, mindful engagement is distinct from other concepts of engagement for two key reasons. First, mindful engagement involves continuous awareness of both external, sensory experiences, and internal, mental experiences (Cardaciotto et al., 2008). This distinction highlights that a mindfulness framework may help researchers understand and clarify existing engagement concepts that direct awareness to external *or* internal experiences in nature (cf. externally focused fascination; Kaplan & Kaplan, 1989, and noticing mood being changed by nature; Korpela et al., 2017). Second, mindfulness is characterised by non-reactive, nonjudgmental awareness (Bishop et al., 2006; Kabat-Zinn, 2003). These qualities of mindfulness present a way of understanding *how* one might engage mindfully, and also offer a theoretical approach to exploring the mechanisms underpinning the association between engagement in nature and psychological outcomes. We draw on research into links between mindfulness, psychological restoration (Djernis et al., 2019; Lymeus et al., 2018) and connection with nature (Nisbet et al., 2019) to describe how different forms of engagement in nature might support psychological benefits.

With a clearer picture of how heightened engagement in nature leads to improved psychological outcomes, we can better examine the range of contexts that may facilitate or constrain engagement in nature. We argue that the mechanisms underpinning the benefits of forms of enhanced engagement in nature where mindfulness is not explicitly applied may be contingent on specific types of nature experience – e.g., highly restorative environments. Less restorative, or constrained experiences may therefore require alternative forms of engaging. While it is evident that some individuals prefer urban environments for restoration (Patuano, 2020), constrained nature experiences are likely to be common in busy urban green spaces or where access to high quality natural environments is restricted (Hartig et al., 2007; von Lindern et al., 2013). We propose that mindful engagement may be particularly valuable in constrained nature experiences because mindfulness helps to mitigate negative reactions to stressful situations (Crescentini et al., 2016) due to self-regulatory mechanisms such as non-reactivity and nonjudgment. The role of nature in self-regulation has been an important topic of research, with a focus on regulation through change of environment (Korpela et al., 2018; Richardson, 2019). Building on that tradition, we focus on self-regulation in the intersection of environmental and cognitive strategies. Interventions to overcome constraints and improve psychological benefits of constrained nature experiences would support wellbeing among certain populations (for example, urban residents). To our knowledge mindful engagement has not been applied as an intervention in these specific circumstances. This paper makes a theoretical contribution to such endeavours, and our resulting framework will require empirical testing to guide practical implementation of mindful engagement in constrained nature experiences.

In the following sections we first demonstrate the importance of cognitive engagement with nature for both attention restoration and nature connection, before drawing on the concept of mindfulness to distinguish between different forms of cognitive engagement. While other literature has considered the relationship between mindfulness and nature in various ways (for example, Van Gordon et al., 2018), the specific intersection of cognitive engagement, nature experiences, and psychological benefits, forms the focus of this paper. Thus, we do not intend to present a complete picture of all links between mindfulness and human-nature relations, but rather focus on mindfulness as a form of engagement in nature experiences, and highlight plausible mechanisms that may underpin benefits of these processes. Based on this framework, we propose pathways through which mindful engagement with constrained nature experiences can maximise psychological outcomes in this context, including psychological restoration and connection with nature. We conclude by discussing what remains unresolved within this theoretical integration and suggest research questions for further investigation.

2. Role of individual engagement in nature for psychological outcomes

In this section we propose that cognitive engagement underpins both psychological restoration and connection with nature. Psychological restoration refers to renewal of mental resources, as described in ART (Hartig, 2004; Kaplan & Kaplan, 1989). Connection with nature can be defined as an experiential oneness with the natural world (Mayer & Frantz, 2004), that develops through experiences with nature. We understand nature experiences as a complex transaction between a person and the surrounding natural environment (Hartig, 1993), where certain processes give rise to short and long-term psychological outcomes that depend in part on an individual's level of engagement with their experience. Nature experiences are defined both by the natural features of an environment, but also the way a person perceives their environment; thus outcomes of nature experiences are in part mediated by how an individual engages with and perceives their environment (Clayton et al., 2017).

Psychological restoration and connection with nature processes have been explored together in empirical literature and appear to mutually reinforce one another. Correlations between psychological restoration and connection with nature have been demonstrated (Capaldi et al., 2014; Howell et al., 2011; Whitburn et al., 2019) and other studies have explored the direction of these associations, with mixed findings (Mayer et al., 2009; Nisbet & Zelenski, 2011). Wyles et al. (2019) tested different mediation pathways between nature contact, nature connection, and restoration, and concluded that there is likely a bi-directional, mutually reinforcing relationship between connection with nature and psychological restoration. The theoretical reasons for these associations remain speculative; some authors propose that those with a higher level of nature connection tend to seek out and benefit psychologically from nature more readily (Mayer et al., 2009), or position nature connection as a moderator of benefits of nature exposure (Shanahan et al., 2015), while others propose that psychological benefits of nature experiences strengthen level of connection with nature (Nisbet & Zelenski, 2011). By viewing psychological restoration and connection with nature together in this paper, including the intersections between them in mindful engagement processes, we begin to identify potential overlapping elements between the pathways in nature experiences that support these outcomes.

Cognitive engagement with nature is inherently critical to psychological restoration as described in ART (Kaplan & Kaplan, 1989). ART was developed to consider the recovery of directed attention fatigue in environments that have certain restorative qualities: environments that are softly *fascinating*, that evoke a sense of *being away* from everyday demands, have enough *extent* or scope to constitute an immersive experience, and are *compatible* with one's expectation and purpose.

These properties are often considered as traits of a 'restorative environment', but might better be attributed as properties of the person-environment transaction (Hartig, 1993), with each mechanism reliant on how one cognitively engages with a nature experience. Two examples can be drawn to illustrate this. For soft fascination to occur, an environment should contain an interesting stimulus *and* the individual must be receptive enough to their environment that attention can be gently captured by that stimulus (Kaplan, 2001). Likewise, to experience a sense of being away from everyday demands, an environment should present physical differences to demanding situations, *and* the individual should be mentally engaged with that different environment (and not, for example, reading work emails). Although we acknowledge the key role of environmental properties for psychological restoration to occur, we focus on individual engagement as an underpinning attribute of all four restorative qualities of person-environment transactions.

In this paper we consider connection with nature as an outcome of nature experiences that explicitly depends on engagement with nature. Connection with nature has been conceptualised in various ways, including a state-like, experiential construct, where contact with nature fosters a stronger sense of connection with the natural environment (Mayer & Frantz, 2004), and as a trait-like construct, that represents one's identification with the natural environment (Clayton, 2003). Connection with nature has also been defined to encompass one's cognitive beliefs and attitudes towards nature (Brügger et al., 2011; Nisbet et al., 2009), emotional affinity towards nature (Kals et al., 1999), and behaviours and experiences in nature (Nisbet et al., 2009). Less attention has been given to how a connection with nature is formed and researchers have called for a better understanding on the mechanisms underpinning its development (Cleary et al., 2017). There is, however, some evidence that connection with nature can be strengthened through experiences. For example, spending time in natural environments (Lumber et al., 2017; Mayer et al., 2009; Nisbet et al., 2019) and viewing photographs of nature (Richardson & Sheffield, 2015) heighten one's sense of connection with nature. In this paper we explore psychological outcomes arising through transactional, person-environment experiences, so we focus on nature connection at the moment of development: that is, within the transaction itself.

Recent research by Lumber et al. (2017) explores connection with nature as it develops through nature experiences, identifying multiple 'pathways' to nature connection through specific forms of engagement with nature. The pathways to connection with nature are defined by Lumber et al. (2017), as: *contact*, the act of engaging with nature through the senses; *beauty*, the perception of aesthetic qualities in nature; *meaning*, using nature to interpret or communicate a concept; *emotion*, an affective state that occurs as a result of engaging with nature; and *compassion*, extending the self to include nature, leading to a concern for other natural entities. Viewing these pathways within a transactional perspective can help to identify the different ways that individual engagement can support connection with nature, where pathways rely on both environmental and individual qualities. This can be illustrated for the contact with nature pathway: for one to experience *contact* with nature, there must be an environmental presence of natural elements, and the observer must perceive those elements as 'natural' features. Identifying the environmental and individual qualities of transactions that lead to both psychological restoration and nature connection allow us to more closely examine the range of factors that can support or constrain outcomes of nature experiences.

The role of individual engagement is important to understand across different forms of experiences in nature. We should not assume that the pathways to restoration and nature connection – and the role of engagement within those pathways – function in the same way across all contexts of nature experiences. For example, the sense of being away may be promoted by becoming immersed in a highly restorative natural environment; while in a constrained, non-immersive environment, being away may rely on selective engagement to aspects of the experience that achieve a sense of distance from work. To allow for exploration of the pathways to psychological restoration and nature connection in a wider range of contexts, a more detailed account of the operation and mechanisms of engagement in nature is needed.

3. Distinguishing forms of engagement with nature

Having established that both restoration and nature connection involve cognitive engagement with nature, we now take a closer look at different forms of engagement with nature. Specifically, we differentiate between mindful and other forms of engagement with nature by highlighting the distinctive qualities of mindful engagement. With existing empirical literature that shows associations between varied types of engagement and psychological outcomes, we propose that different forms of engagement might function to promote outcomes in a variety of ways.

Mindfulness is a term that may characterise a practice, a process, or a form of awareness, and needs to be clearly defined within the context of nature experiences. Kabat-Zinn (2003) defines mindfulness as a form of awareness that arises from a purposeful, nonjudgmental perception of the current moment. Some operational definitions of mindfulness distinguish between *to what* one attends, and *how* they attend. Cardaciotto et al., (2008), proposed a two-part model to conceptualise mindfulness: 1) the *behavioural component of mindfulness* (what one does), which involves awareness of the totality of experience, including the internal and external experience, and 2) *the way this behaviour is conducted* (how one is mindful), which involves acceptance, nonjudgment, and openness. Similar models also include qualities such as curiosity and perceptual sensitivity (Bishop et al., 2006; Tanay & Bernstein, 2013). Drawing on this body of work, we use the term *mindful engagement* in nature experiences to refer to the intentional act of maintaining awareness of the ongoing internal and external experience, with curiosity and without reactivity or judgment. This form of mindful engagement in nature reflects open monitoring, a practice of mindfulness that is distinct from those that focus on specific objects of attention (Lutz et al., 2008).

There is evidence that some forms of mindfulness can support restoration in nature experiences, but the definitions and operationalisations of mindfulness vary widely in this literature and are not always theoretically clear. In studies of interventions of mindful engagement with nature, effects on psychological restoration outcomes have been reported, including attention (Lymeus et al., 2018), anxiety (Shin et al., 2013), and mood (Nisbet et al., 2019; Shin et al., 2013). While these studies point to the potential benefits of mindful engagement in nature for restoration, only one explicitly employs a design where a need for restoration is assumed (Lymeus et al., 2018). These studies define and operationalise mindfulness in different ways: for example, open monitoring mindfulness practice in nature (Lymeus et al., 2018), and mindful walking interventions that direct attention to physical and sensory phenomena (Nisbet et al., 2019; Shin et al., 2013). Further, the theoretical tenets of the mindfulness intervention are not made clear in some studies (e.g., Shin et al., 2013), creating ambiguity around the concept and application. We highlight here the need to clarify the theoretical underpinnings of mindful engagement in nature, and distinguish such interventions from other broad applications of engagement in nature.

Experimental studies have demonstrated that mindfulness practice can promote connection with nature (Aspy & Proeve, 2017; Choe et al., 2020; Nisbet et al., 2019; Wang et al., 2016). These studies also vary considerably in their approach to the mindfulness intervention, including a mindful walking intervention in nature (Nisbet et al., 2019); an intervention where participants were required to perform abstract cognitive tasks (Wang et al., 2016); and an audio-guided mindfulness intervention that directed participants to focus on the breath and body (Aspy & Proeve, 2017). While Choe et al., (2020) used a typical mindfulness program that likely fostered awareness of the external environment and thoughts and emotions, other interventions only direct focus to sensory (external) or physical sensations, and lack a central aspect of

established approaches to mindfulness practice - awareness of thoughts and emotions. The approaches in this literature lack consistent alignment with mindfulness theory, hindering theoretical evaluation of the underlying processes and application in nature experiences.

As we turn our attention to other forms of engagement that have been used to promote psychological outcomes of nature experiences, we consider how other engagement concepts can be understood in relation to the qualities of mindful engagement. Studies have demonstrated the efficacy of engagement exercises in improving numerous psychological benefits from nature experiences, including attention (Lin et al., 2014), psychological wellbeing and contentment (Duvall, 2011), memory (Unsworth et al., 2016), connection with nature (Lumber et al., 2017; Weinstein et al., 2009), and satisfaction with the environment (Duvall, 2011). These empirical studies use a variety of engagement exercises that tend to draw attention to either the *external*, sensory elements of nature, including the visual array of the environment; or to the *internal* experience where one notices thoughts and feelings associated with the environment (e.g. Korpela et al., 2017; Lin et al., 2014). Further, some engagement methods prompt some elaborative, and judgmental qualities (for example, forms of engagement that promote noticing the "good things" in nature; Richardson & Sheffield, 2017).

The characteristics of mindful engagement offer a framework in which we can identify forms of engagement in terms of object of engagement (to *what* one engages) and the qualities of engagement (*how* one engages). Fig. 1 highlights these key qualities of mindful engagement in nature experience, while drawing on these qualities to distinguish other forms of engagement in nature. Thus, engagement concepts are grouped into internally or externally oriented awareness, and into reactive/non-reactive quality of engagement (Fig. 1). Fig. 1 illustrates how mindful engagement is distinct from other engagement concepts, but also highlights overlapping qualities of some forms of engagement – for example, contact with nature and fascination involve nonjudgmental, external awareness. Fig. 1 also presents concepts that show greater divergence from key qualities of mindfulness. The positioning of each form of engagement on the dimensional space in Fig. 1 represents a way to understand our hypothesised portrayal of relationships between forms of engagement alongside qualities of mindful engagement. In the following section we examine the mechanisms through which mindful engagement heightens outcomes of restoration and nature connection, and consider associations with the other forms of engagement that lead to these outcomes.

4. Mindful engagement in nature and psychological outcomes: proposed mechanisms

In this section we identify the key mechanisms that underpin the psychological benefits of mindful engagement in nature. Our first step is to appraise existing accounts in the literature for why mindful engagement in nature promotes psychological restoration and nature connection. We identify three main mechanisms of mindful engagement in nature: perceptual sensitivity, decentering, and non-reactivity. Drawing on theoretical mindfulness models (Bishop et al., 2006; Hölzel et al., 2011; Tanay & Bernstein, 2013) to review these explanations, we develop an integrated model that highlights the multiple dimensions of mindful engagement and psychological outcomes in nature experiences. Second, we more closely examine the links between these mechanisms

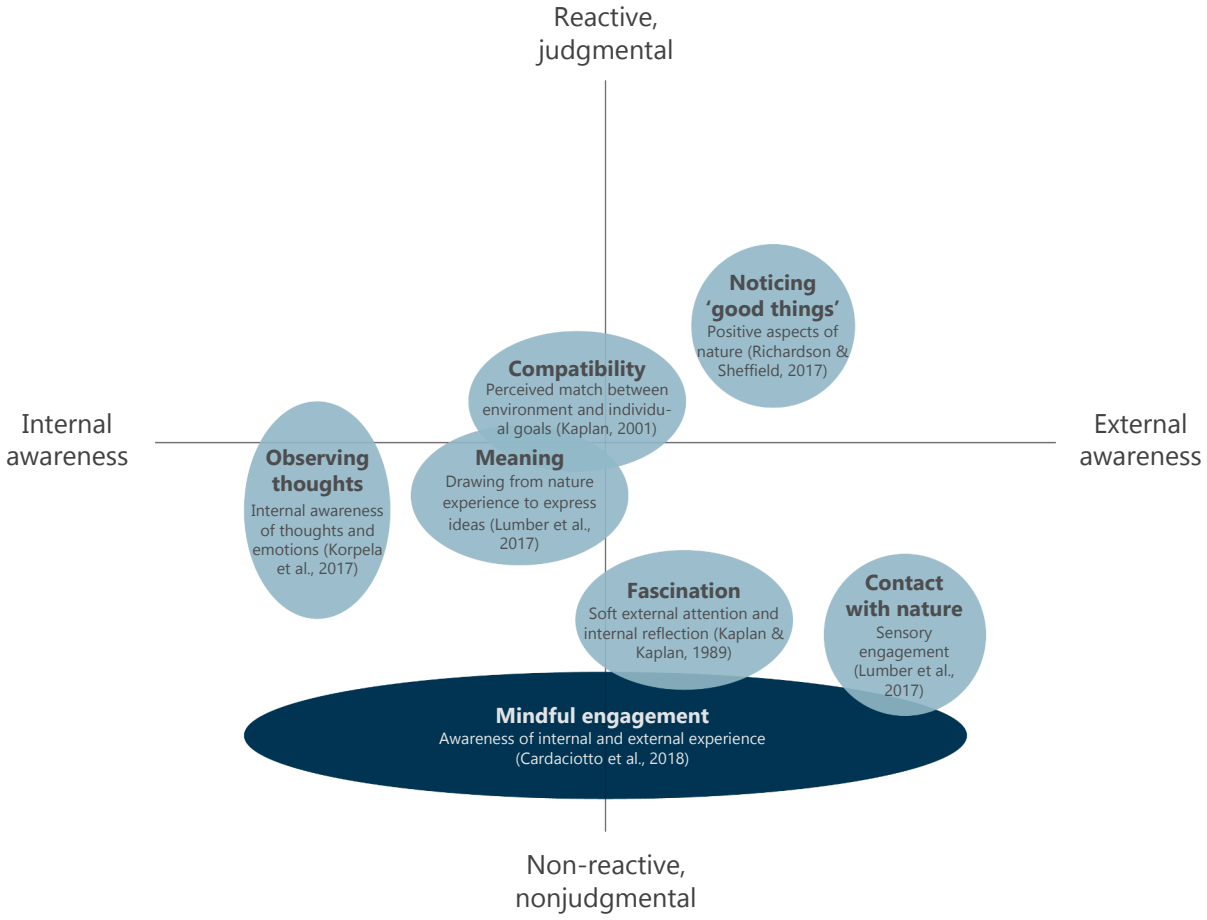

Fig. 1. A representation of the qualities of mindful engagement and how other forms of engagement relate to these qualities. Mindful engagement involves internal and external, non-reactive and nonjudgmental awareness. Six other forms of engagement in nature are mapped to show how they relate to qualities of mindfulness. Position and form of each shape indicate whether forms of engagement would typically span across the dimensional qualities.

and pathways to restoration and nature connection, and suggest specific mindful engagement pathways that support these outcomes.

A common explanation in the existing literature is that mindful engagement heightens perceptual sensitivity of the experience. Mindful engagement enhances awareness of the environment, thus supporting restoration through fascination (Nisbet et al., 2019), curiosity and openness (Lymeus et al., 2018). Relatedly, authors argue that mindful engagement intensifies experiences in nature – through enhanced sensory impact and present-moment awareness – and thus the potential of connecting with nature is strengthened (Barbaro & Pickett, 2016; Howell et al., 2011). This is consistent with models of mindfulness. In a review of mindfulness models that depict the mechanisms underpinning mindfulness and wellbeing outcomes, Hölzel et al. (2011) establish attention regulation as a central mechanism that acts a 'pre-requisite' for other mechanisms, including body awareness. Further, Tanay and Bernstein (2013) highlight perceptual sensitivity as a quality of mindful awareness, where there is a heightened sensory experience that arises through mindfulness.

Authors have suggested that a change in perspective on the self through mindful engagement may support restoration (Lymeus et al., 2018) and connection with nature (Hanley et al., 2017). The change in perspective on the self refers to a sense of 'detachment' from identifying with the self and other internal experiences (Hölzel et al., 2011), also referred to as *decentering*. Decentering can be defined as observing cognitions as transitory mental events rather than centrally representative of self-worth or truth (Baer, 2009). The process of decentering in mindfulness creates psychological distance from thoughts and emotions, and worries with daily life become less intrusive. With regard to restoration in nature, Lymeus et al. (2018) suggest that mindful decentering allows an individual to be grounded in present experience and may strengthen the sense of *being away*, supporting restoration in nature experiences. Hölzel et al. (2011) refer to even minor changes in how one identifies with their internal experiences as a change in perspective on the self, and find this to be a central mechanism underpinning mindfulness and wellbeing outcomes.

Hanley and colleagues (2017) argue that deidentifying with the contents of consciousness provides opportunity for stronger identification with and involvement in the external environment, and connection with nature is subsequently strengthened. In support of this theory, results from two studies find that decentering partially mediates the relationship between mindfulness (specifically factors of *observing* and *non-reactivity*) and connection with nature (Hanley et al., 2017), and that decentering is associated with self-transcendence (Hanley et al., 2018). Taken together, results suggest that through the practice of mindfulness, and specifically the facets of observing (or awareness) and non-reactivity, one deidentifies with their subjective experience, can become more grounded/present in the natural environment, and has an expanded self-concept that allows one to connect more deeply with the external world. These findings also highlight the interdependencies between mindfulness mechanisms - observing, non-reactivity, and decentering.

Emotion regulation and non-reactivity to the internal experience are related mindfulness mechanisms (Hölzel et al., 2011) and may be particularly involved in the association between mindful engagement and nature connection. Non-reactivity to thoughts and emotions is the ability to allow thoughts to come and go without elaborating on them (Baer et al., 2008). Some authors maintain that mindfulness is effective in strengthening connection with nature because it is a shift in perspective that is required to overcome cognitive limitations, such as pessimistic attitudes towards nature (Aspy & Proeve, 2017), and a typical mindset that 'human' is wholly separate from 'nature' (Wang et al., 2016). These explanations, however, seem to reflect a form of cognitive *reappraisal*, rather than an accepting 'non-appraisal' that would develop from a non-reactive and nonjudgmental mindful awareness (for contestations on the role of appraisal in mindfulness, see Chambers & Hassed, 2015; Chiesa et al., 2013; Garland et al., 2015). In contrast, we position non-reactivity (and *non*-appraisal) to be key mechanisms involved in the process of mindful engagement in nature, that facilitate the regulation of internal responses within nature experiences. This is consistent with evidence that non-appraisal in mindfulness is associated with connection with nature (Hanley et al., 2017). Further, we draw on an established operational framework of mindful open monitoring, where emotions and cognitive reactions are monitored with a non-reactive orientation (Lutz et al., 2008). This framework has previously been applied in nature experiences (Lymeus et al., 2018), supporting the notion that an open orientation in nature can support psychological outcomes. Non-reactivity in nature experiences may strengthen the potential for nature connection through regulating negative reactions to challenging aspects of the experience.

Having identified three central mechanisms, we propose how each can support psychological restoration and nature connection through nature experiences. The regulation and grounding of attention in the present experience is required to enable these mechanisms (Hölzel et al., 2011), along with an awareness characterised by openness and curiosity. First, mindful engagement heightens sensitivity to perceptual experiences in nature – through enhanced sensory impact and present-moment awareness (Barbaro & Pickett, 2016; Howell et al., 2011; Nisbet et al., 2019). Second, mindful engagement leads to decentering, where a detachment from the subjective experience allows one to fully engage with their experience in nature. Third, non-reactivity is proposed to link mindfulness to nature connection (Hanley et al., 2017), where mindful engagement can overcome unhelpful thought patterns relating to the distinction between 'human' and 'nature' (Wang et al., 2016).

The links between these mechanisms and the pathways to psychological restoration and connection with nature are specified in Fig. 2. Not all pathways identified as important to nature connection and psychological restoration are fully consistent operationally with mindful engagement because they may involve a level of reactivity or judgment. The meaning and compatibility pathways (Lumber et al., 2017; Kaplan, 1995), for example, may involve a degree of judgment in nature. To provide clearer links between all pathways and mindful engagement, we suggest non-reactive/nonjudgmental forms of engagement that would support the pathways to restoration and nature connection.

With this model of mindful engagement in nature, we aim to more clearly depict how engagement may lead to improved psychological outcomes. This leads to the possibility of examining contexts beyond highly restorative nature experiences and exploring when and how the mechanisms of engagement in nature function. In the next section we build upon previous literature that explores mindful engagement in restorative natural environments (Lymeus et al., 2017, 2018), and consider how mindful engagement may be applied in constrained nature experiences.

5. Applying mindful engagement to constrained nature experiences

While we have developed our model considering engagement in restorative nature experiences, people often encounter nature in urban settings where the experience of nature may be somewhat constrained – for example, noisy, busy, green spaces. There is reason to question whether the mechanisms underpinning engagement and related psychological outcomes would function in the same way across settings of varying levels of restorativeness and constraint. For example, forms of engagement that adopt only external awareness in nature may be particularly beneficial in more restorative environments (Howell et al., 2011). Here, perceptual sensitivity to the aesthetic and enjoyable qualities of the environment may lead to better restoration and connection with nature, and other mechanisms may not be so involved. In environments that are somewhat constrained – such as busy urban green spaces or unattractive landscapes - heightened perceptual sensitivity alone may not be adequate to support these benefits. We argue that mindful engagement would be valuable in these contexts, where

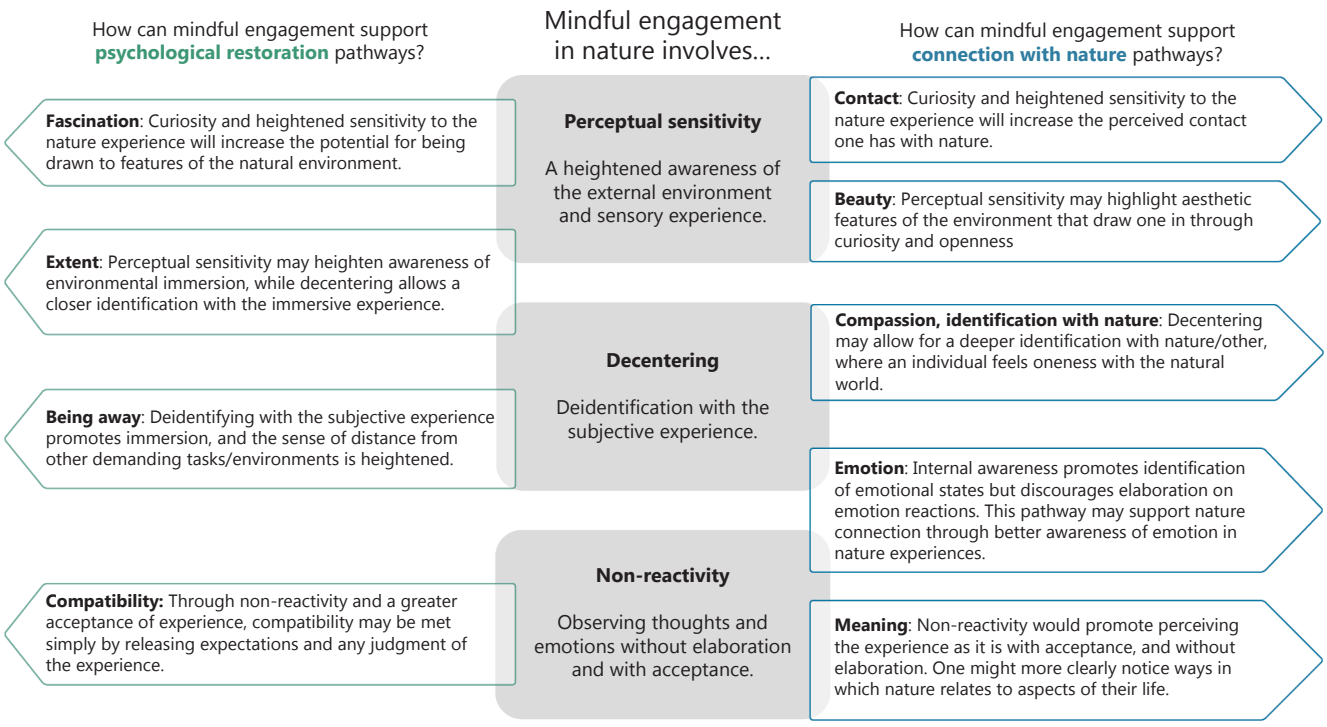

Fig. 2. Conceptual model representing how mindful engagement functions within a nature experience. Perceptual sensitivity, decentering and non-reactivity arise through mindful engagement in nature and support psychological restoration and connection with nature. Overlapping text boxes represent links between mindful engagement mechanisms and pathways to outcomes. Two pathways (*extent* and *emotion*) connect with two mindful engagement mechanisms.

internal awareness and self-regulatory mechanisms of decentering and non-reactivity can mitigate negative qualities of the subjective experience. In this section we demonstrate how mindful engagement mechanisms might function in a constrained environment. We first consider examples of constraining situations in nature experiences and illustrate how constraints on psychological outcomes occur.

Constraints on psychological outcomes of nature experiences may occur in two general ways. First, circumstances may limit access to high quality natural environments that are usually relied upon for restoration and nature connection. Second, the qualities of nature experiences that lead to these outcomes (for example, fascination, or meaning), are reduced or impacted (von Lindern et al., 2013). In practice, these two forms of constraint may interact to impact psychological outcomes. For example, if illness or injury prevents one from travelling to a highly restorative natural environment (limited access), that person is restricted to nature experiences close to or in their home and over time, their sense of being away in that experience is diminished. Considering the interaction of these two general forms of constraint is helpful when discussing common, everyday experiences of nature. Previously, von Lindern et al. (2013) have outlined these forms of constraint with regard to restoration, but to our knowledge, connection with nature has not been explored in relation to constraining circumstances.

Everyday nature experiences provide us with some contexts that are useful in exploring constraints on restoration and connection with nature. Examples of situations that limit access to natural environments include illness (Duggan et al., 2008), old age (van Heezik et al., 2020), and poor weather (Duffy & Verges, 2010) – we extend this to include the circumstances associated with the COVID-19 pandemic restrictions, as well as nature experiences in the urban environment. Circumstances associated with the COVID-19 pandemic may constrain restoration and nature connection because of restrictions on movement and access – for example, although far from 'everyday' circumstances, in Victoria, Australia, public health measures were introduced including limited outdoor gatherings and restricted travel beyond a certain distance from the home (Saul et al., 2020). In these contexts, access to high quality natural environments is limited, and nature experiences may become confined to nature around one's home. However, during strict lockdowns in Australia, those with access to nearby green spaces tended to visit green spaces more, and experiences were potentially more meaningful due to the imposing demands of lockdown (Astell-Burt & Feng, 2021). Living in an urban environment more generally can also present constraints on restoration and nature connection, as work and social responsibilities may limit opportunities to access and be restored by high quality natural environments (Hartig et al., 2003; Staats et al., 2016; von Lindern et al., 2013).

Psychological outcomes of everyday nature experiences may be hampered via an impact on the transactional qualities that lead to restoration or connection with nature. Studies have demonstrated that the following factors negatively impact the quality of urban green spaces for psychological restoration: traffic, city noise, poor design (Mesimäki et al., 2019; Nordh & Østby, 2013; Peschardt et al., 2016; Taylor et al., 2020), environmental reminders of the work place or of demanding situations (von Lindern, 2015), and congestion/presence of others (Arnberger & Eder, 2015; Nordh & Østby, 2013). The listed factors may impact restorative qualities through, for example, reduced fascination with the environment or a disrupted sense of being away from demanding situations, and we suggest that mindful engagement with the nature experience would be beneficial in mitigating these impacts. Proposed links between specific mechanisms and the restorative qualities of nature experiences that may be impacted by constraining factors are shown in Fig. 3.

A significant constraining factor on feeling connected with nature in everyday urban nature experiences seems to be a restricted perception of 'nature', and we suggest that mindful engagement can be implemented to notice and re-engage with nature in urban environments. The perception that urban green spaces are *not* 'nature' can be pervasive in some instances to the extent that individuals do not believe they can connect with nature in these spaces (Earl & Heinitz, 2017). Indeed, it is common for people to underestimate the capacity for urban nature to provide emotional benefit and foster connection with nature (Nisbet &

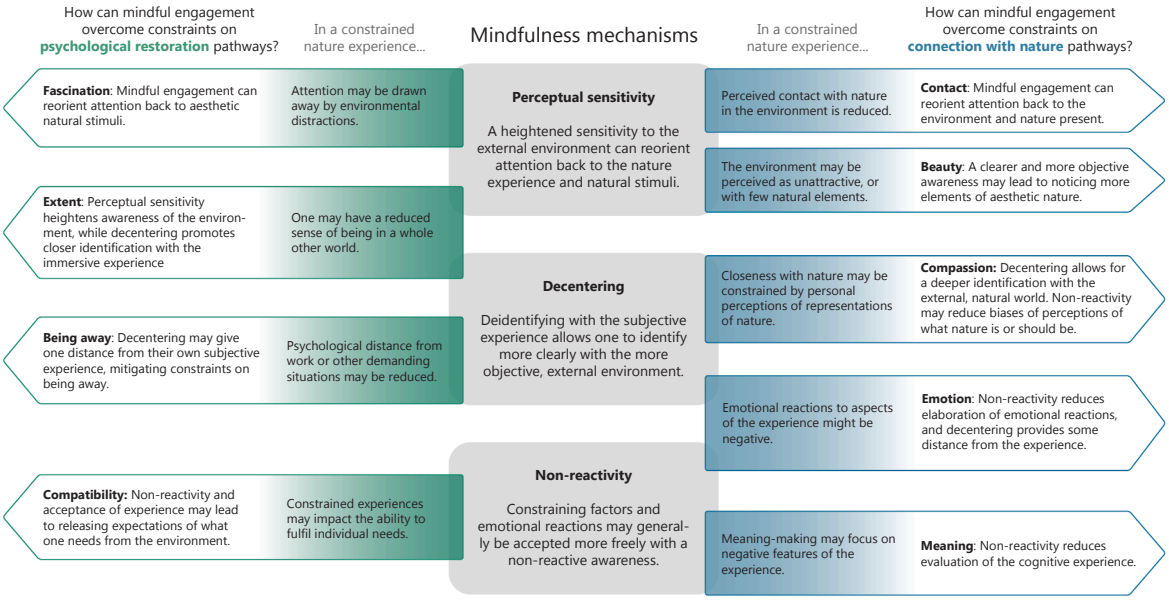

Fig. 3. Mindful engagement overcoming constraints in nature experiences. Examples of constraints on each pathway to psychological outcomes are shown, and the outer pathways represent how mindful engagement mechanisms may mitigate these constraints.

Zelenski, 2011). Underlying these beliefs appears to be perspectives of what 'nature' is relative to humans and the built environment; that is, whether one considers urban green space within one's definition of nature, or excludes it. For instance, respondents in some studies perceive nature to be characterised by the absence of human-made objects or artifice (Church, 2018; Earl & Heinitz, 2017), which may be driven by the widespread ideal of nature as pristine wilderness (Cronon, 1996; Dickinson, 2018). In a qualitative study on perceptions of urban green roofs, Loder (2014) found that some participants felt that any form of wildlife or plants is nature – including those on an urban roof - while others believe nature to be 'out there' and untouched by humans. We argue that a restricted perception of what 'nature' is can constrain the qualities or pathways that lead to nature connection, such as reduced perceived *contact* with nature. Mindful engagement in urban nature experiences may support the perspective that urban green spaces *are* 'nature', and overcome this constraint on connection with nature in everyday nature experiences.

Where constraining factors disrupt the beneficial qualities of nature experiences, mindful engagement can be employed to redirect attention, respond to internal phenomena with less reactivity, and gain clearer perspectives of the ongoing external and internal experience. The mechanisms underpinning mindful engagement and enhanced psychological outcomes (Fig. 2) may be particularly applicable to constrained experiences, where negative perspectives or reactions to constraining factors benefit from self-regulation strategies such as non-reactivity and decentering. Fig. 3 builds on the pathways outlined in Fig. 2: with examples of constraints on the beneficial qualities in nature experiences, we use these pathways to demonstrate how mindful engagement may operate to support psychological restoration and connection with nature in constrained settings. While the mechanisms remain consistent, we specify slight differences in how mindful engagement may function in constrained nature experiences: for example, the benefit of decentering in a restorative experience may be greater immersion in the (external) restorative environment, while in a constrained experience decentering may provide some psychological distance from negatively impactful aspects of the experience and support the potential to gain a sense of being away. These insights are useful in broadening the research on engagement to wider contexts, where we can specify how engagement functions in different types of nature experiences.

6. Future research directions

Drawing from existing approaches in the literature we provide recommendations to advance research on the benefit of mindful engagement in nature experiences, and summarise these future research directions and questions in Table 1. First, the connection with nature pathways (Lumber et al., 2017) that our model draws upon needs to undergo more empirical testing to understand how each pathway actively contributes to a sense of connection with nature. An approach to exploring the contribution of each pathway might be to examine them

Table 1
Summary of future research directions and questions.

Topic	Questions
Assessing connection with nature pathways	• Do proposed pathways lead to a sense of connection with nature? • What is the contribution of each proposed pathway in developing a sense of connection with nature through nature experiences?
Constraints on restoration and connection with nature	• What factors constrain restoration and/or connection with nature in experiences with everyday nature – e.g. urban environments, nature at home? • How do certain factors or situations constrain psychological benefits from nature experiences (i.e. via which pathways)?
Mindfulness mechanisms and their role in boosting psychological outcomes	• Are changes in psychological outcomes seen in mindfulness interventions in nature the result of increased state mindfulness? • To what extent are the proposed mindfulness mechanisms involved in enhancing psychological outcomes of nature experiences?
Role of environment on mindful engagement	• Can mindful engagement be feasibly applied by the general population in constrained circumstances? • Is mindfulness more beneficial in environments that are somewhat constrained, rather than highly restorative/unconstrained environments?

separately and analyse potential mediating pathways. To analyse the separate and combined contribution of these pathways, an effective instrument is required. Richardson et al. (2019) developed the Nature Connection Index (NCI) for children and adults, which is based off the proposed pathways to nature. However, the NCI measures a trait-like nature connection, and would not be suitable to measure the contributions of pathways through nature experiences. A self-report scale that measures state-like, experiential connections via each pathway (such as the Perceived Restorativeness Scale that measures theoretical components of psychological restoration; Hartig et al., 1997) would be a valuable future research effort. The development of such a scale would enable evaluation of the pathways and a better understanding of how nature experiences lead to nature connection.

Second, further research is required on constraining factors of nature experiences. There is some research on constraints on restoration through nature experiences, and we suggest this research could provide a model for evaluating constraints on nature connection pathways. For example, over two studies, von Lindern and colleagues (2015; 2013) aimed to find out whether various forms of constraint would negatively impact restoration via a reduction in the sense of being away. Other research has examined the environmental features of different sites that may contribute to or constrain psychological effects of nature experiences (Janeczko et al., 2020). However, consideration of multiple aspects of constraint (including subjective experiences and attitudes) is important, as some results suggest that measuring only environmental factors are not enough to detect differences in restorative outcomes of different environments (Janeczko et al., 2020). These approaches offer directions for testing constraints on opportunities to connect with nature, provided measures of nature connection pathways are available. For instance, studies could be designed to determine how factors (for example, perceived naturalness of urban green space) constrain connection with nature, using models that include the pathways as potential mediators.

Third, a key area for future research is empirical testing of our mindful engagement model, including the role of specific mindfulness mechanisms in promoting psychological outcomes of nature experiences. A first step towards this is testing whether mindful engagement interventions in nature lead to an increase in state mindfulness during that experience (above and beyond groups that do not participate in mindful engagement interventions). Previous empirical studies have used state mindfulness measures immediately after nature experiences (for example, Nisbet et al., 2019; Stewart & Haaga, 2018), which are sensitive to differences between experimental groups. Our model involves three main mechanisms that underpin the association between mindful engagement in nature experiences and improved psychological outcomes: perceptual sensitivity, decentering, and non-reactivity. The relative contributions of these mechanisms to psychological benefits of nature experiences should be critically evaluated, by testing the mediating roles of each mechanism (see Coffey et al., 2010, for an example of this statistical approach in a cross-sectional design). The role of different mechanisms may differ across population groups (for example, experienced and unexperienced mindfulness practitioners), and in different environments.

Finally, we recommend that future research explores the role of the environment on mindful engagement in nature experiences. In this paper, we argue that mindful engagement may be more beneficial in environments that are somewhat constrained, in comparison to environments that are highly restorative and unrestricted in their capacity to provide psychological benefit. However, research conducted by Lymeus and colleagues (2017) suggests that a restorative environment is important in supporting mindfulness practice, particularly for novice practitioners. Further, while open monitoring mindfulness practice requires less effort than other mindfulness practices such as focused attention (Lutz et al., 2008), it is likely more effortful for novice practitioners than for more experienced meditators (Lutz et al., 2015), so the question arises whether mindful engagement is feasible for the general public in constrained environments. A second question is, if mindful engagement can be usefully applied in constrained circumstances, are the benefits greater than the use of mindful engagement in unconstrained, or more restorative environments? We recommend exploring these questions in future research to understand the best practice of implementing mindful engagement in nature experiences.

7. Conclusion

Our primary goal in this paper was to develop a theoretical model of how mindful engagement in nature experiences supports psychological restoration and connection with nature (Fig. 2). Empirical studies have demonstrated the effects of engagement and mindfulness on psychological outcomes, and some authors have provided explanations for the underpinning mechanisms. We work from a theoretically grounded knowledge of mindfulness to draw together these lines of thoughts, and clearly articulate the multiple mechanisms associated with mindful engagement in nature and psychological outcomes. Such an approach provides a step towards more rigorous intervention design of mindfulness in nature experiences, where proposed mechanisms can be tested and appraised empirically. The integrated model presented in this paper provides a basis for examining other contexts of nature experiences, including constrained nature experiences as we have done in this paper.

This paper highlights the value of an interdisciplinary approach to the field of nature and health. Applying theory from mindfulness and environmental psychology literatures to the built environment in the context of constrained urban nature advances the discussion beyond mere exposure to nature, to draw attention to the impact of individual agency and engagement in nature. There are practical implications of this for urban green space design and use. Everyday nature experiences or interactions may be constrained to some degree – for example, in the busy urban setting, on work breaks, or in the home environment – and improving urban health and liveability through experiences of urban green space and nature is important. Of course, a necessary area of this work is in developing green infrastructure in the built environment for health and wellbeing. By demonstrating the factors in the urban environment that may constrain the processes that lead to positive outcomes, we highlight the importance of individual cognitive strategies, where an individual can improve health and wellbeing opportunities in the urban context by engaging mindfully with nature. We believe that these approaches complement and support each other and should be considered alongside each other: high quality urban green space should be made accessible for all, and so too should the ability and opportunity to engage with nature in green spaces effectively.

8. Author statement

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CRediT authorship contribution statement

Rose Macaulay: Conceptualization, Writing – original draft, Writing – review & editing. **Kate Lee:** Conceptualization, Writing – review & editing. **Katherine Johnson:** Conceptualization, Writing – review & editing. **Kathryn Williams:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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