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Trends in General Medicine

Forest Therapy and Garden Therapy: Theoretical Mechanisms, Functional Benefits and Current Global Practice-A Review

Cai-Zhu Hong[1], Meng-Ling Wu[2], Guan-Ying Lin[3], Hsin-Hui Wu[4] and Kun-Yuan Hong[4,5]*

[1]*National Pingtung University of Science and Technology, Department of Food Science, No. 1, Xuefu Road, Laopi Village, Neipu Township, Pingtung County, Taiwan.*

[2]*Researcher and Deputy Director, Taiwan Forestry Research Institute, Ministry of Agriculture. No. 67, Sanyuan St., Zhongzheng Dist., Taiwan.*

[3]*Silviculture Division, Taiwan Forestry Research Institute, Ministry of Agriculture. No. 67, Sanyuan St., Zhongzheng Dist., Taiwan.*

[4]*Forest Products Utilization Division, Taiwan Forestry Research Institute, Ministry of Agriculture. No. 67, Sanyuan St., Zhongzheng Dist., Taiwan.*

[5]*Department of Chinese Medicine and Institute of Traditional Medicine, National Yang Ming Chiao Tung University, No. 155, Sec. 2, Linong St., Beitou Dist., Taiwan.*

***Correspondence:**

Hong Kun-Yuan, Forest Products Utilization Division, Taiwan Forestry Research Institute, No. 67, Sanyuan St., Zhongzheng Dist., Taiwan, Tel: 02-23039978.

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ABSTRACT

Contemporary society faces an unprecedented wave of mental health crises and environmental degradation driven by rapid urbanization and technological integration. Natural interventions, specifically forest therapy and garden therapy, have emerged as vital, low-cost, and side-effect-free components of holistic preventive medicine. This paper clarifies the fundamental distinctions between these two healing models under the Plant-Based Adjunctive Therapies (PLAT) framework, categorizing forest therapy as passive, immersive Plant Perceptive Therapy (PPET) and garden therapy as active, reciprocal Horticultural Therapy (HT). Grounded in Attention Restoration Theory (ART) and Stress Recovery Theory (SRT), the therapeutic mechanisms are analyzed across environmental, experiential, and institutional dimensions. Empirical evidence demonstrates that forest therapy significantly enhances immune functions, such as natural killer (NK) cell activity via phytoncides, and regulates cardiovascular health. Conversely, garden therapy excels in accessibility and targeted rehabilitation, employing universal design features like circular paths and elevated planting beds to accommodate specific populations, including individuals with dementia, autism spectrum disorder, and visual impairments. Globally, natural healing is increasingly integrated into formal public health sectors, exemplified by Taiwan's professional green prescription certification, the United Kingdom's social prescribing scheme, and Europe's care farming initiatives. Despite their documented physiological and psychological benefits, transitioning these therapies into mainstream medicine requires overcoming challenges related to clinical standardization, dose-response quantification, and health insurance policy support. Ultimately, forest and garden therapies form a complementary matrix of perception and nurturing, mending the severed connection between humanity and nature while establishing a new paradigm for inclusive, sustainable, and holistic healthcare infrastructure.

Keywords
Attention Restoration Theory, Forest therapy, Garden therapy, Horticultural therapy, Preventive medicine.

Introduction

The Paradigm Shift in Contemporary Society and Natural Healing

In the 21st century, the global urbanization process and the high integration of technology have improved the convenience of material life, but have also triggered an unprecedented wave of "diseases of civilization". Contemporary human society is facing the dual challenges of mental health crisis and environmental degradation. About one billion people worldwide are affected by psychological distress to varying degrees, and "ecological anxiety" caused by climate change is gradually becoming a cross-generational source of collective stress [1].

Against this background, the field of public health has begun to re-examine the biological connection between humans and the natural environment, shifting from simple clinical medicine to more holistic preventive medicine. Forest therapy and garden/landscape therapy, as core components of a natural prescription, are important because they provide a low-cost, highly accessible, and side-effect-free intervention. Although both are rooted in the soothing power of plants on the mind and body, there are significant professional differences in the depth of intervention, the mode of interaction, the scale of space, and the expected clinical goals. Forest therapy tends to "sensory experience" of large-scale natural landscapes, emphasizing the immersive experience of the environment as a whole; while garden/landscape therapy emphasizes the "reciprocal relationship" and "functional operation" between the individual and the plants [2,3]. We clarify the academic differences between these two healing models through a systematic analysis of existing empirical research and theoretical frameworks, explore their physiological and psychological mechanisms of action, and summarize current design standards and industry practices in Taiwan and internationally, providing a scientific basis for future healthcare, landscape design, and social welfare policies.

Chapter 1: An Analysis of the Fundamental Differences Between Forest Healing and Garden Healing

Conceptual Framework: A Classification System for Plant-Based Adjunctive Therapies (PLAT)

To precisely define the differences between forest therapy and garden therapy, the academic community has proposed a framework called "Plant-Assisted Therapy" (PLAT). Within this system, human interaction with nature is categorized into two basic behavioral types (Table 1).

- **Plant Perceptive Therapy (PPET):** This model is based on human hunting behavior. Forest bathing is an example of this, where participants passively and immersively access the sensory resources provided by nature, primarily through sight, hearing, smell, and touch. The core of this behavior lies in a deep connection with the pristine environment, pursuing a holistic spiritual recovery and a "transcendental experience" [2,4].
- **Horticultural Therapy (HT):** This model is based on human "fostering behavior." The core of garden therapy often includes elements of horticultural therapy, emphasizing human cultivation, pruning, and maintenance of plants. In this model, the relationship between humans and nature is reciprocal, and participants transform from "those being cared for" to "caregivers," thereby gaining a sense of accomplishment, self-esteem, and fine motor skills training [2,5].

Table 1: Comparative analysis of spatial scale and depth of intervention.

Comparison Dimensions	Forest Therapy	Garden /Landscape Therapy
Environmental properties	Natural forests, wilderness, and semi-natural plantations	Healing gardens, hospital green spaces, urban gardens
Spatial Scale	Megalithic, vast and expansive	Microscopic, controlled, and ergonomically designed
Behavior orientation	Walking, static observation, sensory meditation	Planting, harvesting, crafting, social interaction
Technological intervention	Low, emphasizing the preservation of the natural and original state.	High, emphasizing accessibility facilities and specific planting configurations
Main mechanisms	Phytoncides (phytoncides), negative oxygen ions	Precise sensory stimulation, sense of accomplishment, social support
Target Group	Sub-health, high-pressure office workers, and the general public	Patients with chronic illnesses, elderly people with dementia, and children receiving special education

Forest therapy often exhibits significant physiological effects, particularly in boosting the immune system (such as NK cell activity), where high concentrations of volatile organic compounds (Phytoncides) in forests play a crucial role [4,6]. In contrast, garden therapy offers advantages in its high accessibility and targeted approach. For individuals with mobility impairments or specific rehabilitation needs, garden therapy can provide a safe and precise training environment through "healing elevated planting beds" or "sensory pathways" [7,8].

Chapter Two: The Core Theoretical System of Natural Healing

The two cornerstones of psychological recovery: ART and SRT

The therapeutic efficacy of forests and gardens is primarily based on two complementary psychological theories: Attention Recovery Theory (ART) and Stress Recovery Theory (SRT).

Attention Restoration Theory (ART) explores the restoration of cognitive function. In modern urban life, humans are forced to maintain high levels of "directed attention", leading to severe cognitive fatigue. Natural environments, especially forest edges or biodiverse gardens, provide "soft fascination", attracting human attention effortlessly and allowing directed attention to rest. An

effective healing space must possess "being away", "fascination", "compatibility" and "extension", allowing the mind to detach from the complexities of digital distractions [6,9,10].

Stress Recovery Theory (SRT) focuses on rapid emotional and physiological responses. Ulrich's research indicates that simply viewing natural scenery can trigger a relaxation response in the human nervous system. When the body senses safe natural elements (such as flowing water and green vegetation), sympathetic nerve activity decreases rapidly, while parasympathetic nerve activity begins to dominate. This is crucial for alleviating long-term psychological stress caused by modern life [9,11].

The Pro-Life Hypothesis and Spiritual Transcendence

In addition to cognitive and stress levels, the Biophilia Hypothesis suggests that humans' love for nature is an evolutionary genetic predisposition [9]. This instinct explains why forest environments can evoke "Awe Experiences". In mature forests (trees over 100 years old) or large-scale gardens, people feel a sense of "insignificance" and "compatibility" with the whole. This psychological state can effectively reduce anxiety caused by egocentrism and even replace the spiritual regulation function of traditional religions in some cultural contexts [4,12].

The three-dimensional mechanism of environment-experience-institution

A recent review suggests that the therapeutic effects of forests and gardens are not unidirectional, but rather a closed-loop system comprised of three levels:

- **Environmental base mechanism:** The biological, physical and landscape characteristics of forests and gardens (such as plant volatiles, microclimate and negative ions) directly regulate the neuroendocrine system [4].
- **Experience transformation mechanism:** Through structured activity design (from low-intensity static viewing to medium-intensity gardening operations), environmental resources are transformed into concrete health benefits [4].
- **Institutional guarantee mechanism:** Scientific resource management (such as planting configuration standards and certification paths) ensures the sustainability and professionalism of the therapeutic effect [4].

Chapter Three: Empirical Research Analysis of Physiological and Psychological Functions

(Note: Table 2 has been moved to the end of the manuscript as per guidelines.)

The positive effects of forests and parks on human physiological systems have been supported by a wealth of clinical data (Table 2). The most significant manifestation is the synergistic optimization of the nervous, endocrine, immune, and cardiovascular systems.

It is worth noting that physical factors unique to the forest environment, such as light intensity, can also affect the therapeutic effect. Studies have found that bright natural scenes are more effective at reducing stress than dark scenes [4]. In addition, the age of trees and the configuration of tree species in forests have significant differences in their health benefits: mature forests are generally more effective than young planted forests, while bamboo forests and dawn redwood forests are better than other forest stands at reducing heart rate [4].

Mental health: Emotional recovery and sleep quality

The psychological benefits are mainly reflected in the relief of negative emotions and the enhancement of positive emotions. Empirical studies show that short-term (20-30 minutes each time) contact with nature can significantly reduce physiological stress; in the long term, contact with nature for more than 120 minutes per week can significantly improve an individual's overall well-being [8].

- **Emotional regulation:** The Positive Emotional State Scale (POMS) test revealed that after participating in the natural healing program, participants experienced increased energy and calmness, while anxiety, depression, and fatigue decreased significantly. For example, in a study at the Taipei Botanical Garden, participants' "exhaustion" mood decreased to 35.1% of its original level after guided activities [4,13].
- **Sleep quality:** Experiments on high-pressure groups (such as medical staff, IT personnel, and pilots) have shown that forest bathing has a significant effect on improving the severity of insomnia (ISI) and daytime sleepiness (ESS), and its effect is better than traditional indoor routine therapy [4,9].
- **Social welfare:** The forest environment can promote social interaction, enhance community cohesion, and even help

Table 2: Physiological Regulation: Responses of the Nervous and Endocrine Systems.

Physiological system	Functional performance and empirical indicators	Description of Empirical Research Results
Nervous system	Stress regulation and relaxation	It significantly increases heart rate variability (HRV), reduces the concentration of oxyhemoglobin in the prefrontal cortex, and promotes parasympathetic dominance.
Endocrine system	Stress hormone balance	Significantly reduced salivary cortisol and norepinephrine levels, and improved glucose metabolism.
Immune system	Disease defense capabilities	It significantly increased the activity of natural killer cells (NK cells) and enhanced the expression of perforin and granzymes.
Cardiovascular system	Circulatory health	Lowering diastolic blood pressure and pulse rate, and increasing blood oxygen saturation; certain forest stands, such as bamboo forests, are more effective than mixed coniferous and broad-leaved forests.
Respiratory system	Anti-inflammatory benefits	It significantly improves COPD (Chronic Obstructive Pulmonary Disease) patients and reduces the level of pro-inflammatory cytokines.

groups who have suffered the pain of bereavement to rebuild their resilience [4,14].

Chapter Four: Design Principles and Practical Applications of Garden Therapy Healing Garden Creation

According to Roger Ulrich's environmental psychology theory and combined with the practical experience of Taiwan's forestry authorities, a successful healing garden must have five design elements to meet the physiological and socio-psychological needs of users [13]:

1. **Privacy and sense of control:** For those who are physically and mentally vulnerable, the unpredictability of the environment is a source of stress. The design should provide small, semi-sheltered spaces that allow users to freely choose to enter or leave. For example, the Taipei Botanical Garden uses "detachable bamboo blinds" to create temporary privacy areas in limited spaces [13].
2. **Social support:** The garden should not be just a place for solitary meditation. It should be a spacious and flat area for family members, caregivers or peer groups to socialize and enhance psychological resilience [7,8].
3. **Possibility for physical exercise:** Through gently sloping circular trails and multifunctional rest seats, users are encouraged to engage in non-stressful exercise [11].
4. **Natural elements:** This is the essence of healing, including the diversity of plants, the setting of water features, and the delicate use of microclimates such as light and shadow and cool breezes [11].
5. **Local materials:** Using native plants not only reduces maintenance costs, but also evokes the historical sentiments of local elders, which has profound significance for cultural creation and emotional comfort [11].

Functional design for specific groups

Lin Yuan Healing's strength lies in its "Universal Design", which can precisely meet the needs of different pathological characteristics (Table 3) [8,14,15].

Dementia and the Elderly

- **Circular and figure-eight paths:** Circular paths with a single entrance allow patients with a tendency to wander to walk within a safe range and avoid anxiety caused by getting lost or disoriented [15].
- **Variety of height planting beds:** Tabletop elevated planting beds (approximately 60-70 cm high) are designed for wheelchair users and provide sufficient knee space so that participants can have close contact with the plants [7,16].

Children with Autism Spectrum Disorder

- **Safety boundaries and enclosures:** Enclosed space design can prevent children from getting lost when they are overly excited.
- **Sensory adjustment space:** "Withdrawal spaces" must be set up so that children can have a dark and quiet haven to adjust themselves when they are overstimulated by their senses [14].

Visually and physically impaired individuals

- **Multi-sensory navigation:** Utilize different materials for the walking path (such as gravel, planks, and grass) to provide tactile guidance, combined with Braille signage [13,17].
- **High-contrast planting:** Plants with bright and contrasting leaf colors are selected to help visually impaired people navigate space [15].

Chapter 5: Industry Status and Global Practice Trends

Taiwan: From Environmental Education to Health Promotion

Taiwan's current development of garden therapy is at a critical stage of professionalization. Government agencies such as the Forest Research Institute of the Ministry of Agriculture (TFRI) are actively developing therapeutic demonstration sites. The "Healing Garden" at Taipei Botanical Garden has become a model of urban natural therapy. Their research shows that through professionally guided five-sense experience activities (such as "Hearing the Breath of the Forest" and "Looking Up at the Canopy of Trees"), the mental health of the subjects can be significantly improved, with a satisfaction score as high as 9.07 [11].

In terms of industry training, the Taiwan Great Vision Green Living Association has partnered with several universities (such as National Cheng Kung University, Kaohsiung University of Hospitality and Tourism, and National Chung Hsing University) to offer certification courses in garden therapy. The courses cover therapeutic space planning, horticultural therapy, and the crucial "risk management" [18]. This shows that the Taiwanese industry is trying to transform garden therapy from a simple outdoor activity into an auxiliary medical industry with the potential to become a "green prescription".

Table 3: Five Senses Plant Selection and Configuration Standards.

Sensory dimensions	Design Goals	Recommended plant and elemental indicators
Visual	Color psychology adjustment and seasonal perception	Brightly colored annual flowering plants (such as marigolds and sage), and variegated schefflera with distinctive leaf colors.
Sense of smell	Memory connection, calming and soothing	Fragrant flowers (magnolia, osmanthus, Murraya paniculata), herbs (rosemary, mint, lavender).
Hearing	Masking noise and arousing curiosity	Fountains, water walls, nectar-producing plants that attract insects and birds, and bamboo groves that make sounds when the wind blows.
Touch	Texture experience, physical empowerment	Hairy leaves (sheep's ear grass), rough bark, smooth leaves (aloe vera), a multi-material walkway.
Taste	Spicy experience, self-sufficiency	Taiwanese lemon, taro, mint, basil, strawberry, tomato.

International Practice: Social Prescriptions and Farm Healing

In the international arena, natural healing has gradually been incorporated into the formal public health system.

- **Social Prescribing in the UK:** The National Health Service (NHS) has begun to promote non-pharmacological interventions. Physicians can refer patients with depression or anxiety to community programs that participate in Social and Medical Gardening (STH). Studies have shown that STH can significantly reduce healthcare budget expenditures and improve the problem of non-adherence [19].
- **European farm therapy (Care Farming):** In the Netherlands, Norway and other places, agricultural activities are transformed into a therapeutic means. Participants feed animals and cultivate crops in a real farm environment. This "informal situation" and "sense of usefulness" have significant social integration benefits for patients with post-traumatic stress disorder (PTSD) and rehabilitated individuals [12].
- **Japan and South Korea promote their policies:** Japan is committed to developing forest medicine and forest bathing site certification; South Korea is using its abundant forest resources to develop standardized forest therapy programs for different occupational groups (such as high-pressure teachers and medical staff) and conduct large-scale physiological indicator monitoring [13,20].

Chapter 6: The Goal System and Future Prospects of Forest-Garden therapy

Core goal: Holistic health encompassing body, mind, spirit, and environment.

The promotion of Lin Yuan Healing is not a single-dimensional leisure activity, but rather aims to achieve a multi-layered system of goals:

- **Physiological aspects:** By lowering blood pressure and cortisol and enhancing immune activity, it can prevent chronic diseases and accelerate post-illness recovery.
- **Psychological aspect:** Provides an emotional buffer zone, alleviates anxiety and depression in modern people, and rebuilds attention resources [5,9].
- **Social aspect:** Through the social nature of gardening activities, the loneliness in urban life can be alleviated, and a social training field for disadvantaged groups can be provided [3,8].
- **Environmental aspects:** Raise public awareness of biodiversity conservation and use healing gardens for the conservation of endangered plants (such as the Botanical Garden Ark Project) [11].

Future Challenges and Integration Path

Despite the potential of forest therapy, it still faces many challenges in becoming a mainstream complementary medical approach:

- **Standardization and quantification:** A more explicit dose-response model needs to be established. For example, what frequency and duration of gardening operations should be used to address different intensities of depression [4].
- **Digital empowerment:** With the development of VR/AI technology, digital nature or virtual forest therapy may become an important alternative for bedridden patients who cannot enter the natural environment in person. Related studies have found that bright virtual forest environments have stress-relieving effects [4,21].
- **Insurance and policy support:** Including forest therapy in the coverage of health insurance or long-term care system is the key to the large-scale development of this industry. This requires more long-term, large-scale randomized controlled trials (RCTs) to support its economic effect analysis [19].

Conclusion

Forest healing and garden healing each have their own unique characteristics, and both construct a complete map of the connection between humanity and nature through "perception" and "nurturing". Forests, with their abundant biochemical energy (phytoncides, negative ions), reshape the human immune defense; while gardens, with their user-friendly ergonomic design and functional operation, empower the elderly, women, children, and patients with the ability to self-repair.

In contemporary society, these two are no longer luxuries, but essential "urban infrastructure". Through scientific design principles, professional guidance, and cross-disciplinary policy integration, forest-based healing has the potential to become a new paradigm of preventive medicine, mending the relationship between humans and nature that has been severed by modern cities through the touch of every blade of grass, every inch of soil, and every stone. In the future, when "natural prescriptions" stand alongside medical prescriptions, we will truly be stepping into a new era of inclusive and sustainable health.

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