



Role of Green Infrastructure in Enhancing Mental Health through Green Roofs

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Abstract:

Urbanization has led to increased stress, anxiety and mental health challenges among City dwellers due to reduced access to environments. Green roofs have emerged innovative strategies for improving sustainability. These roofs also have important implications for mental health by reducing stress and fostering social well-being. This paper explores how green roofs help save energy by keeping buildings cooler in summer and warmer in winter. They also improve air quality by trapping dust and reducing pollution, green roofs absorb rainwater, which helps control runoff and reduces water pollution.

Keywords: Green Infrastructure, Green Roofs, mental health, social well-being, environment.

Introduction:

Green infrastructure it means strategic planned network of natural and man made green and blue spaces like parks, river, green roofs, street trees, forests, wetlands, rivers, streams, coastal habitats, green corridors that provides essential environmental, social and economic benefits such as cleaning air and water, managing stormwater, reducing urban heat, supporting biodiversity and enhancing human health and quality of life. Green roofs known as buildings that have growing plants and vegetation covering them either entirely or partially over a waterproofing membrane. Green roofs have several purposes such as absorbing rainwater, creating a habitat for wildlife and reducing water pollution. It contributes to mental health through direct indirect pathways: greenery on rooftops create visual and physical environments that promote relaxation and reduce mental stress. It improves environmental conditions by reducing building temperature, lowering noise levels and improving air quality all of which contribute to

encrypted comfort and reduced psychological discomfort. In addition accessible green roofs can be surveyed as social and recreational spaces encouraging interaction relaxation and community engagement which are important factors for emotional well being.

Green Infrastructure and Mental Health:

Green infrastructure plays an important role in supporting mental well-being. Studies show that people who spend time around greenery feel calmer and happier. Natural environments help reduce stress, improve concentration, and support emotional balance.

How Green Roofs Improve Mental Health:

Stress Reduction:

Green roofs create a peaceful environment that helps people relax. Plants, fresh air and natural views help reduce mental stress caused by noise.

Improve Mood and Focus:

Exposure to green spaces improves attention. It helps people feel refreshed and reduces mental tiredness.

Social Interaction:

Accessible green roofs provide spaces where people can meet, relax and socialize. Social interaction improves emotional well-being and reduces feelings of loneliness.

Better Environmental Comfort:

Green roofs help lower building temperature and reduce noise pollution. Comfortable environments help people feel calmer which indirectly support mental health.

Environmental Mediators:

It may also affect mental health indirectly by improving microclimate conditions (cooling roofs, reducing noise), enhancing aesthetics and offering opportunities for gardening, an activity linked to healing benefits.

Some plant spaces best for restorative and biodiverse roof gardens:

Certain plants species on green roofs due to their drought tolerance low maintenance and ability to support biodiversity while providing restorative visual and sensor benefits for mental health did select priority pollinator attraction year round interest, to rooftop conditions like wind heat and shallow soils. Native and hardware artist in Hans ecological value and static appeal for coming urban spaces. Grasses and perennials deliver textured, evergreen foil is for shaded areas promoting tranquility through soft rustling and low upkeep.

Research Objectives:

1. To study the role of green roofs in reducing stress by providing a peaceful environment with natural elements such as plants and fresh air.
2. To examine how exposure to two green roofs helps improve mood attention and mental focus.
3. To assess how green roofs enhance environmental comfort by reducing heat, noise and how this indirectly supports mental well-being.

Research Methodology:

This study adopts a descriptive and exploratory research design to examine how green roofs improve mental health; it also used secondary data to understand environmental benefits associated with green roofs.

Subject Discussion:

Although green roofs are smaller than parks, they are very useful in cities where space is limited. Regular exposure to green roofs, even for short periods, can improve mental health. When green roofs are designed to be accessible and comfortable, people are more likely to use them. More research is needed to understand how different designs and plant types affect mental well-being; however existing evidence clearly shows that green roofs are beneficial.

Major Challenges:**High Coast:**

The installation of green roofs involves high initial investment, including structural reinforcement, waterproofing, drainage system and plant materials. These costs discourage building owners and developers from adopting

green roofs especially in developing urban areas.

Maintenance requirement:

Green roofs require regular maintenance such as irrigation plant care and monitoring of drainage systems. Lack of proper maintenance can reduce their effectiveness and limit their long term mental health benefits

Limited Accessibility:

Many green roofs are not designed for public or user access.

Structural limitations of buildings:

Older buildings may not be actually capable of supporting the additional load of soil and vegetation. This limits the retrofitting of green roofs in existing urban structures.

Lack of Awareness and Expertise:

There is limited awareness among policy makers, architects and building owners about the mental health benefits of green roofs and lack of trained professionals in green roof design and maintenance poses a challenge.

Climatic and environmental constraints:

Climate conditions such as extreme heat, heavy rainfall or drought can affect plant survival on green roofs, unsuitable plant selection may reduce greenery quality and psychological benefits.

Policy and regulatory barriers:

In many regions green roofs implementation is not strongly supported by building codes or urban planning policies. Absence of incentive and regulatory support reduce white spread adaptation

Limited Empirical Evidence:

Although research on environmental benefits of green roofs is growing there is still limited large-scale, long term empirical evidence specifically linking green roofs to

mental health outcomes which affects policy acceptance.

Approach:

Green roofs as a key element of green infrastructure play a vital role in enhancing mental health by integrating nature into urban environments. Introducing stress boosts mood and promotes cognitive restoration through direct and indirect mechanisms. Exposure to Green roofs enhances concentration then it elevates serotonin in and dopamine fostering happiness and mindfulness suitable for activities like meditation or yoga. Cleaner air from pollutant filtration indirectly aids sleep and cognitive function reducing anxiety risks communal green roofs encourage social interactions through shared gardening combating isolation in dense cities. These spaces build collective Stewardship strengthening emotional well beings. Broader adaptation lowers City wide stress and even influences urban resilience metrics like reducing crime. Implementation strategies prioritise accessible design with diverse plants for biodiversity driven restoration integrated into public buildings for equitable access combining private mental health gains with societal benefits. It improves attention and emotional respite countering mental fatigue from City noise and pollution, cooler micro climates created by plantspiration further irritate and support relaxation.

Conclusion:

Green roofs are an important part of green structure. It plays a role in improving mental health. They help reduce stress, improve mood, support social interaction and create healthier environments as it continues to grow.

Including green roofs in building design and urban planning can help improve the mental well-being of urban populations.

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