



Ecological Identity, Access to Green Spaces and Mental Health in Urban Areas

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"The environment and the mind are not separate. As we destroy the world around us, we are also destroying ourselves."

- Matthieu Ricard, *Beyond the Self: Conversations between Buddhism and Neuroscience* (2017).

Matthieu, a French writer, photographer and Buddhist monk highlights the interdependence of the natural world and our mental wellbeing. He suggests that the degradation of the environment not only harms the planet but also has negative impacts on our mental and emotional health. By destroying the environment, we are disconnecting ourselves from the natural world, which can lead to feelings of isolation, anxiety, and depression. Ricard's quote highlights the interdependence of the environment and human beings, suggesting that the degradation of the natural world can have negative impacts on our mental and emotional wellbeing; ecological identity takes this idea one step further, suggesting that a strong connection with nature and a sense of environmental responsibility can actually promote psychological wellbeing and lead to more pro-environmental behaviors (Howell et al., 2011a).

Ecological Identity

Ecological identity refers to the extent to which individuals identify with nature and perceive themselves as part of the natural world. It encompasses an individual's relationship with nature, including their attitudes, values, beliefs, and behaviors related to the environment (Schultz, 2001). Ecological identity can be developed through experiences in nature, education about environmental issues, and personal reflection on one's relationship with the natural world (Stevens & Mitten, 2018). Those with a strong ecological identity are more likely to engage in pro-environmental behaviors, such as recycling, reducing energy consumption, and using public transport (Hinds & Sparks, 2008). Ecological identity has been linked to improved mental health outcomes; research suggests that spending time in nature and developing a strong ecological identity can reduce stress, anxiety and depression (Capaldi et al., 2015). Individuals who have a strong ecological identity are more likely to support sustainable development practices such as renewable energy and conservation efforts that promote the long term health of the planet and its inhabitants (Kals et al., 1999).

Loss of Ecological Identity

Despite its significant importance and necessity for survival, many countries around the world are facing significant challenges in maintaining their ecological identity due to a variety of factors, including rapid urbanization, industrialization, deforestation, pollution, and climate change. For example, The Amazon rainforest in Brazil, which is home to a significant portion of the world's biodiversity, is being destroyed at an alarming rate due to deforestation, mining, and agriculture (World Wildlife Fund, 2023). India's rapid urbanization and industrialization have led to significant environmental degradation, including air pollution, water pollution and loss of green spaces (Ministry of Environment, Forest and Climate Change, Government of India, 2016). Indonesia's rainforests are being destroyed for the production of palm oil, which is used in many consumer products around the world (Rainforest Action Network, 2022); it has led to significant biodiversity loss and carbon emissions. China is facing severe air and water pollution and immense loss of habitat due to industrialization and urbanization (State Council of the People's Republic of China, 2014). The United States has a significant

ecological footprint due to its high levels of consumption and greenhouse gas emissions (Global Footprint Network, 2021). The country is also facing significant challenges related to climate change, including sea level rise and extreme weather events (Smith, 2022).

Green spaces

The concept of 'Greenspace' or 'Green space' is an extensive term that pulls under its purview maintained or unmaintained environmental areas like urban parks, natural reserves and wilderness (Barton & Rogerson, 2017). Rapid urbanization drives across the globe has significantly curtailed access to and engagement with green spaces, especially in the urban areas where they are purposefully designated for aesthetic merits or recreational purposes. However, Barton and Rogerson (2017) state that there exists a significant positive relationship between mental health, well-being and access to, or availability of green spaces in one's neighborhood. Furthermore, urban areas which boast of ample green spaces have citizens reporting lower levels of anxiety and depression, lesser mental distress, higher levels of well-being and healthier cortisol profiles as compared to those residing in spaces with limited or no green spaces (Barton & Rogerson, 2017). Maas et al. (2009) also reported similar findings wherein reported disease prevalence varied greatly when comparing citizens residing in 'very green' and 'less green' settings. This finding denotes the critical importance of availability of green spaces as other intervening factors like socioeconomic status of citizens were controlled so as not to influence the findings.

Neighbourhood Green space and Stress

Van Den Berg et al. (2010) highlights one of the potentially powerful physical resources in our neighborhood, i.e., green spaces. Substantial research programs on urban green spaces affirm their influence and role in improving the quality of life of those residing in areas with an abundance of green spaces in the neighborhood (De Ridder, 2003). Just like any public space, green spaces also facilitate social cohesion and support various physical activities (Kaczynski & Henderson, 2007; Maas et al., 2008). Additionally, green spaces also provide restoration from mental fatigue and stress; it is this 'restorative quality' of our

natural environment that has been established through several surveys in various countries which reiterate that people do consider exposure to nature as one of the most effective ways to seek relief from stress and anxiety (Grahn & Stigsdotter, 2003).

The 'restorative effect' of green spaces are usually referred to from an evolutionary standpoint which argues that as a result of millions of years of evolutionary history in natural environments, "modern humans have developed a partly genetic readiness to respond positively to habitable settings that were favorable to well-being and survival for pre-modern people" (Kellert & Wilson, 1993). In accordance with this view, Ulrich (1993) stated that "the readiness to respond positively to habitable settings is assumed to be triggered only by natural environments; humans do not possess such a disposition for most built environments and materials." Van Den Berg et al. (2010) reiterates an important implication of this readiness to respond positively to one's natural surroundings; nature's ability to easily and effortlessly capture people's attention. Kaplan and Kaplan (1989) refer to this 'attention-drawing' quality of natural surroundings as "soft fascination", which plays a crucial role in the restorative quality of nature. In accordance with these findings, Parsons (1991) expound, being exposed to natural surroundings captures people's attention which allows executive systems that regulate directed attention to rest; additionally, negative emotions are replaced by positive emotions and pessimistic thoughts are blocked all together. Mayer et al. (2009) further state that when this exposure to high quality natural environment is extended to longer time periods, it may stimulate reflections on themes of one's goals, priorities, purpose in and place in the larger scheme of things which in turn might assist people to find a sense of direction and meaning in life.

Ecological Identity, Green spaces and Mental Health

Losing ecological identity can have drastic consequences at both the individual and societal level (Kellert, 1997); from environmental degradation, reduced environmental stewardship, unsustainable living practices to poor mental health outcomes. Loss of ecological identity increases stress and anxiety (Howell et al., 2011b); spending time in nature and developing a strong connection to the natural

word has been shown to reduce stress and anxiety levels (Bratman, Hamilton, & Daily, 2012). Therefore, the loss of ecological identity can lead to higher levels of stress and anxiety. Research has also shown that spending time in nature can improve mood and reduce symptoms of depression which can be aggravated by a loss of ecological identity (Keniger et al., 2013). A lack of green spaces and natural environments can negatively impact well-being. Spending time in nature has also been linked to improved cognitive functioning, including attention and working memory (Berman et al., 2008); hence a loss in ecological identity might reduce cognitive functioning. Developing a connection to the natural world can provide a sense of meaning and purpose; a loss of which can negatively impact mental health (Mayer & Frantz, 2004). Overall, losing ecological identity can have negative impacts on mental health including increased stress and anxiety, depression, decreased well-being, reduced cognitive functioning, loss of sense of meaning and purpose.

Furthermore, Bailey (2017) highlights that for vulnerable groups like those with dementia or mental illnesses, youth at risk, people undergoing excessive stress, greenspaces could be utilized and are often used to provide structured therapeutic interventions; these range from social and therapeutic horticulture to care farming, wilderness therapy, nature based art and craft, eco therapy and animal assisted interventions. For instance, week-long expeditions in wilderness greenspaces are instrumental in enhancing self-esteem, self-control, self-image, self-empowerment, self-confidence and also in decision making among adolescents who report behavioral or self-esteem issues (Bailey, 2017). Similarly, those suffering from dementia can benefit greatly from engaging with greenspaces; it is shown to have a positive influence on their fitness and mobility, self-esteem, eating and sleeping patterns, and sense of well-being; moreover, it also improves the quality of social interactions and provides a sense of belongingness (Bailey, 2017). In addition to these benefits, Bailey (2017) also notes that exposure to green spaces significantly improves one's emotional states by reducing anger, stress, agitation, depression and apathy.

Several studies have explored the 'buffering effects' of green spaces on a number of outcome variables. For example, Wells and Evans (2003) discovered that availability of and accessibility to nature in residential environments among

rural communities in New York acted as a buffer against the impact of stressful life events and aided in children's psychological well-being. Furthermore, stressful life events had significantly lesser impact on children who had access to a lot of natural habitat around their houses as against those who had lesser amount of natural surroundings around them (Wells & Evans, 2003). In a similar research study among employees of a Southern European company, Leather et al. (1998) found that exposure to elements of nature like plants, trees, vegetation, and foliage acted as a buffer against the negative impacts of job stress like the intention to quit and a sense of general well-being.

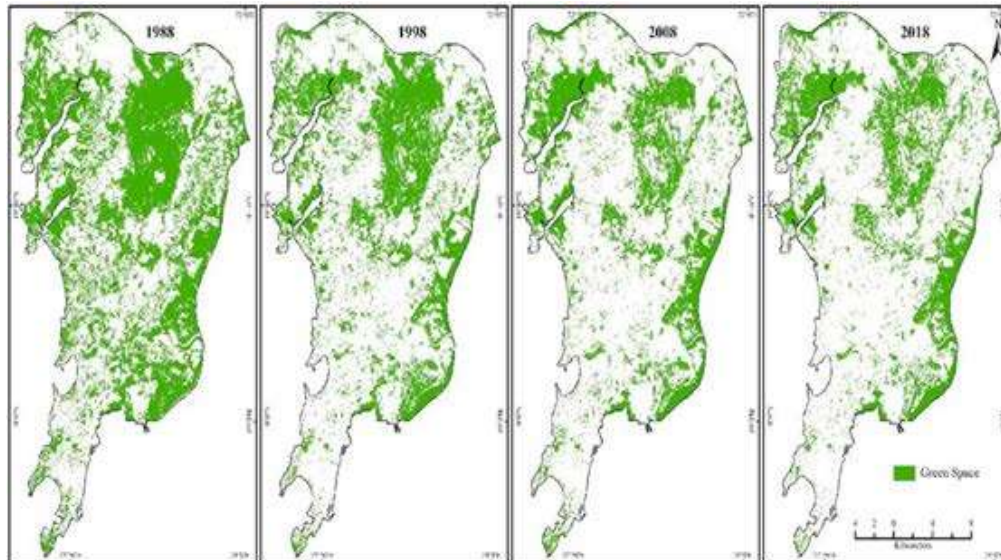
In their experimental study, Parsons et al. (1998) demonstrated that the magnitude of galvanic skin response to a subsequent stressor is lessened when exposed to nature dominated roadside views as against those dominated by artifacts. Several studies have sought to explore the protective effects of accessibility and exposure to natural surroundings among individuals undergoing severe stressful life events. For instance, Cimprich and Ronis (2003) conducted an intervention study among a group of women suffering from breast cancer; they found that those who engaged in more nature based activities regularly showed significantly greater improvement in performance on attention based tasks as compared to the non-intervention group. Adding to these findings, researchers also found that those with better access to green spaces exhibited less stress-related psychosocial symptoms than those with little or no access to green spaces (Gidlof-Gunnarsson & Ohrstrom, 2007).

A Case Study of Mumbai

Mumbai, like many other rapidly developing cities, is facing significant challenges in maintaining its ecological identity (Shah, 2017). The city's rapid urbanization and industrialization have led to widespread environmental degradation, including air pollution, water pollution, deforestation and loss of biodiversity (Thakkar & Shah, 2012). Mumbai's rapid urbanization has resulted in the loss of green spaces, including parks and forests (Sarode et al., 2019). This has led to a reduction in the city's natural habitat and biodiversity. The air quality in the city has deteriorated significantly due to heavy traffic and industrial activities (Deshpande & Joseph, 2020). This has led to respiratory illnesses and other health

problems for its residents. Mumbai's water bodies, including the Mithi river and the Arabian Sea, are heavily polluted due to untreated sewage and industrial waste (Gajbhiye et al., 2017). Mumbai's coast is eroding at an alarming rate due to the construction of infrastructure along the shoreline (Kunte, 2019). The city is also vulnerable to the impacts of climate change, including rise in sea level and extreme weather conditions. The city's rapidly growing population and expanding economy have led to unsustainable living practices, including overconsumption and wastefulness (Kunte, 2019). Overall, Mumbai is facing significant challenges in maintaining its ecological identity.

Additionally, the Brihanmumbai Municipal Corporation (BMC) has been accused of causing severe environmental degradation and causing Mumbai to lose its ecological identity in several ways (Lukose, 2014). The BMC has been accused of turning a blind eye to illegal construction and encroachment in Mumbai, which has led to the destruction of natural habitats, wetlands, and open spaces (Gupta, 2019). This has resulted in the loss of green cover and wildlife habitats, leading to a loss of ecological identity (Gupta, 2019). Chatterjee (2020) highlights a recent study published in the peer-reviewed journal Springer Nature, stating that the city's developmental activities in the last three decades has had several negative consequences - a significant decrease of 42.5% in urban greenery. The study reveals that out of Mumbai's total land area of 63,035 hectares (ha), the green cover was 29,260 ha in 1988; however, this figure progressively declined to 20,481 ha in 1998, 17,331 ha in 2008, and 16,814 ha in 2018, resulting in an overall reduction of 42.5% over the course of 30 years (Rahaman et al., 2020). To put this into perspective, the loss of green cover amounts to 12,446 ha, which is larger than the Sanjay Gandhi National Park (10,300 ha) (Chatterjee, 2020). From January to July 26, 2020, the Brihanmumbai Municipal Corporation (BMC) issued notices for the removal of 6,382 trees. Similarly, in 2019, notices were issued for the felling of 14,518 trees, while in 2018, the number was 8,775 trees (Chatterjee, 2020).

Figure 1**Land use Land cover changes & proportion of vegetation in Mumbai from 1988 to 2018**

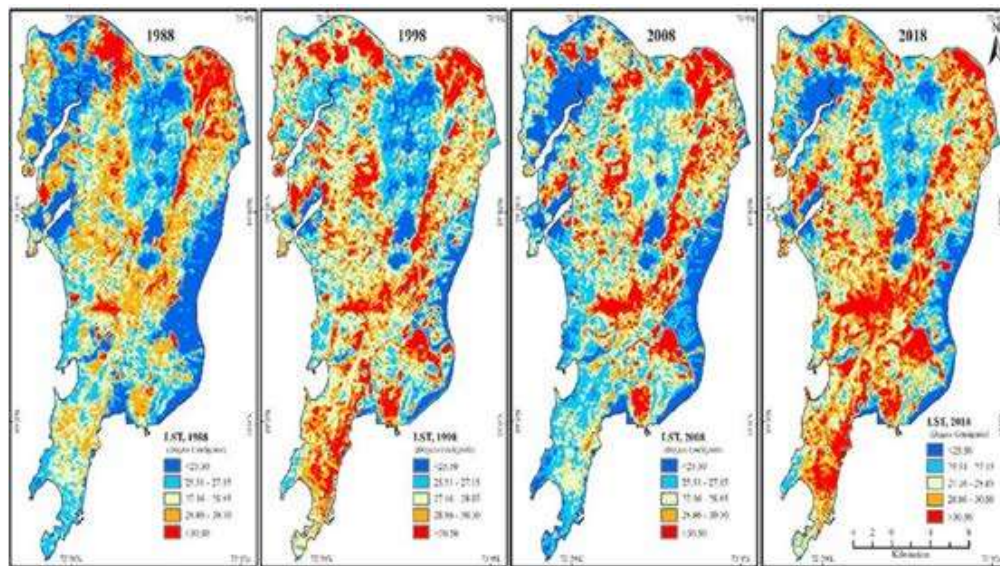
Source: Rahaman, S., Jahangir, S., Haque, M. S., Chen, R., & Kumar, P. (2020). Spatio-temporal changes of green spaces and their impact on urban environment of Mumbai, India. *Environment, Development and Sustainability*, 23(4), 6481–6501. <https://doi.org/10.1007/s10668-020-00882-z>

Over a span of 30 years, a group of researchers from Manipal Academy in Karnataka, Kazi Nazrul University in Asansol, West Bengal, Delhi School of Economics, and East China Normal University in Shanghai conducted a study on Mumbai using multi-temporal satellite images from Landsat-5 and Landsat-8, which were provided by the United States Geological Survey (Chatterjee, 2020). The objective of the study was to analyze changes in land use, land cover (LULC), land surface temperature (LST), vegetation proportions, and other relevant parameters during the spring season (March–April). The study attributed the rise in land surface temperature (LST) in Mumbai, to the reduction of green spaces caused by increased urbanization and the resulting release of latent heat, which contributed to micro-climate variations (Rahaman et al., 2020). These changes in land use and land cover (LULC) have significantly impacted the urban ecosystem of the city. Specifically, the proportion of green spaces in relation to the total area declined from 46.7% in 1988 to 26.67% in 2018, with the most substantial alterations occurring between 1988 and 1998 when approximately 14% of green spaces underwent transformation due to developmental activities (Rahaman et al., 2020). According to satellite maps, there was a consistent decline in the extent of dense vegetation, which accounted for 43% of the area, as well as sparse

vegetation, which covered 20% of the area, from 1988 to 2018 (Rahaman et al., 2020). The areas most affected by changes in dense vegetation included Sanjay Gandhi National Park (SGNP), Aarey Colony in Goregaon, Mulund, Bhandup, Gorai, Malad, and the Versova creek areas (Rahaman et al., 2020). Researchers also noted a reduction in sparse vegetation across the central suburbs and isolated zones in south Mumbai, including Bandra, Khar, Malabar Hill, Pedder Road, Dadar, Lower Parel, Mazgaon, Colaba, and Cuffe Parade (Rahaman et al., 2020).

Figure 2

Increasing land surface temperature in Mumbai from 1988 to 2018



Source: Rahaman, S., Jahangir, S., Haque, M. S., Chen, R., & Kumar, P. (2020). Spatio-temporal changes of green spaces and their impact on urban environment of Mumbai, India. *Environment, Development and Sustainability*, 23(4), 6481–6501. <https://doi.org/10.1007/s10668-020-00882-z>

Mumbai's water bodies such as rivers, lakes and creeks have been polluted and neglected, leading to a loss of biodiversity and degradation of the ecosystem (Pillai & Joseph, 2017). The BMC has been criticized for not doing enough to clean and restore the water bodies (Nair & Krishnan, 2018). Mangroves, which play a critical role in protecting the city's coastline from flooding and storm surges, have been under threat due to encroachment, illegal construction and pollution (Sandilyan, 2015). Mumbai's air quality has been deteriorating rapidly due to a range of factors, including vehicular emissions, industrial pollution and construction dust (Pinto & Tembhekar, 2022). The BMC has been criticized for not doing enough to monitor and control air pollution in the city. However, there are

initiatives underway to address these challenges, including the development of green spaces and the promotion of sustainable living practices.

It is important to acknowledge that various factors contribute to the increase in mental health issues, hence it is worth noting that causation cannot be definitively stated for any one aspect of our habitat. However, it is crucial to inspect and reflect on the state of mental health prevailing in the city. In a mental health study that aimed to assess stress levels among 8,396 Indian individuals between April and June 2020, it was discovered that Mumbai experienced the highest level of stress, exhibiting a significant net increase of 48% (Dhar, 2020). According to data from the Union health ministry, there has been a notable 24% rise in the number of patients seeking psychiatric care in Mumbai's clinics (Chakraborty, 2019). In 2017, approximately 88,672 individuals received treatment for mental illnesses at outpatient departments (OPD) in private and civic-run clinics and hospitals in the city; this figure increased to 1,10,257 in 2018, indicating a significant growth (Chakraborty, 2019).

Extensive research has provided substantial evidence regarding the rejuvenating effects of diverse forms of nature, such as roadside vegetation and indoor plants. Chan et al. (2021) focused on investigating the buffering effects of vertical greenery, a growing trend in urban areas with high population densities. To simulate the experience of walking through a bustling downtown environment, researchers utilized virtual reality (VR) technology, where the exteriors of buildings were adorned with vertical greenery. Their findings indicated that the presence of vertical greenery on urban structures can serve as a buffer, mitigating the adverse psychophysiological effects of stress (Chan et al., 2021). This study makes a valuable contribution to the limited literature on the buffering effects of nature against stress. Moreover, the utilization of virtual reality (VR) technology enabled the researchers to effectively isolate and examine the distinct impact of nature by controlling for color effects. These findings also align with prior research, providing further support for the notion that nature has the potential to alleviate stress (Brown et al., 2013; Kweon et al., 2007). There is a potential mechanism by which nature acts as a stress buffer, involving the preservation of both parasympathetic and sympathetic activity during stressful situations, as well as the promotion of parasympathetic activity following the stressor (Chan

et al., 2021). This notion is reinforced by the understanding that the sympathetic branch governs activation, which is likely to be more prominent during a stress-inducing event; conversely, the parasympathetic branch regulates relaxation, which is expected to be more pronounced after the removal of the stressor (Andreassi, 2010).

The Brihanmumbai Municipal Corporation (BMC) has taken several steps to increase green space in Mumbai (Devasia, 2023). It regularly conducts tree plantation drives across the city, aiming to plant more trees in the city's open spaces, gardens, and on roadsides (Devasia, 2023). BMC has also undertaken the development of several new parks in Mumbai, such as the Mithi river park, Mahim Nature Park and Tansa wildlife sanctuary (Kunte, 2019). It has also taken steps to maintain and upgrade existing parks and gardens such as the Horniman Circle garden, Kamla Nehru Park, and Jijamata Udyan (Yerunkar, 2016; Express News Service, 2021). BMC is also encouraging the development of vertical gardens by providing technical support and financial assistance to interested parties (Devasia, 2023). The BMC has initiated several programs to protect the biodiversity hotspots in Mumbai such as the Thane Creek Flamingo Sanctuary and the Matheran eco-sensitive zone (Lewis, 2021). BMC has actively involved citizens and local communities in its efforts to increase green spaces in Mumbai through programs such as the 'My Tree Challenge,' which encourages citizens to plant and take care of trees (Bhalerao, 2020). The BMC has also undertaken urban forestry initiatives by planting more trees in vacant land areas in Mumbai (Ramanath, 2022).

Conclusion

Natural environments, availability, accessibility and exposure to natural surroundings have several beneficial effects on human health and well-being. The physical and mental health benefits derived from exposure to natural habitat are many and are influenced by the duration of exposure. While short term exposure to urban parks, forests, gardens and other (semi-) natural environments reduces stress and depressive symptoms, increases self-reported positive emotions, restores attention fatigue, improves mood, self-esteem and perceived mental and physical health (Tzoulas et al., 2007; Barton & Pretty, 2010; Bowler et al., 2010;

Van Den Berg et al., 2015; Van Den Bosch and Sang, 2017); long term exposure has been associated with reduced respiratory, cardiovascular and cancer mortality (James et al., 2015; Gascon et al., 2016) and also with improved respiratory and mental health (Gascon et al., 2015; Liddicoat et al., 2018). Researchers have also investigated the effects of 'chronic' exposure to green spaces over varying spatial scales and have found positive effects of green spaces over distances between 150 m and 5 km (Liddicoat et al., 2018; Dadvand et al., 2016; Triguero-Mas et al., 2015; Demoury et al., 2017; Browning & Lee, 2017).

Living in urban areas is often marked by heightened exposure to environmental stressors such as noise pollution, coupled with limited access to natural surroundings. In addition to the duration of the exposure, several research studies demonstrate that the presence of vertical greenery on urban buildings can effectively mitigate negative psychophysiological reactions to stress, highlighting the potential of integrating nature into urban settings as a means to enhance resilience against stressors (Chan et al., 2021). Green spaces, restoring biodiversity and improving the ecological health of the city can help absorb pollutants and improve air quality in the city. It can help to reduce the urban heat island effect, where temperatures in urban areas are higher than those in surrounding rural areas. Overall, enhancing ecological identity, and expanding green spaces have the potential to promote the mental health of its citizens by promoting physical activity, social interactions and providing sustainable exposure to nature.

Green spaces thus play a crucial role in improving mental health and promoting physical and emotional well-being among citizens in urban areas. The importance of these green spaces and ecological identity in urban areas cannot be overstated, as they offer a multitude of benefits that positively impact individuals and communities. By providing a natural and serene environment, green spaces offer respite from the stressors of urban life. They act as a sanctuary where people can escape noise, congestion, and the fast pace of city life. The presence of greenery, trees, and natural elements has a calming effect on the mind and body, reducing stress levels, and improving overall mental well-being. This connection with nature also helps individuals develop an ecological identity—a sense of belonging and connection to the natural world—which further enhances their mental health and emotional resilience. Ecological identity involves recognizing

and valuing the interdependence of humans and the environment. It promotes a sense of stewardship and responsibility towards the natural world. Moreover, green spaces contribute to psychological restoration by allowing individuals to rejuvenate. The social aspect of green spaces cannot be overlooked either. They provide gathering places for communities to come together, fostering social interactions and promoting a sense of belonging. These social connections are vital for maintaining positive mental health and creating resilient communities. Additionally, the opportunity for physical activities and exercise in green spaces further enhances mental health outcomes. In light of these critical factors, it is imperative that urban planning and development prioritize the creation and preservation of green spaces. Governments, city planners, and communities ought to collaborate, to ensure that all citizens have equitable access to these valuable resources. By fostering ecological identity and promoting a connection with nature, urban areas can create healthier, more resilient communities that prioritize the well-being of both humans and the environment.

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