
RESEARCH ARTICLE

People-plant Interaction: Plant Impact on Humans and Environment

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ABSTRACT

People-plant interaction studies the complex interactions that exist between humans and the natural environment, particularly plants; it is a thorough research that covers a wide range of views, including ecological, cultural, and psychological aspects. People-plant interaction, at its foundation, investigates how humans use plants as resources and imbue them with cultural and spiritual values, plants have provided humans with food, medicine, and shelter for millennia, and they have considerable cultural and symbolic importance in various nations and cultures. Furthermore, research on people-plant interactions emphasizes the numerous ways in which exposure to plants might promote human health. Exposure to nature, particularly plants, has been demonstrated in studies to help decrease stress and boost productivity. Indoor plants have been shown to enhance air quality and provide a more pleasant environment for humans to work and live in. With our planet's serious environmental issues, understanding the intricate interactions between humans and plants is more crucial than ever. Human-caused environmental changes, such as deforestation, pollution, and climate change, have a significant influence on the natural world, including plants.

KEYWORDS

Plants, Human well-being, Environment, Green spaces, Air quality, Physiological effects

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1. Introduction

Since ancient times, plants have been utilized for therapeutic purposes (Albahri, G. et al., 2023); plants have been discovered to have a major impact on many biological processes and systems, according to new studies on their impact on human physiology (Brown, E. M., et al. 2023). Certain plants, for example, may eliminate toxins and enhance air quality, both of which can aid respiratory health (Kumar P. et al., 2023). Exposure to flora and green areas has been related to decreased blood pressure, stress reduction, and enhanced cardiovascular health (Stepansky K. et al., 2023). Plants also have immune-boosting characteristics, with certain species possessing anti-inflammatory and antibacterial capabilities (Kaur, L. et al., 2023.), the presence of plants in both indoor and outdoor spaces has been shown to promote productivity, focus, and general well-being, resulting in the rise of gardening therapy as a supplemental therapy for a variety of health ailments (Niazi, P. et al. 2023, Wang, M., et al. 2023). Plants have been essential to human survival, supplying food, shelter, and therapeutic cures (Mohd Salim, J. et al., 2023); a recent study has shown that interactions between humans and plants improve human well-being (Goh, A. Y. et al. 2023). Various studies have demonstrated the beneficial effects of working with plants on physical and mental health, leading to the potential for agricultural therapy, which uses gardening as a form of treatment, to be recognized in healthcare settings (Russo, A., & Andreucci, M. B. 2023).

However, more research is required to understand the determinants of the benefits of people-plant interaction, as well as the mechanism behind horticultural therapy (Ip, C. M., 2023). Exposure to green areas and nature can strengthen social cohesiveness, decrease hostility, and encourage prosocial behaviors (Geppert C. et al., 2023). Plants in public areas might improve citizens' perceptions of safety and community, fostering a sense of belonging and identification (Escolà-Gascón et al., 2023). Workplace greenery may boost job satisfaction, reduce stress, and boost creativity and productivity (Voordt, T. V. D., & Jensen, P. A. 2023). Horticultural therapy improves social skills, self-esteem, and general well-being; incorporating plants into everyday life can have substantial positive effects on social dynamics and community health (Symes, L. et al., 2023). Plants can enhance air quality, reduce stress, lower blood pressure, boost mood, promote focus, and alleviate depression and anxiety symptoms (Moslehian, A. S., et al., 2023). Natural surroundings, such as green areas and indoor plants, have been associated with lower stress levels, fewer symptoms of sadness and anxiety, and improved general mood (Wen Q. et al., 2023, Ozturk, H. et al., 2023). Agricultural therapy can help with a variety of mental health issues, including depression and PTSD (Trauth J. N. et al., 2023); the possible psychological advantages of plants have given rise to biophilic design, which tries to incorporate natural elements into constructed settings to improve occupant well-being (Hindley, C. et al. 2023, Milliken, S., et al. 2023).

2. Plants and Human Well-Being

The link between plants and people is one of the oldest and most important in human history (Lewis Jr, C. M. et al., 2023); plants have played an important role in shaping human societies and cultures, from providing food and shelter to serving as a source of medicine and cultural symbolism (Colenbaugh, C., & Hagan, D. L. 2023). However, beyond their practical uses, plants also have a significant impact on human health and well-being, with numerous studies demonstrating the therapeutic benefits of interacting with plants. People-plant interaction refers to the dynamic relationship that exists between humans and plants (Ikeya, K., & Balée, W. (Eds.). 2023) and includes both the physical advantages of plant use as well as the intangible benefits of nature exposure and involvement on mood and cognitive levels (Guidi Nissim, W. et al. 2023), from gardening and horticultural therapy to biophilic design and urban green spaces, it has been demonstrated that interacting with plants can have numerous benefits for physical, psychological, and social health, including reduced stress and anxiety, improved mood and cognitive function, and enhanced social cohesion and community well-being (Martin, M. 2023).

As a result, study into the plant-human connection is becoming more important in fields such as public health, environmental science, and urban planning as we seek to comprehend the potential benefits of incorporating plants into our built surroundings and daily lives (Barron, S., & Rugel, E. J. 2023, Tongyu, W., et al. 2023). The study of plants and humans also encompasses broader issues such as conservation, sustainability, and the intersection of human and natural systems (Krug, A. S. et al., 2023). As our understanding of the relationship between plants and humans continue to evolve, it is becoming increasingly clear that this relationship is essential not only to our physical survival but also to our psychological and social well-being, as well as the long-term health and sustainability of our pluricultural systems.

Human well-being is a complex and multifaceted concept that encompasses various dimensions of health and happiness (Puce, L. et al., 2023); at its core, well-being refers to a state of being in which individuals can fulfill their basic needs, achieve their goals, and experience a sense of satisfaction and meaning in their lives (Martela, F., & Ryan, R. M. 2023), the concept of well-being has been the subject of extensive research in various fields, including psychology, sociology, and public health (Algado, S. S. 2023), as it is seen as a critical determinant of overall quality of life and social development. Well-being has physical, psychological, and social aspects, and each component is impacted by a variety of individual, societal, and environmental variables (Moreira, P. A., et al., 2023).

Physical well-being includes things like health, diet, exercise, and sleep, whereas psychological well-being includes things like emotional states, cognitive function, and subjective judgments of life pleasure and meaning (Durand-Sanchez, E. et al. 2023). The factors that influence well-being are complex and interrelated and include individual factors such as genetics and personality, social factors such as family and community, and environmental factors such as access to resources and quality of living conditions (Ellidge, D. 2023, Chang, Y. H., et al. 2023). It has been demonstrated that increasing well-being has multiple advantages for individuals and society, including improved health outcomes, higher productivity, and improved social cohesion and community development. As a result, increasing human well-being has been a major focus of public policy and social development activities across the world.

Table 1: Physiological and sociological effects of plants on human health and behavior

Effect	Physiological	(i) Sociological
Stress Reduction	Plants have been shown to reduce levels of the stress hormone cortisol in the body, leading to decreased feelings of stress and anxiety.	Exposure to natural settings, including plants, has been associated with increased social cohesion, reduced aggression, and improved mood and well-being.
Improved Air Quality	Plants can absorb and filter toxins from the air, leading to improved air quality and respiratory health.	The presence of plants in a workspace or public setting has been linked to improved job satisfaction, productivity, and overall well-being.
Pain Reduction	Exposure to natural settings, including plants, has been shown to reduce pain and promote healing after surgery or injury.	The use of plants in therapeutic settings, such as horticultural therapy, has been linked to improved mood, reduced stress and anxiety, and increased socialization and communication skills.
Improved Immune Function	The presence of plants has been linked to increased production of white blood cells, which help to fight off infection and disease.	The use of plants in therapeutic settings, such as horticultural therapy, has been linked to increased feelings of empowerment and control and improved self-esteem and confidence.

3. The Benefits of Plants in a Working Environment

For decades, the advantages of plants in the workplace have been acknowledged, with several studies confirming the good influence that plants may have on employee health, well-being, and productivity (Liu, J., & Green, R. J. 2023); plants have developed as a significant component of the biophilic design approach, which has gained appeal as a method of bringing nature into the built world (Rehan, N. M. 2023), to improve human health and well-being, the biophilic design seeks to create spaces that mimic natural environments and incorporate elements such as plants, natural light, and water features, incorporating plants into the workplace can have numerous benefits, including reduced stress and anxiety, improved mood and cognitive function, and increased productivity and creativity (Niazi, P. et al. 2023, Gray, T., & Birrell, C. 2014).

Plants may also help to enhance interior air quality by filtering out dangerous pollutants, which can have a big influence on employee health and happiness (Moya, T. A. et al. 2019); plants in the workplace can enhance social connection and community building, as employees come together to care for and appreciate their shared environment. As a result, the incorporation of plants into the workplace has become an important consideration for businesses and organizations seeking to create healthy, productive, and sustainable work environments (Porter, M. E., & Kramer, M. R. 2018); it has ramifications for areas such as architecture, interior design, human resources, and public health as we endeavor to understand the potential advantages of biophilic design and incorporate nature into our built surroundings in meaningful and effective ways (Kramer, M. R., & Porter, M. 2011).

Overall, the table highlights the numerous ways in which plants can have an impact on human health, both physically and socially. To better understand the physiological and sociological effects of plants in the context of people-plant interaction, we can better appreciate the importance of incorporating nature into our built environments and promoting the use of "green therapy" as a means of promoting health and well-being.

Table 2: The benefits of plants in a working environment

Benefit	Meaning	Example
Air purification	Plants absorb harmful pollutants and improve air quality	The Peace Lily plant can remove formaldehyde, benzene, and carbon monoxide from the air.
Stress reduction	Plants can reduce stress levels and increase productivity	A study showed that people who worked in offices with plants had lower stress levels and were more productive than those without plants.
Noise reduction	Plants can absorb sound and reduce noise levels	The Ficus plant is known for its ability to absorb sound and reduce noise levels in a working environment.
Aesthetics	Plants can improve the visual appeal of a workspace	Adding plants to an office can create a more welcoming and visually appealing environment.
Increased humidity	Plants release moisture into the air, increasing humidity levels	The Spider Plant is known for its ability to release moisture into the air, which can improve humidity levels and prevent dry skin and eyes.
Health benefits	Plants can have a positive impact on physical health	Aloe Vera plants contain a gel that can be used to treat minor cuts and burns, while the Mint plant can help soothe headaches and indigestion.
Improved focus	Plants can improve focus and concentration	It has been shown that being around plants can improve focus and concentration, leading to better work performance.
Cost-effective	Plants can be a cost-effective way to improve a workspace	Compared to other forms of office decor, plants can be relatively inexpensive and require minimal maintenance.

4. Green Spaces and Air Quality

Green spaces, or areas that are predominantly covered by vegetation, are important components of urban environments because they provide a variety of environmental, social, and economic benefits, such as improving air quality, mitigating the urban heat island effect, and improving community well-being (Xie, C., et al. 2023). The presence of plants is the primary contributor to the positive effects of green spaces (Falfán I. et al., 2023). Plants play an important role in the creation and maintenance of green areas, bringing multiple advantages to both the environment and humanity; they give wildlife habitat, prevent soil erosion, and assist in controlling the local climate by lowering temperatures and increasing humidity (Savitri, N. L. E., & Yanuwiadi, B. 2023).

The importance of plants in establishing and preserving green spaces cannot be stressed (Armstrong, E. M. et al., 2023). Whether in urban or rural settings, the presence of plants in our surroundings is critical for our health and well-being, as well as the health of the planet; we can build healthier, more sustainable, and vibrant communities for everybody if we recognize the significance of green spaces and invest in their maintenance and improvement (Papastergiou, E. et al. 2023). Plants have significant social and economic impacts in addition to their environmental benefits. Access to green spaces and plants has been linked to improved mental health and stress levels, as well as increased physical activity and social cohesion (Laprise, C. 2023). In urban areas, green spaces are also associated with increased property values, improved economic development, and lower crime rates (D'Alessandro, D., & Appolloni, L., 2023).

Air pollution is a major public health hazard across the world, accounting for an estimated 6.7 million premature deaths each year (Egerstrom N. et al., 2023). Human activities such as industrialization, transportation, and energy production contribute to the release of harmful pollutants into the atmosphere, such as carbon dioxide, nitrogen oxides, and volatile organic compounds (Richard, G. et al., 2022). Exposure to these pollutants can result in a variety of negative health effects, including respiratory illnesses, cardiovascular disease, and cancer (Richard G. et al., 2022, Kumar P. et al., 2023). Plants, fortunately, have the astonishing capacity to filter and purify the air, successfully eliminating harmful pollutants and poisons via a process known as phytoremediation (Wang Y. et al., 2023).

Plants absorb carbon dioxide and other harmful chemicals while releasing oxygen back into the atmosphere through photosynthesis, which not only helps to minimize air pollution but also adds to the general health of the ecosystem and the sustainability of our planet (Twi-Yeboah, N. et al., 2023). Plants' positive impacts on air quality have been extensively examined in both indoor and outdoor situations). Fernandes, A. et al. (2023), plants have been proven to enhance indoor air quality, minimize sick building syndrome symptoms, and promote productivity and well-being in workplaces and other public spaces; plants have also been demonstrated to lower levels of air pollution and improve respiratory health in metropolitan environments (Aziz, N. et al. 2023, Kiyani, A., et al., 2023).

Plants can improve air quality by filtering pollutants and toxins from the air using a process known as phytoremediation; they absorb carbon dioxide and other harmful gases while releasing oxygen into the atmosphere, which can help to reduce the amount of air pollution in both indoor and outdoor environments, resulting in better respiratory health for humans (Kumar, R. et al., 2023). Plants in interior areas can enhance air quality while also increasing productivity and well-being in offices and other public places (Kapoor, N. R. et al., 2023). Ultimately, the value of plants in improving air quality cannot be emphasized; by encouraging the use of plants in our built environments and lowering our reliance on hazardous pollutants, we can build healthier and more sustainable communities for ourselves and future generations.

Table 3 shows how green spaces can have a significant impact on human physiological and social outcomes, improving both physical and mental health outcomes, as well as promoting opportunities for outdoor recreation and education; green spaces can also promote community engagement and sustainable living practices.

Table 3: Practices, percentages, effect, and the role of green spaces on human physiological and social outcomes

Green space feature	Impact on air quality	% of air pollution reduction	Practice	Role in Physiological and Social Outcomes
Trees	Absorb pollutants and produce oxygen	Up to 60%	Planting trees in cities and along highways to reduce the concentration of pollutants in the air.	Trees can improve mental health outcomes, such as reducing stress and anxiety, and can also promote physical health outcomes, such as reducing the risk of cardiovascular disease. Additionally, trees can provide opportunities for social interaction and community engagement.
Grass and other plants	Trap dust and other particles	Up to 30%	Creating green spaces in urban areas helps trap dust and other particles in the air.	Green spaces can promote physical activity, such as walking and biking, and may also improve mental health outcomes, such as reducing symptoms of depression. Additionally, green spaces can provide opportunities for social interaction and community engagement.
Wetlands	Filter out pollutants and help regulate temperature	Up to 90%	Preserving or creating wetlands in areas with high levels of pollution to filter out pollutants before they reach the atmosphere.	Wetlands can promote physical health outcomes, such as improving air quality and reducing the risk of respiratory illnesses. Additionally, wetlands can provide opportunities for outdoor recreation and education.
Urban forests	Reduce temperature and absorb carbon dioxide	Up to 20%	Building urban forests in areas with high levels of pollution to help regulate temperature and absorb carbon dioxide.	Urban forests can promote relaxation and stress reduction and may also improve mental health outcomes, such as reducing symptoms of depression and anxiety. Additionally, urban forests can provide opportunities for outdoor recreation and education.
Green roofs	Improve air quality and reduce energy consumption	Up to 50%	Installing green roofs on buildings reduces the number of pollutants in the air and lower energy consumption.	Green roofs can promote physical health outcomes, such as improving air quality and reducing the risk of respiratory illnesses. Additionally, green roofs can provide opportunities for urban agriculture and may also promote sustainable living practices.

5. Conclusion

In conclusion, the field of people-plant interaction has gained attention in recent years due to the growing awareness of the positive impacts of nature on human well-being; this multidisciplinary area of research explores the interdependence and co-existence of plants and humans, highlighting the ecological, cultural, and psychological ties that exist between them. Studies from various countries have shown that working with plants has a beneficial impact on human health and the environment. While the benefits of horticultural therapy are evident, further research is needed to understand the underlying mechanisms that cause these effects. Large-scale epidemiological research can provide insights into the factors that drive the positive outcomes of people-plant interaction, paving the way for more sustainable and nature-friendly approaches to healthcare and environmental management. By examining the linkages between humans and plants, we can unlock the potential of nature to improve our well-being and

promote a healthier and happier future for all; as we continue to delve deeper into this field of study, we can uncover new ways of harnessing the power of plants to improve our lives and the world around us.

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