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# *The Relationship Between Stress and Greenspace Exposure*

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***Abstract:*** This essay use literature review to explores the relationship between greenspace and stress, drawing on evidence from multiple studies that utilize cortisol measurements to indicate changes in stress levels. Greenspace refers to all natural green areas, including parks, woodlands, scrublands, and other natural environments. People's stress can be influenced by various factors such as the environment, family, friends, and work or study. Therefore, it is important to understand how much a green environment can reduce stress. The findings strongly suggest that greenspace has a beneficial impact on reducing mental stress. However, the influence of greenspace exposure varies by gender. For men, a moderate amount of greenspace is optimal for stress recovery, while more greenspace does not necessarily lead to greater improvement. In contrast, the effects on women require further investigation to be fully understood.

***Keywords:*** Greenspace exposure, stress, mental health

## 1. Introduction

To begin with, stress is a significant factor that influences people's healthy daily lives. Stress can be defined as a person's physiological responses, such as fight or flight, or as their psychological responses, including thoughts and emotions. Most importantly, chronic stress can lead to mental health problems like depression, anxiety, and cognitive impairments over time. Therefore, it is crucial to prevent stress and maintain overall health [1]. Nowadays, people use all kinds of strategies to cope with stress, for instance, some people spend time with their friends, some people listen to music in order to relax. Some researchers recently points out that greenspace is beneficial for people's health.

The term greenspace is typically defined as open, undeveloped land with natural vegetation [2]. Researches has shown that visiting a forest had greater benefits for improving stress levels than visiting an urban environment in 2011 [3], moreover, Berg and Custer finds out that gardening led to greater levels of stress reduction than a restful indoor task like reading [4]. Several studies have investigated the reasons why greenspaces improve health. Firstly, greenspaces can lead to social interactions, which benefit health [5]. Additionally, exposure to nature and sunlight can counteract certain diseases and aid in generating vitamin D [6]. Lastly, exercising in a greenspace area is more conducive to well-being compared to exercising indoors [7]. The following essay will discuss two studies that explore the relationship between stress and exposure to greenspaces, both utilizing cortisol measurement. Cortisol, often termed the "stress hormone," aids the body in responding to stress. Normally, cortisol output decreases over time, but when individuals face stressful situations,

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cortisol levels rise. However, prolonged or chronic stress can result in consistently elevated cortisol levels, which may adversely affect people's health [8].

## 2. Relationship between greenspace and stress

A review of research and essays on greenspace and stress from the past few years reveals a trend indicating that greenspace is associated with stress reduction, as measured by cortisol levels [8-10].

### 2.1. Study with cortisol measurement

According to the experiment titled 'Green Space and Stress: Evidence from cortisol measures in Deprived Urban Communities' conducted by Roe et al., hypothesized that increased availability of neighborhood green spaces is associated with reduced perceived stress and lower levels of physiological stress, as indicated by diurnal patterns of cortisol secretion. To test this hypothesis, the researchers employed a combination of self-report surveys and salivary cortisol measurements. A total of 106 participants, evenly divided between men and women and aged between 33 and 55, were included in the study. All participants were from deprived areas with Carstairs scores ranging from 5 to 7. Those who used oral steroids were excluded from participation. On two consecutive weekdays, participants were required to first self-report their perceived stress, well-being, and physical activities, followed by completing the salivary cortisol measurement. Each participant provided three samples of saliva per day at specified times: 3, 6, and 9 hours after awakening. To ensure accuracy, participants were instructed not to smoke, eat, or drink anything except water for 30 minutes before each sampling. After collection, participants were to freeze the samples and send them to the lab within five days. Researchers in the lab utilized the Enzyme-Linked Immuno-Sorbent Assay (ELISA) method to analyze the data. The results indicate a significant positive correlation between cortisol levels and the proportion of green space, as well as a significant negative correlation between perceived stress and green space percentage. Additionally, participants experienced higher perceived stress in areas with less green space, regardless of gender. Overall, women exhibited higher perceived stress levels compared to men, regardless of the green space availability in their surroundings. However, women and men exhibit different patterns of cortisol levels throughout the hours after awakening. In areas with low green space, women show a low and flat slope cycle, while men show a high and flat slope cycle. A low, flat cycle is associated with acute and chronic stress, whereas a high, flat cycle suggests more effective overall stress regulation. It appears that greater neighborhood green space may contribute to higher yet healthier cortisol levels in females and moderate unhealthily high cortisol levels in males. This study reinforces the concept that green spaces can aid in stress reduction, demonstrated through the use of cortisol measurements.

### 2.2. The extent of green space and its influence in stress

Having recognized the health benefits of green space exposure, another study suggests that it's not simply 'the more, the better,' as Shanahan discusses in the article 'Health Benefits From Nature Experiences Depend on Dose. The experimental procedure involved 160 participants (80 men, 78 women) subjected to the Trier Social Stress Test to induce psychological stress. Following the stress induction, participants were randomly assigned to view a 3D video of a neighborhood street lasting 6 minutes. The video depicted varying levels of tree cover, ranging from 1.7% to 62%. The researchers will measure participants' salivary cortisol levels and skin conductance levels both before and after they watch the video and undergo the Trier Social Stress Test, enabling them to assess changes in stress levels.The results reveal an inverse-U shaped curve for combined stress reduction in men and an irregularly shaped curve in women. Among men, the stress recovery pattern shows a dose-dependent response: stress recovery increases as tree density in the video ranges from 1.7% to

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24%. However, the stress recovery remains relatively stable between 24% and 34% tree density, followed by a slower recovery for tree densities above 34%. For men, moderate tree cover density elicited greater stress reduction than either low or high levels of tree cover density. It may due to that two much tree density cover the sunlight thus influence the stress reduction. While women display an irregularly shaped curve, it would be premature to conclude that there is no relationship between tree cover density and stress reduction for them. One possible explanation is that women may have different physiological reactions to stress compared to men. Various factors can influence cortisol levels in women, such as being in the follicular phase of their menstrual cycle or taking oral contraceptives. In conclusion, fostering greener living spaces can effectively reduce stress for men, thereby lowering the risk of chronic stress-related conditions such as cardiovascular diseases, depression, anxiety, and others.

## 3. Conclusion

Both studies underscore the positive impact of green spaces on mental health, suggesting that urban environments could benefit from increased tree planting to enhance overall well-being. However, a limitation in both studies is the observed gender differences. Women not only exhibit different cortisol responses than men but also encounter distinct stressors in their daily lives. Therefore, further research specifically focusing on gender, particularly on women, is warranted. The study on the relationship between greenspace and stress is limited by the lack of specific evidence showing a direct correlation. Future research should focus on the differences between men and women. Examining the impact of greenspace on different genders can help identify the most effective ways to cope with personal stress. Moreover, while greenspace is generally beneficial for reducing stress, the extent of its impact may vary across different cultural backgrounds. For example, people living in desert regions may experience different effects compared to those living in urban areas. Therefore, it is important to conduct studies in various locations to capture these differences. Moreover, stress reduction can be influenced by various factors such as relationships with family and friends, work-related stress, and more. In future studies, it is important to control for these influences.

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