A CULTURAL LANDSCAPE: CREATING THERAPEUTIC GARDENS FOR CHINESE SENIOR RESIDENTS

by

YIMING HUANG

(Under the Direction of Sunkyung Lee)

ABSTRACT

Although research on therapeutic gardens has addressed pathologically specific populations such as pediatric, psychiatric, geriatric, and Alzheimer's patients, these studies rarely provide insight into designing healing gardens for a culturally specific population. The primary goal of this thesis is to integrate Chinese cultural connotation into western therapeutic garden design theories in order to design therapeutic gardens specific to Chinese senior residents. This thesis reviews publications that discuss theories on nature, the characteristics of the elderly demographics as well as the notion of health preservation, traditional Chinese medicine, and the Five Elements Theory in Chinese culture, generates guidelines by analyzing the elderly's needs, proposes a design concept derived from the notion of health preservation, and applies the guidelines and the design concept into the therapeutic garden design at the Dongtan Senior Community, Shanghai, China.

INDEX WORDS: landscape architecture, therapeutic gardens, Chinese elderly population, Chinese Five Elements Theory, plant selection

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

As nature has been extensively researched for its therapeutic benefits, therapeutic gardens have been especially proved to alleviate patients' pain and suffering, reduce their stress, and promote their physical and mental health (Ulrich 1979, 1984; Kaplan and Kaplan 1977). Current research and design guidelines for therapeutic gardens primarily target pathologically specific populations that includes pediatric, psychiatric, geriatric, and Alzheimer's patients (Marcus and Barnes 1999); however, these research studies rarely provide insight into designing healing gardens for a culturally specific population. To gain insight requires that landscape architects consider and explore the cultural influence of context design on therapeutic gardens. Context design, which reflects the understanding of local culture and shows respect for the culturally specific population, is what directly makes the design successful. Therefore, the key to developing an appropriate context design of therapeutic gardens for a culturally specific population is to integrate the local culture into the existing framework for a therapeutic garden design.

As China has witnessed a rapidly increasing aging population during the past several years, the therapeutic garden specific to the needs of the elderly population has become more desirable in China (Sun 2011). The therapeutic garden design for the elderly Chinese population requires that landscape architects consider the influence of Chinese culture on design concepts for context designs. Chinese culture considers the human being as an essential part of nature while western culture often regards nature as a healing tool that serves humans in a supplementary way. The differing perspective of the relationship between humans and nature in Chinese culture and western therapeutic design philosophy results in differing design concepts. This thesis acknowledges the differences between eastern and western culture and attempts to create a design that reflects Chinese culture that deeply roots itself in Chinese seniors. With the aim to integrate Chinese culture into therapeutic garden design theories, this thesis will also design therapeutic gardens specific to Chinese seniors. Therefore, the question this thesis seeks to answer is how to integrate Chinese culture into western therapeutic garden designs for a culturally specific population and, in particular, how to interpret the connotations of Chinese culture into a therapeutic design vocabulary that benefits Chinese seniors.

1.2 Site: Shanghai Dongtan Senior Community

The Shanghai Dongtan Senior Community (DSC) will be built as a high-end residential community designed for those Chinese elderly who are seeking a safe and comfortable environment to improve their quality of life. The proposed location of the DSC is on Chongming Island, on the northeastern corner of downtown Shanghai, China. The area is currently covered by farmland, and the construction should be completed by 2015. The current site of the project, with its fresh air, quiet atmosphere, and ecological environment, make it suitable for an elderly population. Steinberg Architects Group is in charge of the architectural design of the DSC. The proposed plan for the DSC indicates that it includes several residential areas. This thesis designs therapeutic gardens for only the southwest area of the site (Figure 1.1).

The DSC has been selected for three reasons. First, senior communities, instead of geriatric hospitals or traditional healthcare facilities, have gradually become the Chinese elderly's preferred living environment, which can provide them a comfortable lifestyle as well as advanced medical facilities and quality service. Second, the proposed location of the DSC will offer an advantage not found in other locations in Shanghai—a quiet atmosphere with fresh air and convenient facilities around the site. The excellent location and the ecological environment provide suitable conditions to apply design concepts. Last, but not least, the new design concept derived from the notion of health preservation may increase the residents' sense of belonging. Due to the western building style and strange garden spaces, new design concept for therapeutic gardens specific to elderly residents may provide an opportunity to connect the residents and the new environment by using Chinese culture and related notions they are familiar with.

The design site within the DSC has been selected for two reasons. First and foremost, the choice of this site relies on the developer's original plan, which has assigned this area as a Continuing Care Retirement Community (CCRC) for seniors with chronic diseases. Therefore, the developer plans to build this site as an experimental landscape model by using a novel design concept derived from the notion of health preservation in Chinese culture. Additionally, the author also offers his own perspectives to justify the choice of this site. These perspectives will be discussed fully in chapter five.

1.3 Thesis Methodology

Projective design is the major research methodology of this thesis. The projective design includes both a literature review and a generative design that leads to the therapeutic garden design for the Dongtan Senior Community in Shanghai, China.

Figure 1.1 Architectural Master Plan of the Project
Figure Source: Provided by Steinberg Architects Group

The literature review provides a comprehensive retrospective of the therapeutic benefits of nature, the characteristics of the elderly population, and the Five Elements Theory in Chinese culture. The therapeutic benefits of nature reveal nature and gardens as restorative agents, which address the patients' recovery process. Marcus's (1999) design suggestions for the therapeutic garden with the purpose to foster a sense of control, to provide more opportunities for social support, to enrich the diversity of exercise activities, and to strengthen the functions of natural distraction, illustrate how the design processes are related to the therapeutic benefits of nature and gardens. In addition, studies on the characteristics of the elderly population explore the different requirements for psychological and physiological well-being. The psychological characteristics of the elderly are interpreted to establish the attributes of the ideal environment. The review of sensory experiences explores the sensory stimulations that help improve the elderly's physical functions according to their physiological characteristics. These analyses result in a framework that is used for more in-depth studies of the attributes of suitable environments as well as suggestions of making garden designs specific to the elderly residents. Lastly, through the introduction of the Five Elements Theory, Chinese culture can be translated into specific design vocabulary in terms of plant selections and sensory experiences.

The generative design provides a new framework for therapeutic gardens. In specific, the selections of plant materials and the design suggestions for sensory environments are combined with a general therapeutic garden approach and the attributes of suitable environments for the elderly to generate a new set of guidelines for a therapeutic garden design specific to Chinese elderly population (Figure 1.2). Moreover, the DSC utilizes the notion of health preservation as its design concept to build a cultural connection among the plant species, the five senses, and the five organs of the human body.

The final product of this thesis is the application of the therapeutic garden design at the DSC. This thesis utilizes design guidelines specific to the elderly population, design concepts derived from traditional Chinese culture, and the site analysis in order to generate a therapeutic garden design specific to the site. Design guidelines and plant selections are provided to assist others in the local development of therapeutic gardens at senior communities in China.

1.4 Thesis Structure

Chapter two primarily discusses previous research regarding the healing power of nature in order to explore a set of guidelines for general therapeutic garden design. The Kaplans' (1989) and Ulrich's (1979) theories provide the empirical data and evidence that argue exposure to natural environments can reduce stress and improve psychological well-being. Based on Ulrich's foundings, Marcus (1999) proposed a set of general suggestions for a therapeutic garden design. Her suggestions aim to promote a sense of control, provide more opportunities for social support, enhance the diversity of outdoor activities, and amplify the distractive functions of natural elements.

Chapter three explores the attributes of a suitable living environment for the elderly by analyzing their physical and psychological characteristics. This chapter explains the benefits of a rich sensory environment by looking at the physiological characteristics of the elderly. Multiple sensory stimulations can beneficially create a restorative landscape that promotes physical health, while the psychological characteristics of the elderly suggest the unique attributes of an ideal environment designed for them. With both the ideal environment and the sensory environmental design incorporated into Marcus's suggestions for therapeutic garden design, this paper develops a set of design guidelines specific to the Chinese elderly population.

Chapter four investigates the cultural connections between nature and Chinese traditions in order to tailor the Western therapeutic gardens to the Chinese context. Chapter four introduces Daoism, traditional Chinese medicine, and the Five Elements Theory to explain how Chinese culture can influence and be integrated into therapeutic garden designs because of their inherent connections. In order to translate the cultural connotations into concrete design terminology, this chapter mainly explores an alternative classification of plant materials to be used to design healing gardens with an emphasis on the Five Elements Theory, thereby building a correspondence between the plant species and the organs of the human body.

Chapter five discusses design application, and develops a therapeutic garden design for the DSC by using the mentioned guidelines and a new concept that includes the notion of health preservation and plant selection derived from the Five Elements Theory. Chapter six summarizes the major points of this thesis and provides a critique of these major points.

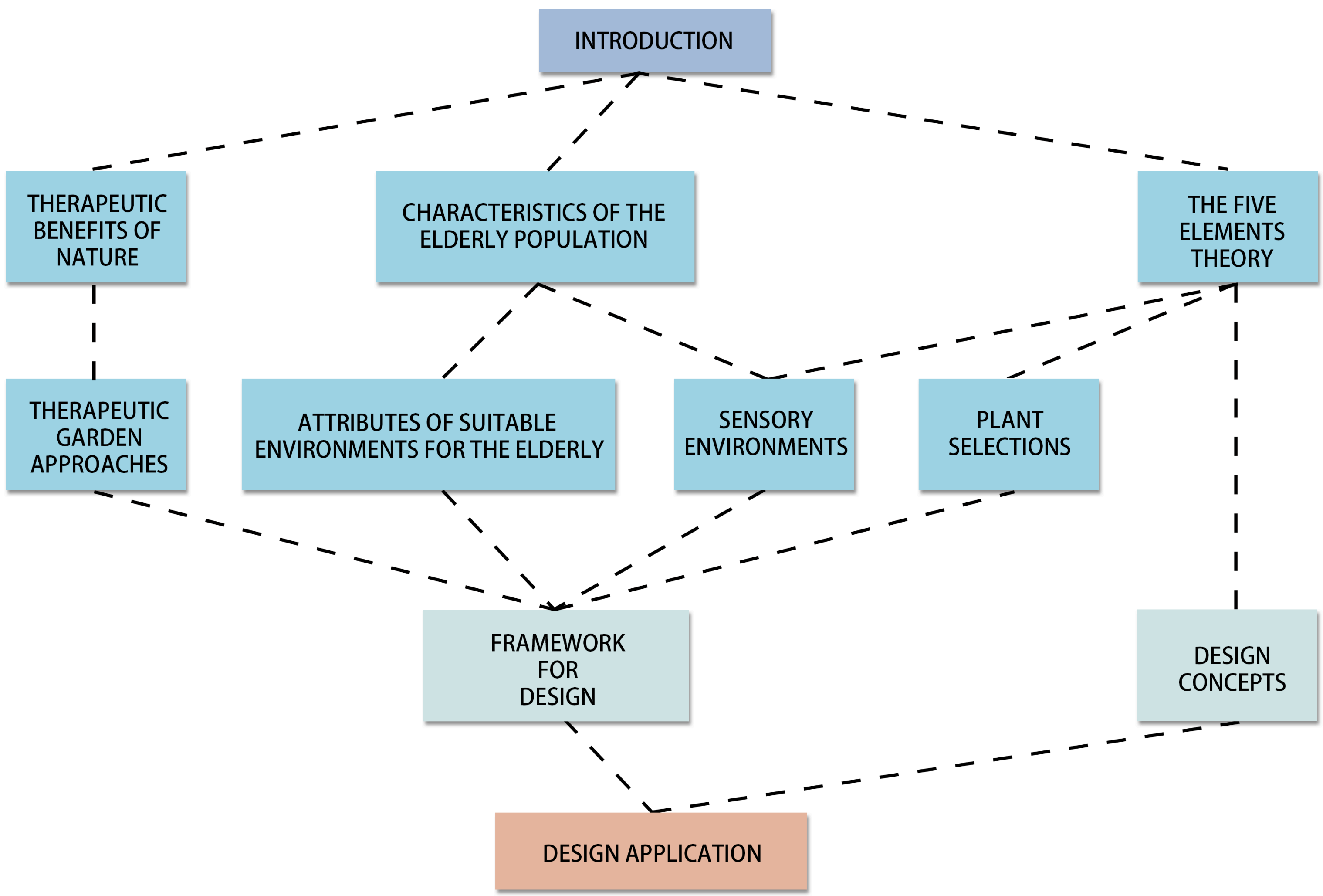


Figure 1.2 Design Methodology
Figure Source: Drawn by the author

CHAPTER 2

THERAPEUTIC BENEFITS OF NATURE

Healing gardens have been used to restore humans' mental health for several centuries (Warner Jr 1995; Horsburgh Jr 1995; Burnett 1997; Ulrich and Parsons 1992). Traces of healing gardens can be found in many different civilizations, ranging from the European monastic cloister gardens to Japanese Zen gardens. According to Marcus and Barnes (1999, 9), "The monastic cloister garden was one of the earliest outdoor spaces designed for contemplation and healing." The hospitals of Roman troops used gardens and open spaces to improve patients' recovery (Kavanaugh 2005). The Zen garden originally was created for meditating, refining one's spirituality, and experiencing enlightenment as well as for teaching its religious principles.

During the past two decades, interest in the theory, design and function of therapeutic gardens has increasingly grown in North America, Europe, and Japan. A variety of theories concerned with the relationship between humans and nature have appeared. These theorists define *healing landscapes* from different perspectives to illustrate why nature plays such an important role in psychological well-being. Massive research has shown that exposure to the natural environment reduces stress and improves health outcomes and mental well-being (Ulrich 1984; Hartig et al. 2003; Kaplan 2001; Kaplan and Kaplan 1989). The term *healing* means the capability to restore or promote health (Marcus and Barnes 1999). However, being healthy encompasses more than not being ill. Being healthy is a status that maintains a balance among various functions, such as the physical and the psychological, at an appropriate level. Preserving such a balance requires paying close attention to mental health. The healing garden is designed to create fulfillment on a spiritual level by allowing its users to interact with it.

Several complementary and overlapping theories can describe how the therapeutic process occurs and functions. Rachel Kaplan's and Stephen Kaplan's Attention Restoration Theory and Roger S, Ulrich's Stress Theory are the two major and most widely accepted theories. This chapter will discuss these two major theories of how the therapeutic landscape process occurs and functions. These scientific measurements of the benefits of nature truly reflect the western scholars' generally accepted attitude towards nature; namely, that nature is a tool for the human body to improve physical and mental health. Thus, Clare Cooper Marcus's suggestions for designing a general therapeutic garden can be utilized as a reference for applying physical design principles for creating therapeutic gardens for the elderly population.

2.1 Kaplans' Attention Restoration Theory

Rachel Kaplan is a professor of Natural Resources at the University of Michigan. Her husband and research partner, Stephen Kaplan, is a professor in the Department of Psychology at the University of Michigan. The Kaplans are known for their research on the positive effects of nature on human health. Their work on restorative environments and the Attention Restoration Theory (ART) have impacted and supported the development of healing gardens. According to the Attention Restoration Theory, spending time in nature or even viewing nature can lift people's moods and enhance their ability to focus. In order to explain how nature affects and restores humans' psychological health, the Kaplans have discussed humans' perception towards nature as well as the relationship between humans' attention fatigue and restorative environments.

The Preference Matrix

To understand the surrounding environment and to have opportunities for exploration are basic human needs (Kaplan, Kaplan, and Ryan 1998). Understanding is a way that people process what goes on in the world around them. After gradually understanding their living environment, people become curious to excavate the mysterious world beyond, to seek more information, and to discover new challenges. Countless information is hidden in the environment. The Kaplans regarded the environment as a source of information. The environment can convey information in various ways, for example, through the ringing of bells and clouds moving across the sky, or even in picturesque scenery. Whether this information is perceived directly or indirectly, the environment always conveys the information with related content: bells, clouds, sky, trees, houses, and gardens. This content is comprised of the unique elements that distinguish their setting from another. For example, a garden setting that has only a variety of non-edible plants implies a garden different from one full of vegetables and fruits. Even though the contents of the gardens are similar, they may present different meanings. Places are more than their contents. The information in an environment also depends on the organization of its contents (Kaplan, Kaplan, and Ryan 1998). Thus, "an environment can be defined by its contents and their organization" (Kaplan, Kaplan, and Ryan 1998, 10). The Kaplan's previous research on environmental preferences demonstrated that the places individuals favored were highly related to their organization. The highly preferred scenes were those of spaced trees and smooth ground, while those of large expanses of undifferentiated landcovers were not highly valued (Kaplan, Kaplan, and Ryan 1998). Such scenes offered a strong contrast to both the expansive area and the blocked views. These kinds of scenes had large areas with a center to focus on. They met the basic human need to understand and explore the surrounding environment.

Besides supplying the framework to understand and explore, the Kaplans also provided four informational factors on which they based design suggestions in their later research. These four factors are coherence, legibility, complexity, and mystery. Along with the framework to understand and explore, they constitute a "Preference Matrix" (Table 2.1) (Kaplan and Kaplan 1989, 53; Kaplan, Kaplan, and Ryan 1998, 13) that helps form criteria for landscape assessment, which are related to what kinds of places people prefer and how comfortable people feel in a place. The Kaplans considered coherence and complexity as a "picture plane" or two-dimensional pattern because observers can directly understand and explore them. Those two criteria provide immediate information. On the contrary, legibility and mystery are inferred information deeply rooted in the setting, but not apparent. The Kaplans regarded such information as a three-dimensional pattern representing clues inside rather than on the surface of the picture. A highly coherent setting is a well-organized, orderly, and clear scene with less complexity. Complexity provides visual richness and depth. "Greater richness or variety in such landscapes would encourage exploration" (Kaplan, Kaplan, and Ryan 1998, 14). Legibility means that places with distinctive landmarks or memorable components can be recognized and organized into a coherent pattern. Mystery stimulates people's desire to explore the shadows behind the scenes. The framework to understand and explore offers an explanation about the relationship between humans and their nature on the basis of the

Biophilia Hypothesis. Humans' preferences, attractions, and tendencies towards natural habitats derive from thousands of years of evolution, development, and experience (Wilson 1984). In other words, during the long process of human evolution, contact with nature and a preference for the natural environment have become deeply rooted in human minds. Consequently, the Kaplans suggested that people today can accept and prefer certain characteristics and specific arrangements of natural environments, which satisfied our ancestors' basic living needs, can be accepted and preferred by people today as well (Kaplan and Kaplan 1977). In addition, the Kaplans collected scientific data and demonstrated that these four informational factors—coherence, legibility, complexity, and mystery—are the key variables in landscape assessment. Even a limited amount of these four elements can make a substantial difference in humans' feelings and attitudes towards a place (Kaplan, Kaplan, and Ryan 1998).

Table 2.1 Preference Matrix
Table Source: Rachel Kaplan and Stephen Kaplan (1989, 53);
Rachel Kaplan, Stephen Kaplan, and Robert Ryan (1998, 13)

	UNDERSTANDING	**EXPLORATION**
IMMEDIATE INFORMATION (2D)	Coherence	Complexity
INFERRED INFORMATION (3D)	Legibility	Mystery

The Restorative Environment

Based on their previous research on The Preference Matrix, The Kaplans developed the Attention Restoration Theory to help explain why preferred natural environments or landscapes contribute to the promotion of good health. According to the Kaplans, our attention is easily distracted by modern life, which is filled with the pursuit of trivial activity, causing a great deal of mental fatigue. In addition, the Kaplans separated attention into two components: "involuntary attention, where attention is captured by inherently intriguing or important stimuli, and voluntary or directed attention, where attention is directed by cognitive-control processes" (Berman, Jonides, and Kaplan 2008, 1207). People lose their patience and become stressed more easily when directed attention wears them down. Under such circumstances, it is hard for them to solve problems, to deal with stress-related work, or even to concentrate on needed work. Their attention shifts quickly to other attractions. Mental fatigue comes about in several ways. For example, staring at a computer screen for a long time without relaxing results in an accumulation of fatigue.

The Preference Matrix has demonstrated that humans were born with a preference for dealing with information in natural settings without making additional efforts that consume directed attention. The Kaplans argued that natural environments or activities could restore directed attention, relieve stress, and improve moods and cognitive functions (Kaplan and Kaplan 1989). The restorative process occurs when humans are exposed to nature so that they imagine themselves to be involved in outdoor activities and can recall the pleasant time they spent. Nevertheless, a restorative environment or a therapeutic landscape must have specific characteristics. The Kaplans consolidated their previous research and interviews to identify four important goals for creating a restorative setting that allows directed attention to be recovered and involuntary attention to be involved.

Being away: People with mental fatigue require an attractive place different from the source of their fatigue. *Away* means a change of the environment instead of a change of the distance from it. For example, wandering around in a garden near the office during lunchtime and even looking out a window are ways to get away from accumulated stress and mental fatigue.

Extent: One distinctive characteristic of restorative settings is a difference in their extent. Reading a novel, visiting a museum, and hiking in a valley can be regarded as completely different physical and mental experiences. The term *extent* here refers to either the wide breadth of the physical boundaries of these activities or the richness of psychological activities.

Fascination: Fascination is highly related to extent. An attractive place allows people to open their minds and use their imagination in an unlimited manner. On the other hand, an expansive open space without any center to focus on can be boring and sterile. Nature, which is full of interesting elements and which is one source of people's imagination, can be described as a place with fascination.

Compatibility: Compatibility, which is an indispensable characteristic of restorative settings, and perhaps the most important characteristic, involves whether or not environmental circumstances match people's inclinations. Without taking humans' needs into consideration, design is meaningless.

Being away, extent, fascination, and compatibility together constitute a setting with restorative experiences and functions. The preferred natural environment that includes all four components provides humans the stimulation for accumulating involuntary attention as well as for restoring directed attention. Thus, the process of how the preferred natural environment contributes to humans' mental health was elaborated by the Kaplans' Attention Restoration Theory.

2.2 Ulrich's Stress Theory

For several years Roger S. Ulrich, who is the director of the Center for Health Systems and Design at Texas A&M University, has concentrated on the effects of gardens on health outcomes. Health outcome is a criterion used to evaluate the quality of healthcare. The performance forms of health outcomes, such as blood pressure, the quality of life, patient satisfaction, infection rate, and the cost of patient care, vary. All of these health outcomes are used to judge whether a treatment or a service is medically effective and cost-efficient. One major factor that affects people's health outcome is stress. Much research has demonstrated that stress is prevalent in most patients. Stress stems from two major sources for patients: internal illness and external environments. An impending surgery, a painful medical procedure, and the loss of control bring endless fears. Noisy institutional environments, the lack of privacy, and blocked social interactions increase feelings of anxiety and depression. Also, stress resulting from internal illness can be divided into two levels. The psychological level includes a sense of hopelessness. The physiological level involves the deterioration of various body systems. These negative effects generated by stress can lead to abnormal or even extreme behaviors, such as drug abuse, which work against wellness. For long-term patients, stress can potentially reduce the effectiveness of medications (Ulrich 1991).

Not only does stress affect patients, but it also affects the moods of patients' family members, healthcare staff, and visitors in health facilities. For families of patients, recent research has demonstrated that the immune systems of the caregivers of patients with Alzheimer's Disease are vulnerable when they are under severe stress for a long period of time (Kiecolt-Glaser et al. 1996). Job-related stress is prevalent among health facility personnel (Parkes 1982). The quality of the healthcare they provide will reduce and adversely affect the patients' wellness when they themselves experience stress. The high rate of turnover among healthcare staff is a particularly salient example of this phenomenon. Ulrich also agreed with Edward Wilson's Biophilia hypothesis, which states "that humans have a partly genetic tendency to pay attention to, affiliate with, and otherwise respond positively to nature" (Wilson 1984). For example, people would rather spend their vacations in rural environments than stay in urban settings with work pressure, noise, and disturbance. In Ulrich's research on the benefits of nature to the human body, Ulrich argued that contact with nature promotes people's physical and mental health (Ulrich et al. 1991). Moreover, Ulrich and other researchers concentrated on a scientific method to examine how nature benefits human health (Figure 2.1 to 2.3) (Marcus and Barnes 1999, 36; Kellert, Heerwagen, and Mador 2008). Viewing nature reduces patient stress in obvious and significant ways. Even briefly viewing natural scenes or elements can help decrease blood pressure, muscle tension, and skin conductance. Exposure to nature can reduce negative emotions and foster significant mental recovery. Furthermore, several studies showed that some built or urban settings fail to produce restoration, and even worsen stress (Ulrich 1979; Van den Berg, Koole, and van der Wulp 2003). Because of the research confirming the positive effects of natural environments on human health, Ulrich proposed a theory of supportive design, which aims to foster stress reduction. Health outcomes are greatly influenced by healthcare facility design. Consequently, they provide a credible basis for assessing whether a design meets the patients' basic living needs, helps patients achieve a desirable level of psychological satisfaction, reduces patients stress derived from various aspects, and offers restorative functions for patient

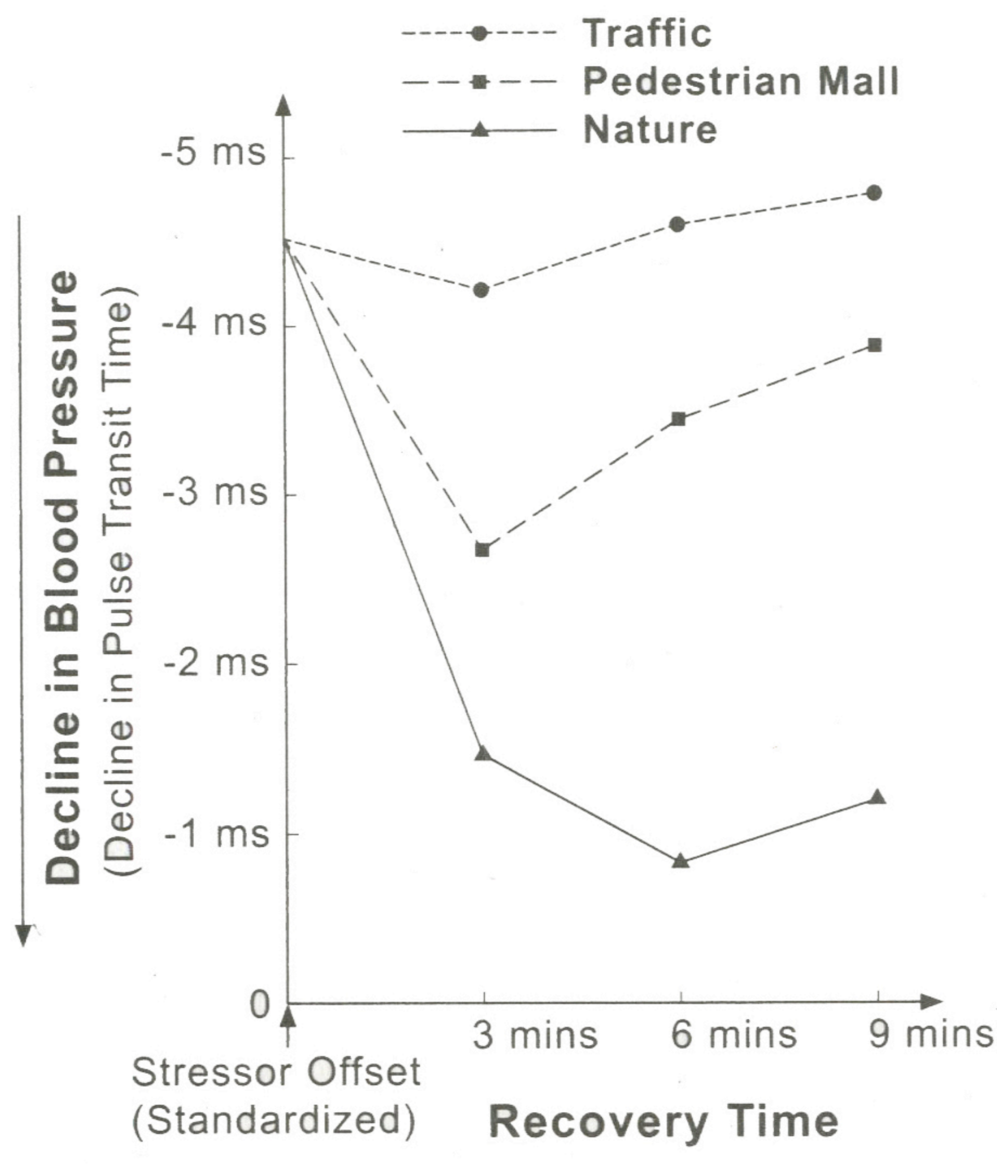


Figure 2.1 The Changes of Blood Pressure after Nature or Urban Exposure
Figure Source: Clare Cooper Marcus and Marni Barnes (1999, 36)

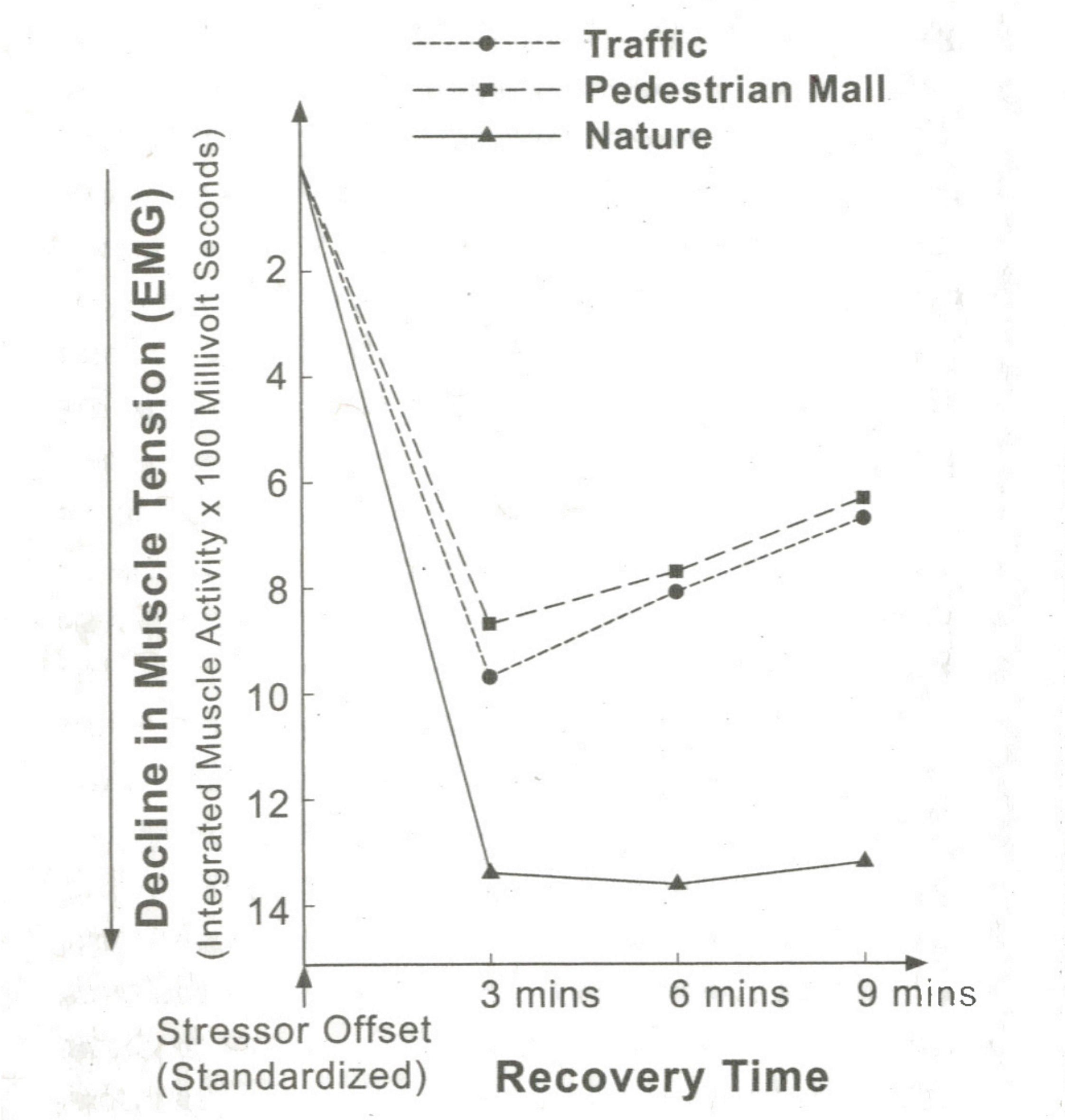


Figure 2.2 The Changes of Muscle Tension after Nature or Urban Exposure
Figure Source: Clare Cooper Marcus and Marni Barnes (1999, 36)

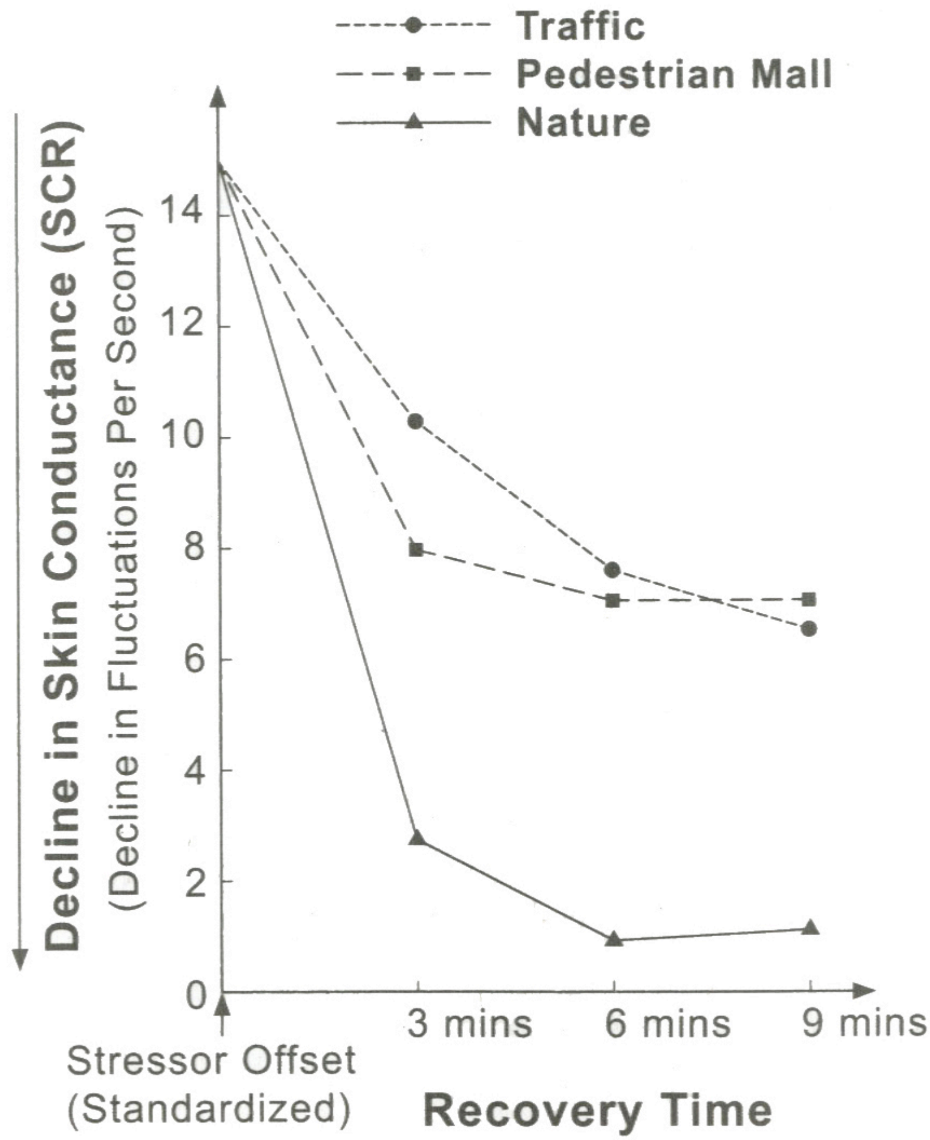


Figure 2.3 The Changes of Blood Pressure after Nature or Urban Exposure
Figure Source: Clare Cooper Marcus and Marni Barnes (1999, 36)

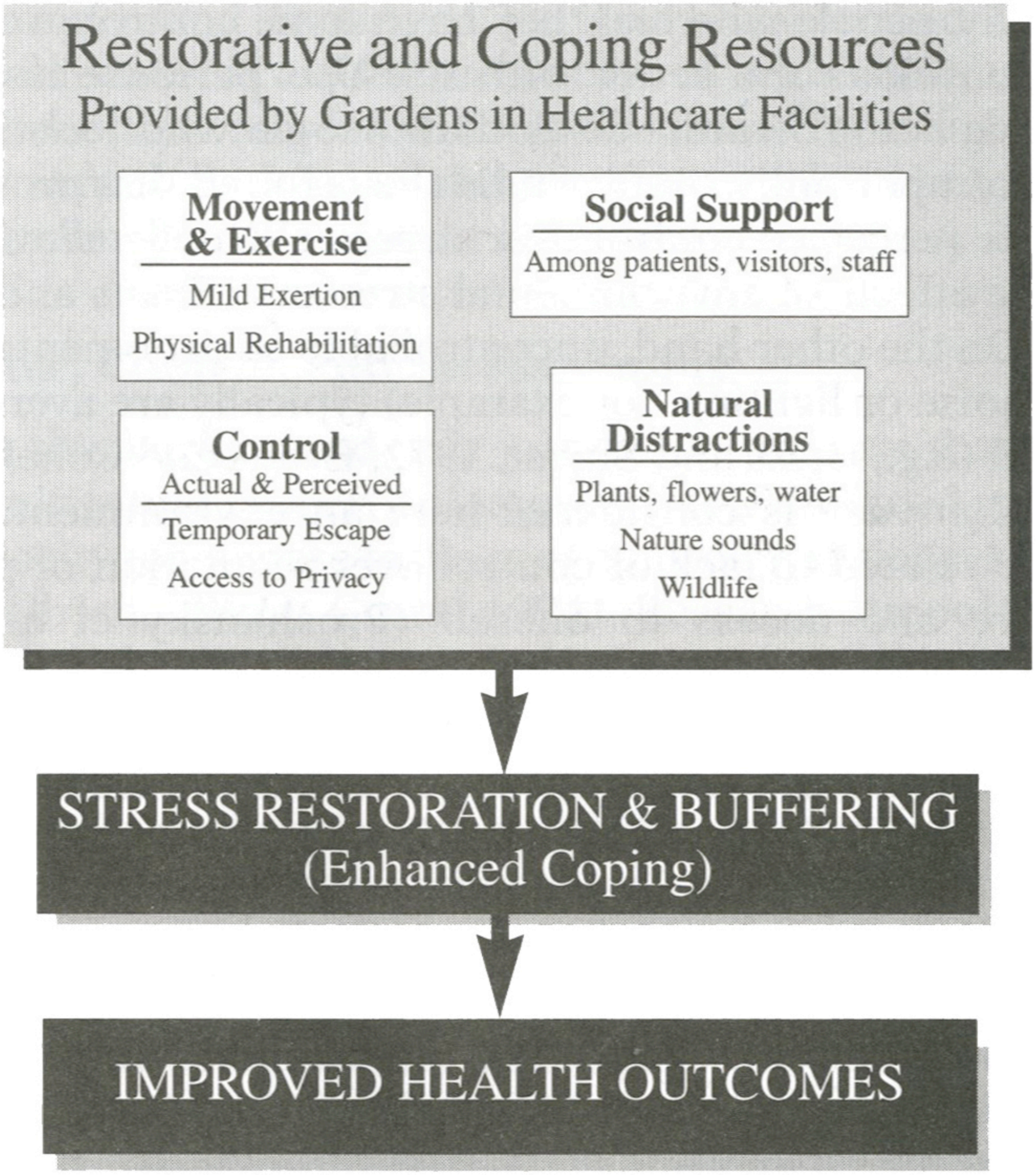


Figure 2.4 Ulrich’s Stress Restoration and Coping Mechanisms
Figure Source: Clare Cooper Marcus and Marni Barnes (1999, 37)

recovery procedures. Ulrich built a conceptual model to better understand how stress restoration and coping mechanisms work and function (Figure 2.4) (Marcus and Barnes 1999, 37). He argued that if a garden in a healthcare situation aims to help patients deal with stress and promote wellness, it must be designed to foster a sense of control, social support, physical movement and exercise, and access to natural distractions. These four components, especially a sense of control and social support, were emphasized because they have been found to affect stress-related issues in a wide range of scientific studies. However, a sense of security is the prerequisite condition for the effectiveness of these four components. A place without safety, security, and privacy is not a welcoming place for persons who are undergoing medical treatment and for the staff who are experiencing stress because of pressure from their work.

Sense of Control: It is a major factor that affects patients' ability to cope with stressful tasks and activities. The lack of a sense of control stems from two general sources of stressors: illness and physical-social environments.

Social Support: Social support means a sense of being cared about, loved, or esteemed. A vast body of research has shown that patients with high social and emotional support experience less stress compared to those with low support.

Movement and Exercise: Several studies have found that both aerobic and non-aerobic exercises are effective in reducing depression. Depression is described as a widespread and serious problem among elderly patients with chronic illness such as heart disease.

Natural Distractions: Nature and environmental elements are regarded as positive distractions that can improve emotional states by blocking or reducing negative feelings. On the other hand, people probably experience more stress when they live and work in urban environments.

2.3 Design Suggestions for Therapeutic Gardens

According to the conceptual model that Ulrich proposed, Marcus and Barnes suggested possible design considerations for each restorative component or coping resource provided by gardens in healthcare facilities. These considerations are offered to potential garden users such as long-term patients, family visitors, and hospital staff. Scientific evidence, which supports all four of these restorative resources, suggests that all four can reduce stress and improve emotional feelings.

Sense of Control: Way-finding and **access** are the two most important design considerations for supportive gardens, and they aim to foster restoration and coping by providing control. Accordingly, a garden designed for patients who need to maintain their sense of control should include noticeable entrances and exits, a simple and convenient sign system, and various program activities that they can use in an active or passive manner. Accessibility and independence for persons in wheelchairs also need to be taken into account. These patients are more likely to need a garden that is located close to their rooms or in an accessible place with an attractive window view of an outdoor garden (Carpman, Grant, and Simmons 1993). Other suggestions or design strategies that increase a sense of control include both visual and spatial **privacy** in gardens (Marcus and Barnes 1999). Visual privacy provides windows that allow access to a natural setting, while spatial privacy encourages a diversity of functions and choices for garden users.

Social Support: With respect to design considerations that promote social support, attention should be paid to ethnic or cultural factors regarding the size of family groups. King suggested that garden design in institutional settings should meet the needs of large or extended family groups, for her research on the social support of Hispanic patients provided by their families revealed this need. In addition, different types of outdoor space are used for different types of activities. The study conducted by Steven K. Barnhart, Nathan H. Perkins, and John Fitzimonds (1998) indicated that the patients preferred

enclosed outdoor spaces for active socializing that often involves talking with others, while they favored **open spaces** for engaging in passive and private activities such as viewing scenery. Finally, the designer should seek to create a balanced status or approaches that promote social interaction without reducing their access to privacy. However, in most situations, the majority of patients spend solitary time in the gardens in healthcare facilities.

Movement and Exercise: There is no doubt that gardens serve as effective and positive places that encourage patients with physical disabilities to enhance their movement and exercise. In regard to design decisions, the location of the gardens and the age of the patients are the two major factors that affect detail considerations. Indoor corridors with green plants offer a continuous series of exposure to nature. Mild exercise, such as that provided by walking loops and barrier-free structures, is advised to increase the accessibility and independence of both children and seniors. In addition, a maze-shaped walking path might be a good way to increase enjoyment and fascination for users.

Natural Distractions: Studies have demonstrated that nature, which includes living elements such as animals as well as non-living elements such as clouds, significantly promotes positive health outcomes and effectively reduces stress. In terms of design considerations, the Kaplans' Preference Matrix and the four restorative components can serve as comprehensive criteria that allow designers to take advantages of the healing power of nature. Additionally, Marcus and Barnes (1999) have pointed out that visual elements in nature such as trees, flowers, and water, are essential to the creation of a garden that positively influences patients' moods.

2.4 Summary

The theories discussed above concerning the therapeutic benefits of nature for human beings are interdependent and intertwined. Both the Kaplans and Ulrich agree with the notion that genetic connections between humans and the natural environments in which they live allow them to respond positively to nature and to increase their adaptabilities and their chances for survival. These researchers utilize scientific methods to measure humans' positive responses to nature. However, compared to Ulrich's passive measurement of healthcare outcomes, the Kaplans' "Preference Matrix" more actively helps identify the kinds of landscapes that are effective for directed attention restoration. The four important goals for the preferred landscapes proposed by the Kaplans, which allow voluntary attention to be recovered and involuntary attention to be involved, need to be achieved gradually, and none are dispensable. The Attention Restoration Theory provides an opportunity to explain how humans understand and explore their surrounding environments and how this framework of understanding and exploration helps them attain a state of psychological relaxation during this process. The Kaplans separated human attention into two categories: voluntary attention and involuntary or directed attention. Each type of attention is associated with either urban or natural environments. The Kaplans consider directed attention to be closely related to stress. When directed attention wears people down, they lose their patience and become stressed more easily. Ulrich further explored the notion that stress is a major factor affecting the psychological wellness of patients. Unlike the concept of attention in the Attention Restoration Theory, stress is the dominant factor that can be produced when people are exposed to urban environments. A restorative landscape that helps patients deal with stress and promotes wellness must include four essential components: sense of control, social support, movement and exercise, and natural distractions. For each component, Marcus and Barnes proposed design strategies and suggested ways to alleviate and remove stress. Thus, they explain how the therapeutic process occurs and functions, and provide detailed suggestions for designing therapeutic gardens.

This chapter mainly emphasizes those therapeutic gardens theories that provide scientific support for the design application that will discussed in chapter five. In order to create a therapeutic garden for Chinese senior communities and to maximize the healing power of nature, the design process should comply with the four key goals of Ulrich's theory of supportive design for healthcare facilities, as well as with Marcus's design suggestions for each key point. The next chapter will explore the attributes of the suitable environment for elderly residents and will incorporate Marcus's design suggestions to develop a set of guidelines specific to the elderly population.

CHAPTER 3

THERAPEUTIC GARDEN DESIGN FOR THE EDLERLY

Although nature has healing power for people's health, as discussed in chapter two, several unique design suggestions specifically pertain to the elderly population when planning therapeutic gardens. Unlike other age groups, the elderly often suffer from mental distress and the deterioration of physical functions at this stage of their life (Marcus and Barnes 1999). This situation is particularly prominent in China. Due to an inadequate healthcare system and stressful work conditions, most Chinese elderly experience chronic diseases that affect their psychological states and their physiological functions. Therefore, any environment designed for the Chinese elderly needs to consider both their psychological and physiological changes. The elderly's psychological characteristics imply that they are sensitive to and dependent on their surrounding environment, while their physiological characteristics suggest that their physical condition may limit their involvement in the natural environment. In order to create a suitable environment to improve the elderly's mental health and to maintain the physical functions of their visual, auditory, olfactory, and tactile senses, the attributes of such an environment should be identified and related to the proposed sensory stimulations. This ideal environment should not only provide the elderly with a safe, private, communicational and comfortable surrounding, but also offer them a variety of sensory experiences for their physical improvements. Specific suggestions for both psychological and physiological considerations are developed. At the end of this chapter, these suggestions will be combined with Ulrich's principles of control, social support, movement and exercise, and natural distractions in order to develop design guidelines related to elderly care. Although several overlaps will occur, it is important to recognize and emphasize the interconnections of these guidelines.

3.1 Characteristics of Garden Users

Due to demographical differences and distinct service goals, senior communities should offer much more tailored outdoor environment compared to parks or other public green spaces. The daily behaviors and psychological states of aged residents who live in senior communities are quite different from those of other age groups. The aged residents in a senior community normally present different psychological behaviors. They often express more sensitive, yet direct, needs towards the surrounding environment than younger people do. For example, the microclimate affects their usage of the garden in a significant way (Regnier 1985). In addition to their different demands on space, the aged residents also have unique individual needs. For example, those who receive sunshine therapy are extremely sensitive to light, some may participate in outdoor activities more frequently than others, some may prefer viewing gardens through their windows, and others may enjoy staying in the gardens (Marcus and Barnes 1999). While there are many types of garden users, they can be generally divided into two categories: the elderly and the family visitors.

The Elderly Residents

Based on their unique behavioral and physiological characteristics, Clare Cooper Marcus divides the elderly into three groups: the active elderly, the frail elderly who need help with their daily activities, and the infirm elderly who need constant medical care

(Marcus and Barnes 1999). Senior community residents mainly fall into the first group. In contrast to the other two groups, the majority of the first group are independent and active, so they need multi-functional outdoor spaces for their activities and rest areas to meet their various requirements (Marcus and Francis 1997). However, because of an inadequate healthcare system and stressful work conditions, Chinese elderly often suffer from chronic diseases before retirement, such as heart diseases, bronchitis, and diabetes. Therefore, the environment of senior communities in China requires providing more therapeutic benefits for their residents than that of senior communities in Western countries.

Generally, the elderly are psychologically sensitive and physiologically vulnerable to the outdoor environment. Their psychological needs are highly related to their psychological health. Moreover, they are at an emotional and sentimental stage of life. As a result, the elderly may easily become anxious, upset, and lonely as well as being sensitive to the surrounding microclimate (Regnier 1985). Therefore, environments that meet the elderly's psychological demands and provide them satisfaction will ultimately promote their psychological health. Maslow's hierarchy of needs (1954) provides a very useful breakdown of the needs that must be met during the entire recovery process: physiological needs, safety needs, belonging needs, esteem needs, and self-actualization needs. In addition, his theory can be applied to design therapeutic gardens for elderly residents. Safety needs, for instance, should be satisfied first and foremost when aged residents are put in an unfamiliar environment unless they have specific physiological needs. In an unfamiliar environment they may feel uncomfortable and hence lack a sense of security. As they familiarize themselves with their new environment and begin to build social connections with others, belonging needs are satisfied. In the meantime, esteem needs can be met when they participate in the activities and complete the challenges offered in this environment. Finally, their physical functions are maintained and recovered through engaging in these proposed activities, therefore satisfying self-actualization needs. The building of such an ideal environment requires that these needs be met in a step-by-step process.

The elderly also exhibit greater physiological vulnerability than younger people. As their physical functions deteriorate and they can hardly perceive the sensory messages from their surroundings, their sense of control is weakened. Although perceptual functions do not deteriorate with age, diseases may produce memory loss, which makes it hard for the elderly to find their way in a new environment (Koncelik 1982). Additionally, it is safe to assume that several residents in senior communities are disabled. Therefore, the accessibility to outdoor spaces should take into account all members of the elderly population. Sense of orientation, opportunities for sensory stimulation, and control of the environment are three design essentials that influence the usage of outdoor space in senior communities (Regnier 1985). Clear way-finding signs, interesting sensory stimuli, and recognizable paths will encourage the elderly to visit and enjoy their outdoor environment. For example, more landscape elements should be designed to add interest and pleasure for the elderly residents who have mobility impairments (Carstens 1993). Considering the short distances and the slow walking speed of the elderly residents, the small garden spaces in senior communities should contain more variety and more visually interesting features (Marcus and Barnes 1999).

The Family Visitors

Family visitors and friends comprise another group of potential garden users in a senior community. The elderly people who live in a senior community often feel lonely and disconnected from the outside world (Marcus and Barnes 1999). Without interaction with family members and friends, the elderly often feel a loss of freedom, a lack of control and a sense of loneliness and failure because they are physically restricted in a senior community (Kellett 1999). Such negative feelings will affect their health status, and can lead to a poor quality of life. Spending quality time with family members is beneficial to both the physical and the psychological health of elderly people who live in a senior community. Family members and relatives are often regarded as providing a social support system for the elderly (Shanas 1979). Most elderly people prefer staying outside to enjoy the sunshine with their family members to staring at the wall in their rooms (Marcus and Barnes 1999). The relatives of the elderly also suffer psychological stress. A garden is a place where the family members of the elderly can relax and unwind. An organized garden may provide a variety of outdoor environments for the elderly to use in multiple ways and also offer an appropriate space for family gatherings. These gardens can support the elderly, strengthen their bonding with family and friends, and make them feel more cared about. Ultimately, they can help the elderly build confidence in their future.

3.2 The Therapeutic Benefits of Sensory Environments

It is critical to consider how the environment will be perceived and understood when designing outdoor space. A well-designed environment may provide the elderly with positive sensory experiences and serve as a source of stimulations. The elderly are more likely to depend on the limited perceptual information available outside them when they socialize with others, recognize the way back home, or enjoy outdoor spaces (Pastalan 1971). An environment that can be perceived, such as the change of seasons, may also contribute to the recovery and the development of individuals' memories (Hiatt 1980). Therefore, an ideal environment designed for the elderly should appeal to all five senses. For example, a landscape with colorful flowers throughout the season, which give off pleasing fragrances and reveal interesting textures that tickle the skin would meet the requirements of such a design.

There is a connection among external structures, human being's visual perceptions, and the visual arts. When the "forces" of these different fields are functioning at the same structural level, people's aesthetic experience may be stimulated. For example, people can understand the abstract concepts of "life," "balance," or "energy" from the external work of art (Arnheim 1954). Perception is a complicated psychological process and can be described as a filter that can percolate certain information about physical and social environments (De Long 1970).

Visual Experience

Colors are closely related to human being's perceptual mechanisms (Jakle 1987). A visual environment can influence human being's physical reactions and mental activities. For example, a person might feel cold when he or she sees black, excited when seeing colorful objects, or uncomfortable when seeing someone in pain (Birren 2006). The psychological effects of color are widely accepted by the public. Color helps change people's moods, emotions, physical reactions, and holistic feelings about the surrounding space (Table 3.1) (Qi 2007, 41). Gimbel (1994) regards color as a complicated artistic element that has healing power. Every color has its own electromagnetic wave length, which can be understood as signals to people's brains, which enter them through their optic nerves. Colors stimulate people's body hormones, which influence their physical

Table 3.1 The Anthropic Analysis of the Physiological Function of Color
Table Source: Daiwei Qi (2007, 41)

COLOR	FUNCTION	ENVIRONMENTAL APPLICATION
RED	It represents enthusiasm, warmth, and happiness. It promotes blood circulation and the prevention of heart disease, but is not suitable for patients with depression.	It is applied to elderly people with cataract disease. It is not suitable for people in psychiatric hospitals or jails.
ORANGE	It represents excitement, brightness, and stability. It is physically helpful for the health of the uterus and the large intestine.	It is widely used in the Army, in schools, and in the landscape of communities with disaster areas.
YELLOW	It represents hope, delight, and clarity. It is beneficial for spleen health. It strengthens the nervous system and enhances metabolism. It is psychologically helpful for focusing attention.	Plants with yellow flowers should be placed in the darkest area of the community.
GREEN	It represents freshness, peace, and harmony. It is helpful for the detoxification of the human liver and the gallbladder.	Green plants should fill rehabilitative landscapes.
BLUE	It represents honesty, eternity, and tranquility. It can lower blood pressure and relieve muscle tension. It is a helpful aid for insomnia sufferers.	Blue plants could be placed at the edges of paths or spaces.
VIOLET	It represents elegance, dignity, and charm. It effectively stimulates brain secretion and the lymphatic system.	It is very effective for early Alzheimer patients.
YELLOWISH GREEN	It restrains impulse and prevents anxiety.	It is suitable for the areas surrounding parking lots or the entrances of parks.
PINK	It effectively mitigates the mind and emotions.	It is widely used in psychiatric hospitals, children's hospitals, and cosmetic centers.

and mental health (Gimbel 1994). Several studies have demonstrated that people's skin temperature may decrease by 1 to 2°C, their pulse may slow down by 4 to 8 times per minute, their blood flow velocity may decrease, their blood pressure may be reduced, and their breathing may relax when they are exposed to a green environment (Birren 1997). Clearly, the effects of different colors are not the same, and these differences result in complicated visual imaginations and associations. Red is usually widely used for impaired vision patients (Marcus and Barnes 1999). Green can release patients' stress and calm them down (Birren 1997). Blue can relieve the pain of eye disease (Qi 1997). Violet has been proved to help early Alzheimer patients (Marcus and Barnes 1999). For residents with visual impairments, a predictable, structured, and visually rich environment is recommended (Wolanin and Phillips. 1981).

Auditory Experience

The messages received by the auditory sense are fewer in number than those received by the visual sense. However, pleasing sounds could bring the elderly back to experiencing wonderful memories of the past because sounds express a variety of characteristics in environments and highlight various atmospheres (Marcus and Barnes 1999). In clinical medicine, patients often receive music therapy to reduce pain or to distract them from the pain (Gaston 1968). Several related studies show that different instruments affect different parts of the human body. For example, orchestral music contributes to blood circulation (Trappe 2010); and the sound of the flute can provide a peaceful environment that allows the release of mental stress (Ruud 2010). In addition to physical benefits, music can bring people emotional contentment and spiritual enjoyment

(Gaston 1968). Human beings from different cultures all over the world tend to display similar emotions the same way when they are immersed in music (Gaston 1968).

In addition to music played on instruments, natural sounds are also important for the recovery process. As Ulrich's theory indicated, a therapeutic garden design should consider natural distractions including everything from the sounds of birds singing to the flow of water from waterfalls (Marcus and Barnes 1999). Thus, a garden design combined with sounds from music and nature can contribute to both the physical and mental health of elderly residents of a senior community.

Olfactory Experience

The olfactory sense may enhance the experience or the memories of space. For example, a famous advertisement in the United States, which was associated with perfume, goes like this: "If you want them to know it, say it; if you want them to believe it, show it to them; if you want them to remember it, just let them smell it." The olfactory experience in the rehabilitative landscape is mainly referred to as aromatherapy. Recently, research has shown that aroma affects humans' moods as well as improves their physical and psychological reactions (Table 3.2) (Guo 2002, 49). Research has demonstrated that aroma molecules can be absorbed into humans' skin, entering the bloodstream and stimulating the nervous system, thus controlling their moods, instinctive reactions, and memories (Guo 2002). In addition, these molecules affect their hormone system that influences heart rate, digestion functions, and emotions. For example, pillows filled with chrysanthemums and honeysuckle can promote sleep. Plant selection needs to consider the type of age-related diseases that affect the elderly: asthma, hypertension, arthritis, and so on.

Table 3.2 The Functional Form of Healing Aromatic Plants
Table Source: Yuren Guo (2002, 49)

DISEASES \ PLANTS	Perilla frutescens (Linn.) Britt.	Betula platyphylla Suk.	Dianthus caryophyllus	Thuja occidentalis L.	Heliotropium arborescens	Salvia officinalis	Eucalyptus Citriodora	Pelargonium hortorum	Citrus paradisi Macf.	Laurus nobilis	Lavandula angustifolia	Citrus limon (L.) Burm. F.	Mentha spicata L.	Citrus reticulata Banco	Mentha canadensis	Cedrus deodara	Rosa centifolia	Rosmarinus officinalis
Asthma	√			√		√	√				√	√	√		√	√	√	√
Pollinosis							√				√					√	√	
Hypertension						√					√	√	√				√	
Hypotension				√			√	√				√			√	√		√
Circulation System	√	√		√		√	√	√		√	√	√	√	√	√	√	√	√
Influenza	√			√			√			√	√	√	√	√	√	√		√
Cerebral Hyperemia	√			√	√		√				√	√	√	√	√	√		√
Arthritis		√		√			√			√	√	√	√		√	√		√
Muscle soreness	√			√	√		√		√	√	√	√	√	√		√		√
Fatigue	√				√	√	√	√		√	√	√		√	√	√		√
Anxiety	√				√	√		√		√			√					
Headache	√					√	√				√		√		√		√	√
Insomnia					√	√		√			√		√					
Depression	√		√		√	√		√	√		√	√	√	√		√		
Sorrow					√						√		√				√	

Tactile Experience

Tactile experience results from the effect of stimuli on our skin surface, which includes the feelings of temperature, texture, and material (Ulrich and Gilpin 2003). Tactile sense is the most basic of the perceptual senses of the human body. Different materials represent different textures, feelings, and details, which functions to show the environment and to highlight the atmosphere. For different users, different construction materials in a garden bring various feelings. For example, wooden materials are more suitable for the elderly because they always give people a warm feeling and make them reconsider traditional culture. The elderly usually suffer from visual impairment. Tactile sense is another major way for the elderly to receive messages from the outside world (Marcus and Francis 1997). In the Elizabeth and Nona Evans Restorative Garden, there are specially designed handrails with braille inserts for the blind and a readable stonewall for touching (Figure 3.1-3.2) (Dirtworks 2007, 20).


Figure 3.1 The Railings Designed with Braille Inserts
Figure 3.2 The Readable Stonewall
Figure Source: P. C. Dirtworks (2007, 20)

3.3 Attributes of Ideal Environments for Elderly Residents

With the psychological and physiological characteristics of the elderly determined, the attributes of environments that satisfy the elderly's needs can be identified. Because the elderly often experience a lack of safety and security, an environment in a senior community should offer them a safe space with physical supports and psychological benefits (Marcus and Francis 1997). A safe and secure environment may encourage the elderly to enjoy the outdoor space, which largely determines life satisfaction and, consequently, life quality (Lawton 1980). After the elderly have accepted an unfamiliar environment, they may begin to seek spaces that can provide both privacy and communication opportunities. Places with privacy offer the elderly spaces for their self-reflection and meditation while communication opportunities provide them strong connections with families and other residents in the garden. All three attributes of the environment—safety, privacy, and communication—aim at building a welcoming place to reduce the psychological concerns of the elderly. When it comes to physiological needs of the elderly, outdoor activities and sensory stimulations that promote their body improvements are included in design considerations. Accessibility is another essential design issue that should be addressed. Finally, the environment for the elderly should be comfortable, so design must consider the elderly's needs in their entirety in order to generate a set of detailed design suggestions that address their unique psychological and physiological characteristics.

Safety

Safety and security are two essential characteristics of the environment in a senior community, both of which significantly influence elderly people's quality of life

(Weidemann et al. 1982). The elderly who live in senior communities suffer both physical and psychological pain. Therefore, to foster a sense of safety in the elderly, an environment should include physical design supports and have psychological implications. Physical design supports include a series of design suggestions for the elderly who have mobility impairments. Psychological implications mean that the atmosphere of the designed environment can relieve stress and reduce the sense of insecurity. Because the elderly are more sensitive to their surrounding environment than younger people, they could be easily distracted during the recovery process. An environment with fewer security concerns may reduce anxiety among the elderly and increase their peace of mind and mobility (Marcus and Barnes 1999). In other words, a safe and secure place in a senior community increases the users' trust in the unfamiliar space. Therefore, more and more elderly people may enjoy participating in the social activities and the physical exercise provided in these secure communities.

Privacy

Because of psychological vulnerability, the elderly often desire private spaces to increase their sense of safety and security. Privacy has been found to contribute to the comfort of the elderly when they are in residential facilities and in turn to promote their interpersonal support and independence (Timko and Moos 1990). Privacy in a senior community means control of both visual intrusion and unwanted auditory stimuli (Marcus and Barnes 1999). It is not difficult to imagine why visual intrusion should be controlled since most residents may prefer not being watched by others when they are in a garden. In addition to visual intrusion, noise is also a serious source of disturbance to the elderly. For this reason, a senior community should be built as a quiet and independent environment that protects the elderly's requirements for privacy. Only in such an environment could the elderly truly relax and improve their health.

Communication Opportunity

Social climate has proved to be closely linked to the health and well-being of elderly residents in a senior community (Lemke and Moos 1986). Residents of senior communities can easily become lonely or agitated. While the therapeutic garden needs to offer private space should the residents need alone time, it is also necessary to provide public space for residents to socialize. The social environment that elderly residents need can range from a small enclosed space to a large open space (Marcus and Barnes 1999). These communicational spaces allow the elderly and their family members to support and encourage one another. At the same time, these spaces also help them release psychological stress and increase their confidence to improve their quality of life.

Accessibility

Accessibility is an essential design consideration to increase the mobility, the independence, and the socialization of the elderly who have functional impairment (Marcus and Barnes 1999). An accessible and convenient environment may attract the disabled residents in wheelchairs to visit the garden. In contrast to younger wheelchair users, older wheelchair users may have greater difficulty using ramps because of their decreased strength (Hiatt 1980). The gradient of ramps for older residents therefore should be as gentle as possible. Generally, the elderly who have physical disabilities often need to be accompanied by their caregivers or family members. An accessible garden, however, provides public space within their reach, therefore encouraging residents with disabilities to engage in outdoor activities more often. Residents who are physically impaired are often also psychologically sensitive and vulnerable. Therefore, a disabled-friendly environment may increase their sense of safety, belonging, and identity.

Outdoor Activities and Exercise

Regardless of whether the spaces are open or private, they are equally important to the elderly, due to the physical benefits of these spaces. Private space enables passive activities such as self-reflection and meditation while open space makes public activities possible, including daily exercise that improves physical health. The majority of the elderly who live in a senior community prefer wandering freely in a garden and doing exercise in outdoor spaces (Cranz 1987). Certain activities have been shown to slow or even reverse mental, emotional, and physical deterioration among the elderly (Brody 1977). For those older residents who suffer physical problems, a comfortable, safe, and secure outdoor space that can be easily accessed is a welcoming place for them to watch or be involved in others' activities (Marcus and Barnes 1999). However, the intensity of the exercise should be reduced to an appropriate level for the aged demographics. A covered walkway is a popular place for the elderly residents' outdoor exercise in bad weather (Regnier 1985). Constant exercise and training is important for the elderly to maintain their physical functions, recognition abilities, and social skills (Atchley 1980).

Sensory Stimulation

Sensory stimulation not only can increase the elderly's perception of their environment, but also can help them orient themselves. On the one hand, tangible environments are the most welcoming design feature for the elderly users because their vision and hearing sensitivity usually decline first as they age. Providing adequate information that can be perceived and recognized is a way to compensate for the sensory impairment of the elderly. Plant materials can be used to create opportunities for the elderly to have visual, olfactory, auditory, tactile, and gustatory experience. On the other hand, orientation is an important consideration in the design of outdoor spaces for the elderly. Both sensory impairment and memory loss make it hard for the elderly to find their way in an unfamiliar environment. The elderly can only locate themselves by relying on the limited perceptual information in the environment. Therefore, landmarks with prominent sensory features can aid confused elderly to achieve a better sense of orientation.

Comfortability

In order to provide a comfortable environment for residents, design should take into consideration details such as seating, signs, microclimate, glare, shade control, and transitional spaces. Comfortable seating may encourage eye contact, which increases the opportunity for socialization (Sommer 1970). Functional signs should be clearly marked to increase the independence, autonomy, and self-esteem of the elderly (Marcus and Barnes 1999). Microclimate and glare are the two essential factors that affect the usage of a garden on a summer afternoon (Regnier 1985). Shade control allows the elderly who are sensitive to sunshine to enjoy themselves in the shade. Transitional spaces are designed between the outdoor and indoor spaces to prevent the harmful influence of glare and weather and to provide the elderly a comfortable place for watching and sitting.

3.4 Guidelines of Therapeutic Garden Design for Elderly Residents

After determining the seven attributes of an ideal environment for the elderly, guidelines for therapeutic garden design can be developed. Because of the sensitive emotional states and the deteriorated physical functions of the elderly, the design of therapeutic gardens for this specific population requires diligent attention to the needs of the residents. This thesis develops design guidelines based on a thorough analysis of the physiological and psychological characteristics of the elderly, and these design guidelines are grouped in categories, with each bulletin point addressing their psychological sensitivities and their physical limitations. The following guidelines for designing therapeutic gardens for the elderly residents have been combined with Marcus's suggestions for how the general therapeutic garden can meet the needs of a specific population.

Safety

- Design outdoor spaces so that are visible from the indoor spaces frequently used by the residents and the caregivers.
- Clearly define the boundaries between resident-only space and public space.
- Use landscape elements, such as shrub fences and screening trees, to create enclosed garden spaces that ensure safety without bringing a sense of pressure and a feeling of being controlled.
- Clearly mark way-finding signs so that older residents who are confused can recognize them and find their way home.
- Provide physical design supports such as wooden handrails on both sides of ramps.
- Provide enclosed spaces to offer the residents' psychological safety.
- Avoid using metal or sharp elements, such as iron way-finding signs, in order to prevent the residents from falling down on these dangerous elements.

Privacy

- Provide enclosed private spaces for small group gatherings and conversations.

- Provide private areas where the residents can interact with nature and wildlife, such as personal planting beds and bird feeders.
- Utilize landscape elements that may increase privacy, such as screening trees, in order to limit visual access into spaces where the residents sit and reflect.
- Provide seating areas where the residents can be alone or have other private activities such as meditation.

Communication Opportunity

- Create both large and small spaces in order to encourage socialization as well as privacy and intimacy.
- Create several kinds of spaces to accommodate the differing needs of the residents, such as sitting alone, listening to water, or sitting in various sized groups to socialize.
- Provide lightweight movable tables and chairs for the residents to build their own socialization group.
- Create a variety of spaces around popular areas to offer opportunities for unexpected communications.
- Provide facilities for the residents to spend quality time outdoors with their family.
- Create outdoor playgrounds for young visitors.

Accessibility

- Carefully lay out outdoor natural scenes so that the residents can view them indoors.
- Avoid using a raised threshold strip in the therapeutic garden design.
- Use lever door openers instead of knobs to allow and encourage the elderly residents with arthritis, decreased strength, or other physical disabilities to visit the garden.
- Gentle gradient of ramps are designed for the residents with decreased strength.

- Clearly differentiate the boundary of pathways from the planting areas to accommodate the elderly residents with reduced depth perception.

Outdoor Activities and Exercise

- Provide a variety of spaces to accommodate the differing needs of the residents, including spaces for reading, sitting, wandering, or doing other outdoor activities.
- Provide different lengths and difficulty of walking routes to accommodate for the residents with different physical capabilities.
- Provide a covered arcade to allow the opportunities for outdoor activities during poor weather.

Sensory Stimulation

- Provide different types of sensory environments for the residents to experience nature in varying ways, such as environments that enhance their visual, olfactory, auditory, tactile, and gustatory senses.
- Use colorful and aromatic plant materials to attract wildlife and therefore allow the residents to interact with wildlife and have their visual and olfactory senses stimulated at the same time.
- Use different leaf textures or other tangible design features to enhance the residents' tactile senses.
- Design activities such as music therapy, or design the landscape with water features in order to strengthen the residents' auditory senses.
- Provide nursery gardens that grow edible plant materials to improve the residents' gustatory senses.

Comfortability

- Increase the residents' sense of security by installing seats in locations with walls or plants behind.
- Adjust the angles and the positions of the seats to encourage more eye contact.
- Place road markings and signs at the height of the elderly's eyesight to avoid their experiencing discomfort when they raise or lower their heads.
- Provide appropriate areas with shadow to reduce the discomfort caused by high temperatures at noon.
- Offer a transition area between the indoors and the outdoors to allow the residents to adapt gradually to the sunlight, and to buffer the impact of bad weather.
- Design effective sunshade ceilings for transition areas in order to reduce the glare produced from direct sunlight.

3.5 Summary

According to the design guidelines provided in this chapter, which pertain specifically to the elderly population, therapeutic garden designs should provide sensory stimulations that prove to be beneficial to the residents' physical functions. These sensory stimulations can both strengthen and recover, to a certain extent, the elderly's visual, auditory, olfactory, tactile, and gustatory senses, therefore making the residents healthier in general. The design guidelines also strongly recommend creating a safe, private, accessible, and comfortable environment, which eliminates uncertainty, insecurity, and other concerns of the residents. The residents, in the meantime, are also encouraged to socialize more in the gardens that meet these criteria. Therefore, the residents are less likely to suffer from loneliness as many elderly do. Last but not least, the guidelines in this chapter have also explained the importance of offering communication opportunities. Increased conversations and other forms of communication will definitely help relieve the sorrows of loneliness.

The guidelines in this chapter share some similarities with Marcus's suggestions for general therapeutic garden design. First, the two design concepts, way-finding and accessibility, both increase the residents' abilities to navigate through the garden. Due to a lack of perception about his surroundings, an old man needs wayfinding support to return home. Disabled and reluctant to move, an old man in his wheelchair requires accessibility support to reach other facilities in the garden. Social support is another concept that has been mentioned in both guidelines. In addition, Marcus's study and this thesis both propose ways to encourage exercise in the therapeutic gardens. This thesis, however, believes that the intensity of the exercise should be reduced to a level appropriate for the aged demographics. Lastly, Marcus takes advantage of natural distraction in her design. While exploring the same concept, the discussion in this thesis has reflected more on the details regarding different types of natural distraction, including visual, aromatic, and tactile distractions.

Apart from the similarities, this thesis places much more emphasis on design details in order to create a comfortable environment, specifically tailoring the design for an aged demographic, and therefore increasing the popularity of therapeutic gardens. In chapter five, these guidelines will serve as a theoretical foundation and will be applied to an actual design framework.

CHAPTER 4

CHINESE FIVE ELEMENTS THEORY AND PLANT SELECTIONS

In addition to identifying and formulating the guidelines for creating therapeutic gardens for the elderly, it is also critical to discuss how these design guidelines can be adjusted to fit the Chinese context. In order to deal with the question proposed at the beginning of the thesis—how to integrate the connotations of Chinese culture into a therapeutic design vocabulary that benefits Chinese seniors—this chapter introduces Chinese culture specifically related to a cultural way of seeing and valuing nature. In addition, this chapter also develops a novel design concept derived from the notion of health preservation, which is a core concept in Chinese culture. The notion of health preservation maintains that nature contributes to humans' health and encourages humans to be involved in nature, shares the same philosophy of western therapeutic garden theories. Therefore, the notion of health preservation can be used as a new design concept and be applied to the design of therapeutic gardens for the Chinese elderly population. The notion of health preservation in Chinese culture establishes an appropriate and beneficial way of life that promotes better health. Influenced by Chinese culture, Chinese elderly people understand and practice the traditional ways to preserve health. With the understanding of how Chinese elderly people value Chinese culture, it is not difficult to claim that therapeutic gardens designed with traditional cultural notions such as health preservation, will be adopted more readily. In the practice of health preservation, the Five Elements Theory has always been utilized as a cultural method that connects substance in nature and the health of the human body. This thesis, therefore, will discuss a specific selection of plants, based on the Five Elements Theory, which may benefit human bodies. This customization will maximize the therapeutic benefits offered to the elderly.

Traditional Chinese culture maintains that plants are beneficial to the health of the human body, a belief that can be found and confirmed in the Chinese understanding of the relationship between humans and nature (Zhang, Wang, and Wang 2010). Similarly, extensive Western research has also confirmed the benefits of plants from a scientific perspective (Ulrich 1979; Kaplan and Kaplan 1989; Marcus and Barnes 1999; Kellert, Heerwagen, and Mador 2008). Currently, the selection of plants used in therapeutic gardens complies with Marcus and Barnes' design suggestions in most cases, which advocates selecting plants that create the most pleasant perceptual experiences. Marcus and Barnes' design suggestions, however, are not the sole criteria for selecting plants; alternative criteria better reflect the Chinese understanding of the relationships between humans and nature.

To describe plant selection in the context of Chinese culture, the criteria to select plants will be discussed, and an explanation of how selected materials can promote physical and psychological health will be offered, using the Five Elements Theory. To support a better understanding, the principles of the Five Element Theory will be briefly explained. Reviews of therapeutic gardens that apply the ideologies of Chinese medicine will be included to further supplement this argument. Ultimately, this thesis will develop a design concept that can be applied to the therapeutic gardens in the Dongtan Senior Community.

4.1 Chinese Culture and Landscapes

Traditional Chinese gardens have been deeply influenced by Chinese culture (Xu and Peng 2009). In Chinese culture, the philosophy of Daoism can be regarded as providing a basic program for living well and harmoniously (Zhang 2009). Systematically, the Chinese regimen for living well can be divided into two areas: theory and method (Liu 2011). Daoism provides the theoretical support for living well and traditional Chinese medicine offers a way to apply that theory, and this combination enhances the human body's resistance to diseases. Because Daoism focuses on longevity, it emphasizes the importance of health preservation. Daoism advocates and encourages appropriate emotional adjustments and self-control in order to avoid the deteriorative influences of negative feelings on the human body (Qi 2007). At the same time, the Five Elements Theory reflects the influence of health preservation in Daoism on the practice of traditional Chinese medicine. Daoism regards the "Unity of heaven and human" and "Imitating nature" as basic methodologies (Qi 2007). Daoist health preservation culture aspires to maintain a human being's physical and psychological health. In addition, the application of the Five Elements Theory to traditional Chinese medicine allows individuals to pay close attention to their lifestyle and their daily habits. From the theoretical view of traditional Chinese medicine, when the five elements lose their harmoniousness with natural cycles and rules, people become sick (Yang, Liu, and Miller 2009).

In traditional Chinese gardens, the idea of health preservation cannot be realized without the support of Chinese culture (Xu and Peng 2009). In the different dynasties of China, traditional Chinese gardens are found in both the northern and the southern parts of China. In the North, traditional Chinese gardens mainly serve imperial families, while in the South intellectuals built such gardens in their private houses (Zhou 1999). However, regardless of a person's social class, the purposes for building a garden are the same—relaxation and rest in a garden environment that imitates nature. The regimen idea of Daoism in a traditional Chinese garden is reflected through three aspects: location, architecture, and plant materials (Xu and Peng 2009). An excellent location for a garden should be a livable place with a pleasant environment that includes fresh air, a source of clean water, ample sunshine, an attractive landscape, and a quiet atmosphere. Such a pleasant environment brings people ecological balance and a healthy atmosphere for a regimen of healthful living. The orientation of the architecture in traditional Chinese gardens also affects the living habits of their residents. The closed yard in the southern side of buildings may keep out the wind during the spring and the winter, while the lotus pond outside a northern building may bring a cool breeze during the summer and the fall. The medical benefits of plant materials have been emphasized in China since ancient times. Additionally, the plant arrangements in different seasons comply with the core idea of a regimen for a good life, which involves preserving health under the rules of the changes in the seasons. This chapter focuses on the benefits of plants and on the plants that should be selected for a therapeutic garden. In order to explain the influence of Chinese culture on plant selections, this chapter will discuss Daoism, the Five Elements Theory, and the theory of traditional Chinese medicine.

Daoism

The emergence of Daoism dates back to around 500 B.C.E., a period of great change in China. The *Daode Jing* (also, *Tao Te Ching*), a famous book from that era, describes the core notion of Daoism. Traditionally, Laozi (571 B.C.E.–471 B.C.E.) is identified as the author of the *Daode Jing* (Hansen 1992). The Daoists emphasized the natural flow of things. *Dao* can be defined as a "way" or "method" leading to the recovery of harmony and social manageability (Kohn 2012). *Dao* is the mother of everything in the world and can be divided into two parts called Yin and Yang, which represent the opposite aspects of the world. From the view of Tai Chi, a type of Chinese martial art that emphasizes both self-defense and health, Yin and Yang are moving and changing all the time. However, the motivation of the movement comes from "*Qi,"* which can be explained as the energy for maintaining such a movement of life. It is because of *Qi* that Yin and Yang are able to preserve a dynamic balance, which is defined as *Dao* (Yang, Liu, and Miller 2009). Additionally, the movement of Yin and Yang results in the five elements. Daoists consider Yin and Yang as the base materials for the five elements, and the five elements are the structures of the movement in Yin and Yang. Yin-Yang and the Five Elements can be used together as a framework to describe the mechanism of macroscopic and holistic life in the universe (Yu and Li 2011).

The core ideas of Daoism are the "Unity of heaven and humans" and "Imitating nature"; these ideas underline the importance of harmony between nature and human beings in Daoism (Zhang, Wang, and Wang 2010). Daoism emphasizes that natural environments can contribute to humans' physical and psychological health, which coincides with the therapeutic benefits of nature theories. Through the Yin-yang Theory and the Five Elements Theory, the human body and nature are integrated into a whole system. As a basic theory in both health preservation culture and traditional Chinese medicine, the origin, mechanism, and applications of the Five Elements Theory will be fully explained.

Five Elements Theory

The Five Elements Theory was first proposed in *Shangshu*, widely accepted by historians and scholars as having been written by Confusius (551 B.C–479 B.C). However, several points of view have been proposed in regard to the symbolism of the five elements (He 2011). The mainstream and classic points of view affirm that the five elements come from the characteristics of five basic materials, which are indispensable to the structure of the world (He 2011). Others viewpoints maintain that the five elements are associated with colors, seasons, orientations, and the emotional feelings of humans (Table 4.1) (Wang and Luo 2010, 120).

Table 4.1 The Corresponding Relationship among the Five Elements and the Colors, the Seasons, the Orientations, and the Emotions
Table Source: Xingyi Wang and Yanyun Luo (2010, 120)

FIVE ELEMENT	COLORS	SEASONS	ORIENTATIONS	EMOTIONS
METAL	White	Fall	West	Sorrow
WOOD	Green	Spring	East	Anger
WATER	Black	Winter	North	Panic
FIRE	Red	Summer	South	Happy
SOIL	Yellow	Late Summer	Central	Meditation

The Five Elements Theory includes three basic ideas. There are five principal elements that are derived from natural materials, there is a specific sequence of generations and restraints in the five elements, and soil is the essence of the five elements

(He 2011). First, the five elements are metal (*Jin*), wood (*Mu*), water (*Shui*), fire (*Huo*), and soil (*Tu*) (Wang 2009). Second, their generation and mutual restraints are based on the characteristics of the five elements (Figure 4.1) (Wang and Zou 2010, 766). For example, fire comes from wood; then wood is burned and becomes soil; soil will gradually accumulate until a mountain, which contains metals, comes into being; water will cover on the surface of the metal when condensation occurs; and water nourishes and supports wood (Wang and Zou 2010). The mutual restraints of the five elements are described as follows in *Huangdi Neijing*, an ancient Chinese medical text:

> When wood meets metal, it is felled.
> When fire meets water, it is extinguished.
> When soil meets wood, it is penetrated.
> When metal meets fire, it is destroyed.
> When water meets soil, it is interrupted (Veith 2002, 115).

Finally, soil is emphasized as the essence of the five elements. According to *Guoyu*, an ancient Chinese history text, soil is mixed with the other four elements respectively to create the world, which means that soil is the most important element of the five elements (He 2011). Other evidence of the importance of soil can be found by considering the properties associated with it, such as its central orientation and its color—yellow. Yellow is often considered an imperial color in traditional Chinese culture, and central in the intersection of the other four orientations. Of the three basic ideas of the Five Elements Theory, the second idea is the most important. An understanding of the relationship between the generations and the restraints of the five elements can assist in introducing the relationships between the five elements and the organs of the human body in traditional Chinese medicine.

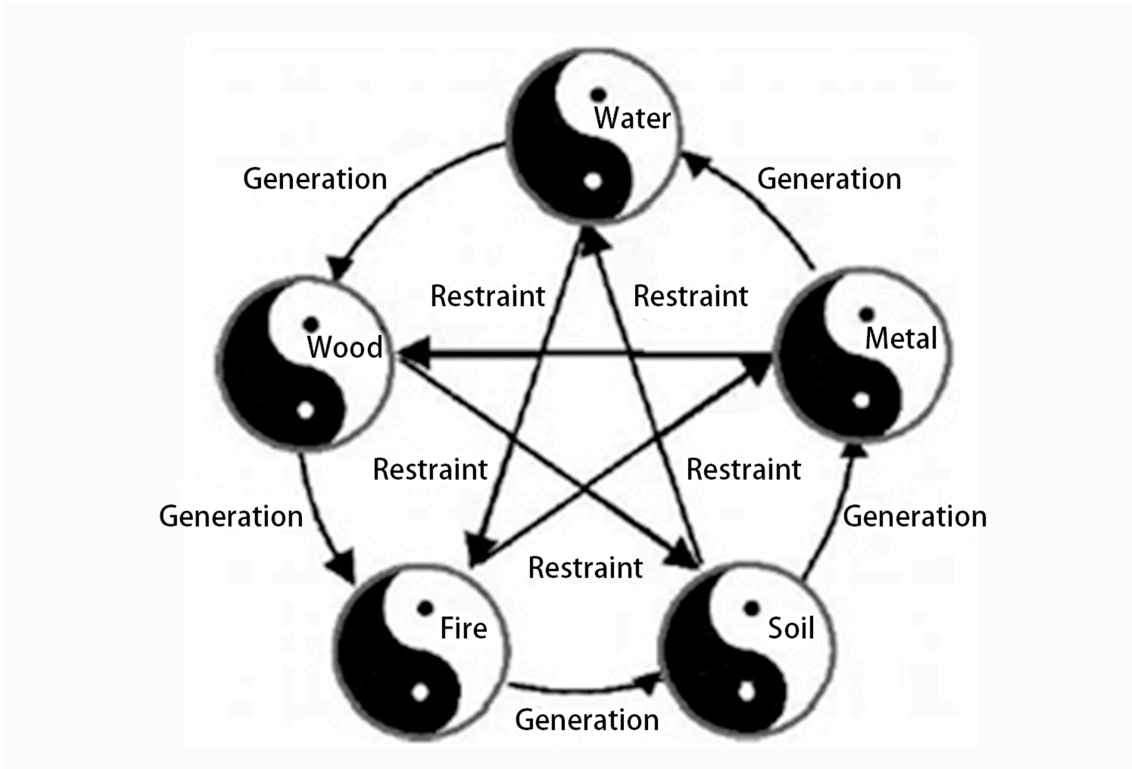


Figure 4.1 The Generation and Restriction among the Five Elements
Figure Source: Qiangfen Wang and Mingliang Zou (2010, 766)

Traditional Chinese Medicine Theory

Traditional Chinese medicine has a long history in China and has evolved over thousands of years (Men and Guo 2010). Traditional Chinese medicine is the second largest medical system in the world, with only modern western medicine surpassing it (Vickers and Dharmananda 1996). The philosophy underlying traditional Chinese medicine derives from the *Daode Jing*, which often represents the core of the Daoist world view and the root of Daoist mysticism (Kohn 2012). For this reason, traditional theory in Chinese medicine always complies with the core idea of Daoism. It focuses on health maintenance and emphasizes enhancing the human body to resist disease instead of receiving medical treatments (Lu et al. 2004). In ancient times, the majority of traditional Chinese physicians were Daoists. For example, Simiao Sun, a famous Chinese Daoist in the Tang Dynasty (618–907 A.D), combined Daoism, health preservation, and pathology into a new method of treatment. He maintained that due to human beings' physical and psychological changes in old age, human beings should pay close attention to their health and regimens, such as living routines, habits, and lifestyle, in order to maintain a healthy state of being. Traditional Chinese medical practice is based on the cosmological principle of Holism, Yin-yang theory, and the Five Elements Theory (Devinsky, Schachter, and Pacia 2005). Traditional Chinese medical practitioners have realized the essence of life and the mechanism of life movements in ancient times (Qi 2007). The traditional Chinese medical concept of Holism affirms that human beings and natural environments coexist in the entire system. At the same time, each person is regarded as a unified and interconnected construct of body, mind, and spirit (Devinsky, Schachter, and Pacia 2005). In practice, this approach considers not only a human being's physical, mental, and emotional states but also a human being's relation to the environment, including the climate, daily activities, and perceptual senses. In addition, traditional Chinese medicine relies on herbs found in nature and uses them, based on past references to them and experiences, to address health problems. Such herbal formulas constitute the principal treatment method of traditional Chinese medicine and were used to balance all physiological functions.

In traditional Chinese medicine, the Five Elements Theory, which assists clinical diagnosis and treatments, is utilized to illustrate the physiology and the pathology of the human body. The viewpoint of traditional Chinese medicine maintains that the principle of generations and restraints of the Five Elements Theory can be borrowed to solve the problems of the human body and to restore the balance of the human-nature system. *Huangdi Neijing* (475–221 B.C), an ancient Chinese medical book, fully summarizes the medical achievements before the Qin Dynasty (1644–1912) and provides theoretical guidance and a basis for further development. *Huangdi Neijing* includes a detailed record regarding the corresponding relationships among the five elements, the human organs, and the five senses of the human body (Table 4.2) (Wang and Luo 2010, 120). It explains that the law of the five elements regulates the natural interactions among the five elements (metal, wood, water, fire, and soil), the corresponding organs (lung, liver, kidney, heart, and spleen, respectively), and the senses of the body (olfactory sense, visual sense, auditory sense, tactile sense, and gustatory sense, respectively).

These corresponding relationships among the five elements, the organs, and the senses of the human body are based on the mechanism of generations and the mutual restraints of the five elements and on centuries of medical practice and experience. Based on the mechanism of generations and the mutual restraints of the five elements, the organs of the human body are connected correspondingly with the elements. The ancient medical text, entitled *Huangdi Neijing,* mentions such connections:

> The liver receives Qi from the heart.
> It transmits it to the spleen.
> The qi rests in the kidneys.
> Death occurs when it reaches the lungs. (Veith 2002, 115)

That is, the liver is associated with the element wood. The liver receives *Qi* from the heart. The heart represents the element fire, which comes from wood. Then the liver transmits *Qi* to the spleen, which represents the element soil. Soil is the agent that is conquered by wood. The *Qi* of the liver can take a rest in the kidney, which is associated with water. Water is the mother of wood. On the other hand, if *Qi* reaches the lungs, death will result because the element metal, represented by the lungs, is able to fell wood. From this perspective, a correspondence between the five elements and the organs of the body is fully illustrated and explained.

Table 4.2 The Corresponding Relationship among the Five Elements, the Five Organs, and the Five Senses of the Human Body
Table Source: Xingyi Wang and Yanyun Luo (2010, 120)

FIVE ELEMENTS	**ORGANS**	**FIVE SENSES**
METAL	Lungs	Olfactory Sense
WOOD	Liver	Visual Sense
WATER	Kidney	Auditory Sense
FIRE	Heart	Tactile Sense
SOIL	Spleen	Gustatory Sense

Based on medical practice and experience, the sensory discomfort of the patients is often caused by the diseases of the corresponding organs. Clinically, the patients often suffer from cardiovascular diseases accompanied by symptoms of numbness; the patients often suffer from lung diseases accompanied by respiratory symptoms; the patients often suffer from liver diseases accompanied by poor eyesight; the patients often suffer from spleen diseases accompanied by symptoms of dyspepsia; and the patients often suffer from kidney diseases accompanied by symptoms of tinnitus or even hearing loss. Consequently, the heart is associated with the tactile senses; the lung is associated with the olfactory senses; the liver is associated with the visual senses; the spleen is associated with the gustatory senses; and the kidney is associated with the auditory senses. From this perspective, a correspondence between the five organs and the five senses of the body is built. Thus, the five elements, the organs and the senses of the human body are connected correspondingly through the Five Elements Theory.

4.2 The Application of Traditional Chinese Medicine to Therapeutic Gardens

The philosophy of traditional Chinese medicine may affect and guide current therapeutic garden design. Traditional Chinese medicine utilizes the Five Elements Theory to integrate nature and humans as a whole system. The five elements connect the organs of humans and plants through an element in which they are associated. This system maintains a dynamic balance in which each part has a close interconnection with the other parts. Consequently, if there is something wrong with one part, the whole system will fail. However, this system has a strong self-regulating capacity similar to that of an eco-system that enables it to reach a new dynamic balance when a certain part recovers. From this viewpoint, therapeutic gardens can offer an excellent opportunity to connect nature and people who have mental problems and physical diseases. Although current therapeutic garden theories include designs of accessibility, comfort, and effectiveness, they may rarely take the colors and species of the plants into account (Yang, Liu, and Miller 2009). Therefore, a systematic strategy of plant selections is required and encouraged. The Five Elements Theory provides such a strategy and allows a classification of the plant materials based on the characteristics of the five elements. Such a classification of the plant materials can be integrated into the existing therapeutic garden theories as an important design principle for the guidance of the senior population. The most important idea of this design principle is that it includes humans and their emotions in the garden design process. This notion not only reflects the philosophy of traditional Chinese medicine but also complies with the core principles of Daoism.

The selection of plants for therapeutic gardens that reflects traditional Chinese medicine differs from the selection of plants for western therapeutic gardens. This plant selection takes users' feelings into consideration, a strategy which prioritizes users' needs. The mental reactions of users may directly affect the garden design process. Through the Five Elements Theory, plants can be connected to the organs of the human body and their emotions. The medical properties of the plants have direct effects on specific organs of the human body. For example, plant materials associated with the element wood may alleviate the pain of an elderly person who endures a liver condition (Niu and Xu 2006). In the traditional understanding of Chinese culture, green, a color associated with the element wood, may benefit humans' eyesight that is controlled by the liver. In addition, the curative effects of plant materials differ during the four seasons. For instance, ginkgo may have the strongest effect on humans' lungs during the summer since the concentration of ginkgolic acid in the air is higher than during other seasons (Wang and Luo 2010). Moreover, the principles of generation and restriction in the Five Elements Theory may guide the plant selection process. For example, the elderly person who has a liver condition often suffers from spleen problems because it is difficult for Qi to be transmitted from the liver to the spleen. Consequently, plant materials that are associated with the elements wood and soil are appropriate for the garden that is designed for such an elderly user. In contrast, plants associated with the element fire, water, and metal should be avoided because there is a restrictive relationship among these three elements and the other two (Figure 4.1). The selection process of the plants will be fully explained in the following section.

4.3 Plant Selection for Garden Design

The Therapeutic Benefits of the Plants

In addition to their aesthetic value, plants—as indispensable natural design elements of landscapes—also have a restorative function that may benefit both the psychological and physical health of humans. The various colors of the plants can bring a pleasant visual experience that contributes to humans' psychological health. In addition, many plant materials can secrete beneficial chemicals that may strengthen the immune system of the human body and prevent diseases. At the same time, in traditional Chinese medicine, fruits, pollen, or even trunks of certain plant materials are usually used as herbal formulas, which may adjust and improve the physical mechanism of the human body.

The colors (visual) of the plants and the scent (olfactory) of the flowers stimulate humans' brains and bring a relaxed and pleasant feeling that contributes to the mental health of humans. The colors of flowers, leaves, and trunks can greatly stimulate the elderly's visual faculties and produce a different visual experience. The colors of plants will also change with the seasons and the climate. Different colors have different restorative functions. For example, blue can relieve an individual's stress and tension as well as adjust body temperature; red can lift an individual's spirits; yellow can increase an individual's appetite; green can promote an individual's concentration; and white can slow down an individual's heart rate (Jia et al. 2009). The changing colors during the seasons not only express the dynamic beauty of nature, but also help the elderly perceive the changes in the surrounding environment (Carpman, Grant, and Simmons 1993). Regarding the olfactory sense, there is a close relationship between the scent of flowers and the emotions of humans (Liu and Liu 2006). Aromatic plants, which can be used as a method for psychotherapy, have predictable effects on human emotions. A pleasant and fresh scent of flowers may increase the excitability of brain cells, improve the emotions, and reduce fatigue, effects which may impact the immune system in a positive manner. For example, the scent of osmanthus has a certain curative effect on patients with mental disorders.

In addition to the psychological benefits of plants, in fact, many plant materials themselves may also benefit humans' physical health (Xu and Peng 2009). For example, gingko, as a basic and common herbal ingredient in traditional Chinese medicine, contributes to the circulatory and respiratory systems of the human body (Liu and Yu 1994). Additionally, gingkolic acid, which is a component of gingko, can effectively inhibit the growth of and even kill *Mycobacterium tuberculosis*, thus promoting lung health (Yu and Zhang 2004). Many plants such as Aloes, can absorb carbon dioxide and release oxygen at a high rate, producing a process that increases the concentration of negative ions (Yu and Zhang 2004). These negative ions are free electrons oxidized by oxygen molecules. Such free electrons are generated from the air molecules during a series of physical and chemical reactions and processes, such as the discharge function of foliage tips or photosynthesis (Bao 2010). Negative ions in the air have been shown to have a positive effect on the functions of the nervous system, to promote blood circulation, to speed up metabolism, and to improve the function of the respiratory system (Lin 1999). Finally, aromatic therapy not only contributes to humans' psychological health, but also improves physical functions. Recently, aromatic therapy has been introduced into landscape architecture and therapeutic gardens as an auxiliary therapy for improving the respiratory and nervous systems. It has been proven that aromatic oil can be absorbed into human blood and function in the same way that medical ingredients do (Buchbauer, Li, and Ye 2000). For instance, the pleasant scent of roses can be absorbed into the skin of an elderly person, enter the bloodstream, stimulate the nervous system, and increase the heart rate, while the scent of lemons can slow down the heart rate (Buchbauer, Li, and Ye 2000). In addition, aromatic plants can clean the air as well as enhance the human body's resistance to diseases (Liu and Liu 2006).

Thus, the functions of plants in the landscape cannot be ignored. The therapeutic garden as a special environment of green spaces has functional characteristics that are often beyond the aesthetic needs. Plants may bring a variety of design choices for landscape architects on the one hand, and on the other, they may help garden users set targeted strategies for their restorative process.

Plant Selection

According to the characteristics of the five elements, a corresponding connection between the plant materials and the five elements can be made. There are many methods on which to base their classification, including the ramifications of the five elements. Plant materials may be classified into five categories by the colors of their leaves, the shape of their leaves, and the colors of their flowers (Niu and Xu 2006). Based on the description of the Five Elements Theory in *Huangdi Neijing,* each element is associated with one color and one shape (Table 4.1). Plants with verdant or light green flowers are associated with the element of wood. Plants with dark green or even black flowers are associated with the element of water. Plants with red flowers are associated with the element of fire, those with yellow flowers are associated with soil, and those with white flowers are associated with metal. A round shape belongs to the element of metal; a linear shape belongs to the element of wood; a flowing shape belongs to the element of water; a polygon shape belongs to the element of fire; and a square shape belongs to the element of soil.

However, there is no exclusive criterion for the plant classification system based on the five elements (Xie 2011). The most widely accepted method of classifications is based on the colors of the flowers or fruits (Xie 2011). On the one hand, the flowers and fruits of the plants are the reproductive organs that are used for gender distinction, and they are essential parts of the plants. On the other hand, the colors are the most important visual stimuli that can be received directly by humans. Therefore, the plants can be classified into the five categories corresponding with the five elements on the basis of the colors of their flowers or fruits (Table 4.3) (Xie 2011, 23-24). However, it is hard to find green or black flowers in nature. Discussions about the colors of the flowers focus on their contrasts instead of the visual meanings. In addition, certain plants may have characteristics that allow them to be categorized according to different elements. Take gingko as an example. In mid-summer the leaves of the gingko plant are round, a shape that is associated with the element metal. At this time, the concentration of ginkgolic acid in the air is higher than during other seasons, which contributes to the health of the lungs (Wang and Luo 2010). The characteristics of gingko are also associated with the element soil since in the fall its leaves turn yellow, a color that may increase an individual's appetite and improve the functions of the spleen and the stomach (Wang and Luo 2010).

Such classifications of plant materials are most beneficial when they emphasize the relationship between humans and plants. Consequently, it is important to select plant materials based on the characteristics of the five elements so that the benefits to the corresponding organs of the human body may be maximized. For example, the flowers of *Cinnamomum camphora* are yellowish green, a color that is associated with the element wood and the liver. From the scientific perspective, the aromatic materials of *Cinnamomum camphora* also benefit the liver (Li 2005).

Table 4.3 Attribute Classifications of Common Plants in China
Table Source: Zhuyu Xie (2011, 23-24)

SCIENTIFIC NAME	**ELEMENTS**	**ORGANS**	**COLORS OF FLOWERS OR FRUITS**
Cinnamomum camphora	Wood	Liver	Green
Michelia alba	Metal	Lung	White
Magnolia soulangeana	Metal	Lung	White
Magnolia denudata	Metal	Lung	White
Aglaia odorata	Soil	Spleen	Yellow
Podocarpus nagi	Water	Kidney	Blue
Podocarpus macrophyllus	Water	Kidney	Blue
Punica granatum	Fire	Heart	Red
Chaenomeles speciosa	Fire	Heart	Red
Ambusa vulgaris var. striata	Soil	Spleen	Yellow
Araucaria cunninghamii	Wood	Liver	Green
Cassia suffruticosa	Soil	Spleen	Yellow
Jasminum sambac	Metal	Lung	White
Rosa chinensis	Fire	Heart	Red
Nandina domestica	Fire	Heart	Red

Jasminum mesnyi	Soil	Spleen	Yellow
Buxus harlandii	Wood	Liver	Green
Murraya paniculata	Metal	Lung	White
Rhododendron simsii	Fire	Heart	Red
Pyracantha fortuneana	Fire	Heart	Red
Nymphaea tetragona	Water	Kidney	Blue
Ligustrum lucidum	Metal	Lung	White
Yucca gloriosa	Metal	Lung	White
Fatsia japonica	Metal	Lung	White
Ophiopogon japonicas cv	Water	Kidney	Blue
Lagerstroemia indica	Fire	Heart	Red
Hedera helix	Wood	Liver	Green
Aucuba japonica	Wood	Liver	Green

Although these plant materials in the table are common native plants to Chinese elderly, several species are not suitable for Shanghai area due to the cold temperature. Generally, the temperature in Shanghai drops below freezing during the winter. Such cold weather makes *Murraya paniculata, Jasminum sambac, and Podocarpus nagi* hard to survive or bloom. Therefore, in addition to the Chinese native plants, the plant materials that live in the same zone are another critical criteria of plant selection for therapeutic gardens in Dongtan senior community.

The plant selections for therapeutic gardens in Dongtan senior community have been categorized according to the five elements with each category divided into three groups, which are trees, shrubs, or herbaceous plants as follows:

Plant materials which benefit to the lungs may include trees such as *Ginkgo biloba, Magnolia grandiflora,* and *Magnolia denudata*; shrubs such as *Michelia alba, Camellia sinensis, Fatsia japonica, Yucca gloriosa,* and *Gardenia jasminoides*.

Plant materials beneficial to the heart may include trees such as *Lagerstroemia indica*; shrubs such as *Rosa chinensis, Nandina domestica, Rhododendron simsii, Punica granatum, Chaenomeles speciosa,* and *Pyracantha fortuneana*.

Plant materials beneficial to the liver may include trees such as *Cinnamomum camphora, Araucaria cunninghamii, Pinus elliottii,* and *Trachycarpus fortunei*; shrubs such as *Buxus bodinieri, Thuja occidentalis,* and *Aucuba japonica;* and vines such as *Hedera helix.*

Plant materials beneficial to the spleen may include trees such as *Senna surattensis* and *Koelreuteria paniculata*; shrubs such as *Aglaia odorata, Osmanthus fragrans, Forsythia suspense,* and *Jasminum mesnyi;* and herbs such as *Cota tinctoria.*

Plant materials beneficial to the kidney may include trees such as *Ligustrum lucidum and Podocarpus macrophyllus*; herbs such as *Ophiopogon japonica* and *Solanum nigrum*; and hydrophytes such as *Nymphaea tetragona* and *Typha orientalis*.

4.4 Summary

The Eastern and the Western approaches and understanding of the relationships between humans and nature disagree with each other, and this disagreement reflects their distinctive cultural background and philosophical frameworks. Western medicine, on the one hand, emphasizes the effective and accurate treatment of specific types of illness or conditions (Marcus and Barnes 1999). On the other hand, traditional Chinese medicine prefers a holistic approach in treatments that span over thousands of years of development (Yang, Liu, and Miller 2009). This holistic approach advocates a harmonious relationship between humans and nature, in which the human is an essential part of nature (Yang, Liu, and Miller 2009). As discussed, the distinct origins and philosophies underlying Eastern and Western methodologies inevitably result in different design concepts of therapeutic gardens.

Unlike the designs that Marcus and Barnes propose for creating western therapeutic gardens, the design concept derived from the notion of health preservation in Chinese culture advocates a stronger connection between the human body and the plant materials. This design concept has been shown to maximize the therapeutic benefits of plants while further strengthening the residents' cultural understanding, which can be interpreted as a medium that deepen the value of nature and its healing power. In the meantime, the unique selection of plants successfully incorporates health preservation culture into landscapes, and satisfies the elderly's desires to improve both physical and psychological functions. Specifically, the carefully selected plants can lead to an effective therapeutic garden design when the unique restorative benefits of each type of plant material are utilized. In chapter five, this new design concept and the selection of plant materials will be applied to the therapeutic gardens at the Dongtan Senior Community.

CHAPTER 5

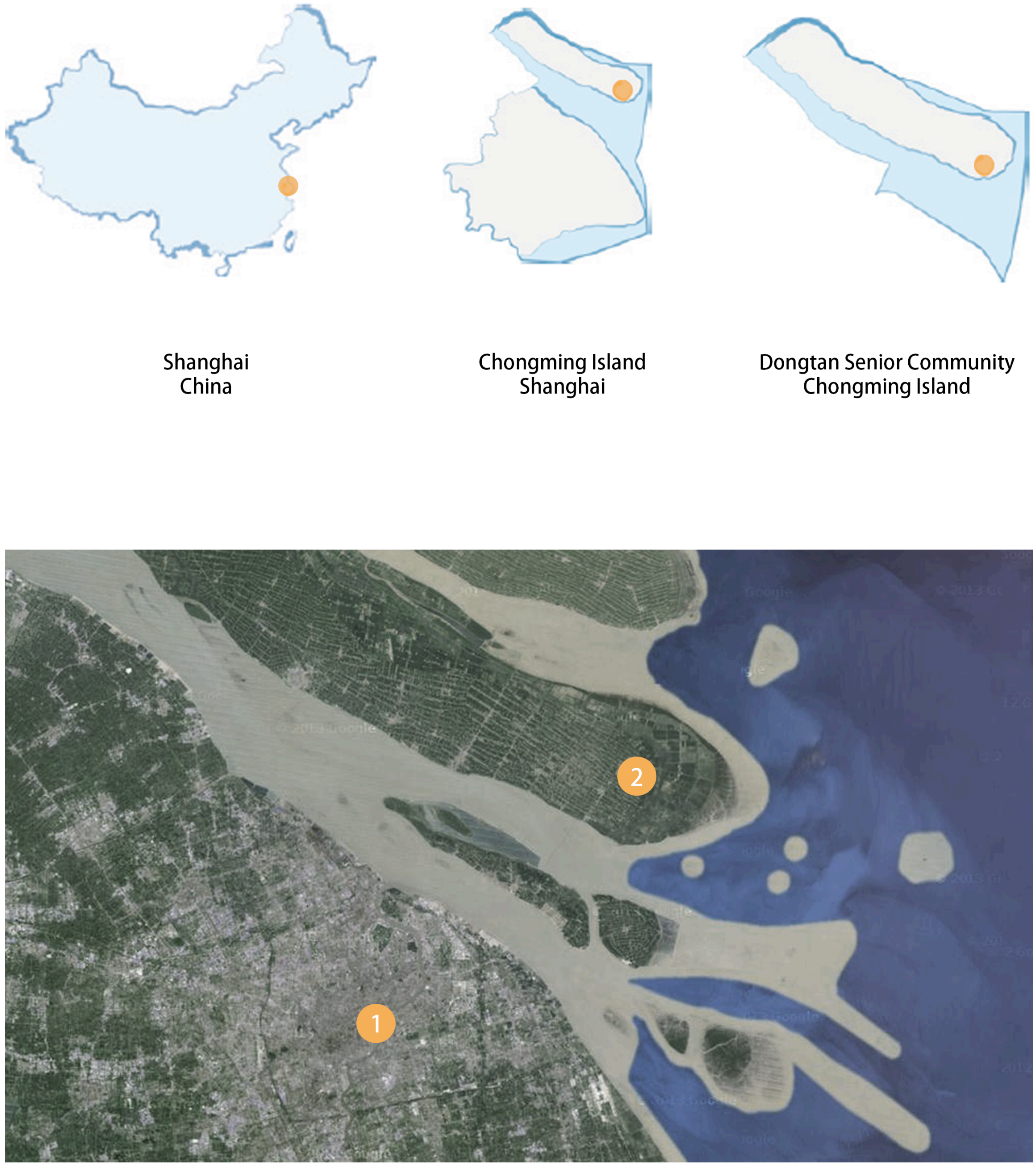
DESIGN APPLICATION

5.1 Project Overview

Location of the Project

The Shanghai Dongtan Senior Community (DSC), which will be built as a high-end senior community, is located at the northeastern corner of Shanghai and is about 35 miles from downtown (Figure 5.1). To avoid excessive noise, it will be built on Chongming Island, a quiet area far away from downtown Shanghai. Therefore, residents will be able to enjoy a peaceful and natural life. Although the DSC will be built on a separate island, the location is, however, not inconvenient, thanks to the bridge over the Yangtze River, which connects Chongming Island to downtown Shanghai.

The DSC has been selected for three reasons. First, compared to traditional healthcare facilities for the elderly, senior communities have gained more popularity among the elderly now in China because of their comfortable living environment as well as their advanced medical facilities and quality service. Second, the DSC offers a quiet atmosphere with fresh air surrounded by convenient facilities, an advantage not found in other locations in Shanghai. The DSC's excellent location and quiet environment suits the garden design concept well. Last, it is expected that the senior residents with chronic diseases in the DSC will better adapt to and respect the new design concept derived from the notion of health preservation, as it is based upon Chinese culture and related notions they are familiar with.



1. Downtown Shanghai
2. Chongming Island

Figure 5.1 Location of the Project
Figure Source: Drawn by Yiming Huang

Current Situation of the Project

The DSC site is currently farmland, but construction will turn this place into a senior community by 2015. Figure 5.2 consists of 5 photos that show the current state of the project site. The 10-meter wide country road, demonstrated in the first photo, will be extended to a main avenue leading to the community entrance. The second photo shows the location that will become the main entrance of the DSC. The canal in the third photo will be filled up with earth that will come from the architectural construction. The last two photos were taken at a cornfield on the east side, which contributes to the fresh air, the quiet atmosphere, and the natural environment of this place.

Surrounding Context of the Project

Since the project of the DSC will not be completed until 2015, two aspects of the surrounding context of the project should be discussed: the current situation and the proposed plans (Figure 5.3 and 5.4). Right now the majority of Chongming Island is farmland, which provides a sustainable living condition in the future. The quiet and safe atmosphere gives Chongming Island a unique advantage in becoming a premium residential area. Although Chongming Island is separated from downtown Shanghai, the Shanghai Yangtze River Bridge provides a direct and convenient route for commuting between downtown and the DSC. According to projections, many luxury residential communities and villas will be built on Chongming Island during the next 20 years. Apart from those, the dike, originally built for safety concerns, offers spectacular seascapes views for residents on the Island.

As shown in Figure 5.4, the proposed design will offer a variety of living facilities, including medical clinics, convenience stores, and commercial plazas, in the vicinity of

LEGEND

1. 505 Country Road
2. Road in the Field
3. Canal in the Site
4. Corn Field
5. East Side of the Site

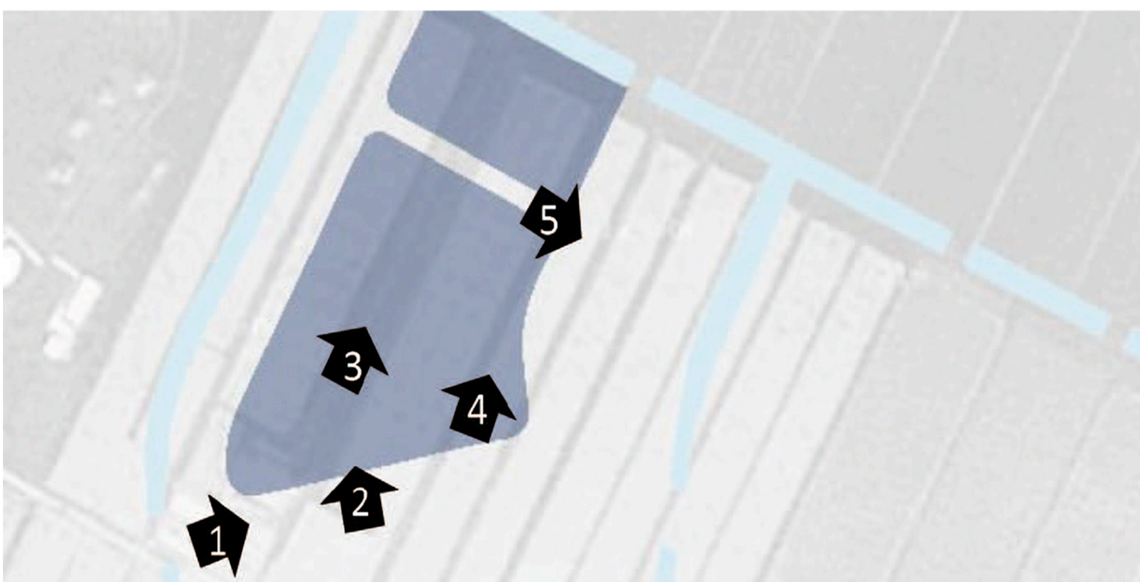


Figure 5.2 Current States of the Project
Figure Source: Photos by Yiming Huang

LEGEND

1. Shanghai Changjiang
2. Jinmao Yishu Villa
3. Dike
4. SIIC On Site Office
5. Dongtan Senior Community

Figure 5.3 Current Surrounding Context of the Project
Figure Source: Photos by Yiming Huang

Figure 5.4 Proposed Surrounding Context of the Project
Figure Source: Provided by Steinberg Architects Group

the senior community. These living facilities will greatly reduce the burden of satisfying the seniors' basic living needs despite the distance between the DSC and downtown Shanghai. Specifically, a community park sits to the west of the site, offering public gathering space and entertainment. In addition, to the southeastern side of the community, a community hospital that will serve the entire residential area is being planned. A commercial area will be built on both sides of the main entrance, providing catering, entertaining, and shopping services. Last but not least, a conference center is planned to the southwest corner of the site that will serve for business occasions. These convenient facilities, combined with the quiet living atmosphere, will make the DSC a popular and desirable community for seniors.

Location of the Design Site

The senior community consists of several residential areas, divided by surrounding roadways. The design site is located in the southwest corner of the community, as indicated by the red line (Figure 5.5). This design site has been chosen since the developer of the Dongtan Senior Community originally assigned this area as a site for constructing Continuing Care Retirement Community (CCRC) for seniors with chronic diseases. Marcus believes that design complexity grows when different levels of healthcare services are mixed together in the same landscape (Marcus and Francis 1997). In light of that notion, the uniformity of the residents in the southwest part of the DSC and the healthcare services they demand, present a unique advantage so that the efficiency and the effectiveness of the landscape design provided in this thesis is improved.

5.2 Design Site Analysis

Architectural Analysis

Steinberg Architects Group, an international architectural design company from Los Angeles, is experienced in both residential planning and architectural design. Steinberg Architects Group designs and tailors their architectural and structural layouts to fit the needs of its residents. The proposed architectural design for the CCRC consists of three types of structures: residential buildings, commercial buildings, and multi-functional buildings (Figure 5.6). The five U-shaped residential building units each have a ground floor connecting a 4-story and a 6-story building. Access to these units is granted to

Figure 5.5 Location of the Design Site
Figure Source: Provided by Steinberg Architects Group

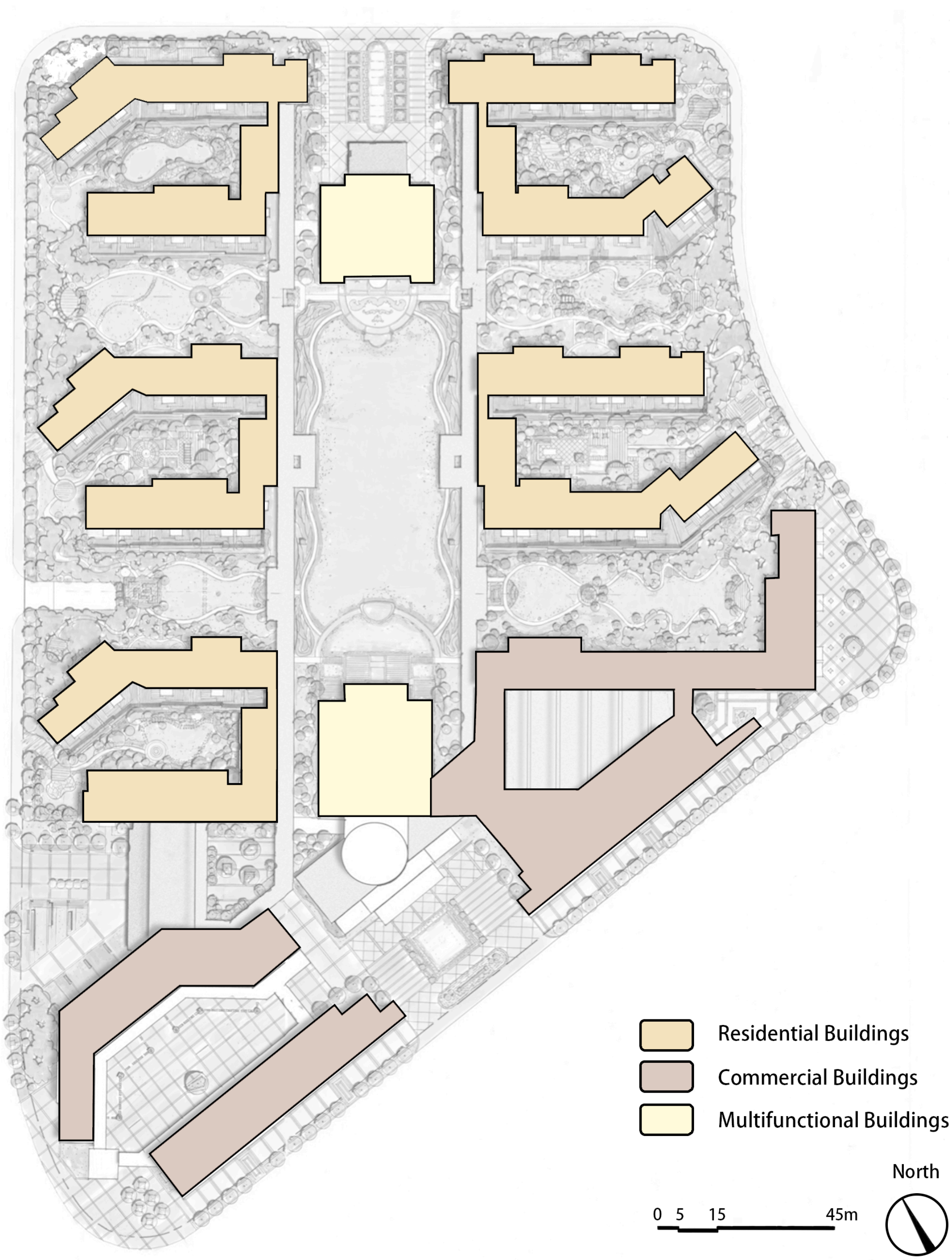


Figure 5.6 The Type of the Buildings of the CCRC
Figure Source: Drawn by Yiming Huang

residents only. The semi-closed garden between the two buildings offers a quiet and secure private space for daily activities. The height difference between the two buildings in each unit allows sufficient sunshine in the rooms facing south, while creating both sunlit and shaded areas in the garden to satisfy different demands of exposure (Figure 5.7). However, the six-story residential buildings will make the four green spaces inbetween the residential units in the shade during the daytime. Therefore, shade plant materials should be considered and selected for these green spaces, such as *Zoysia sinica*, *Fatsia japonica, Aucuba japonica, Thuja occidentalis, and Osmanthus fragrans.* The site is also equipped with a multi-functional building in the north, which has sufficient medical facilities and wards in case of emergencies. Another multi-functional building sitting in the south offers recreational facilities, including a dining hall and an entertainment room. These multi-functional buildings provide a complete chain of services and demonstrate its capabilities in handling emergency situations. Commercial buildings contain various business facilities, such as restaurants, supermarkets, and an ATM. These services offer much convenience to the residents. For safety concerns, security checkpoints are placed between the residential areas and commercial buildings.

Circulations Analysis

Among the three entrances of the CCRC, the north and the south entrances are accessible to both pedestrians and vehicles. The west entrance, however, admits vehicles only and directly leads to the underground parking lot (Figure 5.8). The entrance on Dongtan Avenue is the main entrance, through which cars can proceed to a separate underground parking lot in a commercial area. The south entrance is often more crowded, as it is close to a nearby commercial block. The north entrance, on the other hand, is

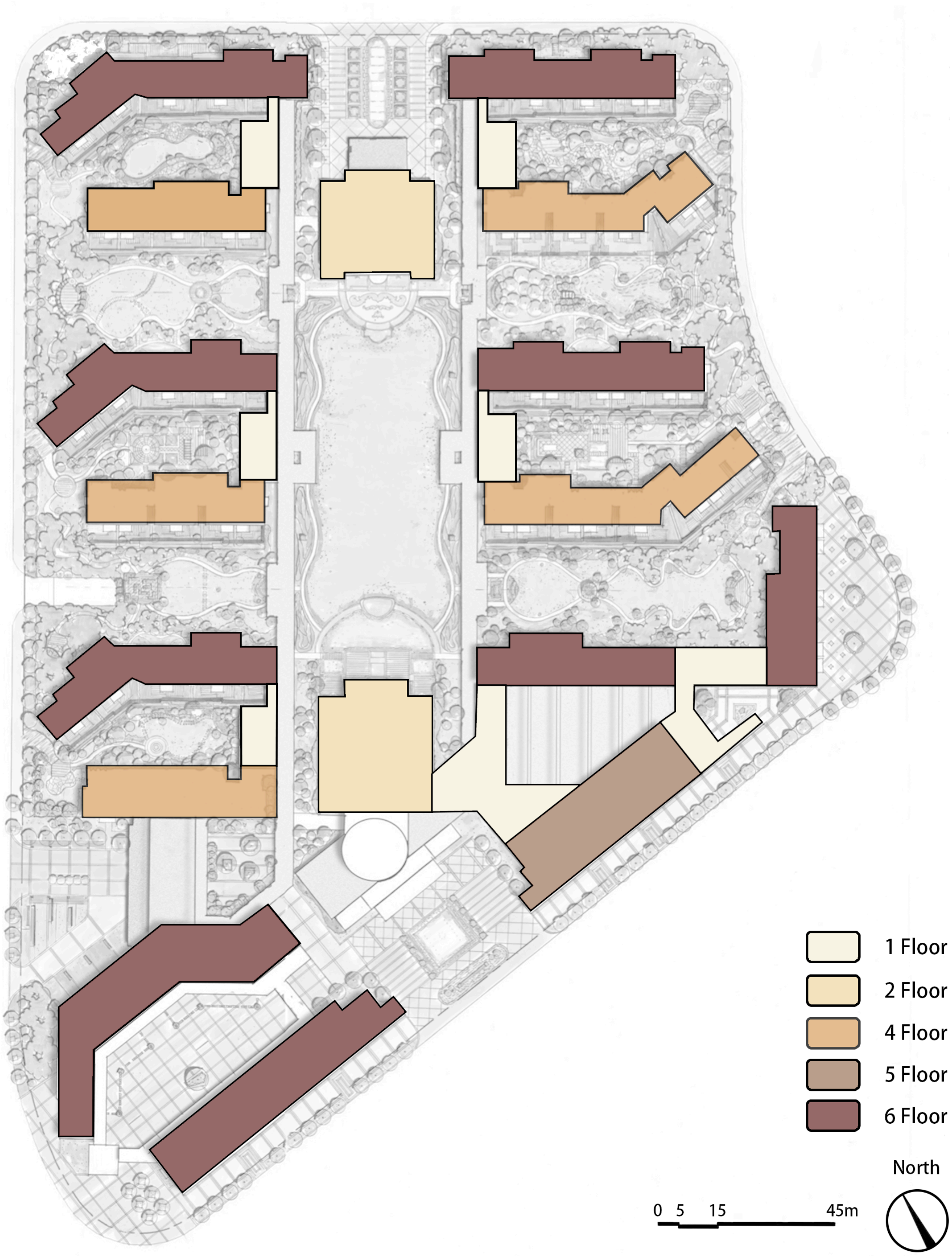


Figure 5.7 The Height of the Buildings of the CCRC
Figure Source: Drawn by Yiming Huang

Figure 5.8 Vehicular and Pedestrian Circulations of the CCRC
Figure Source: Drawn by Yiming Huang

located inside the community and is therefore much more peaceful. The site encompasses two types of circulation, by design: vehicular circulation and pedestrian circulation. The path for vehicular circulation is concise and clear, as there is driveway connecting all three entrances and the parking lots. In addition, vehicles are not permitted to enter the residential area and the central area of the site. This separation of the pedestrians from the vehicles, therefore, creates a significantly safer community for the senior residents. The proposed paths for pedestrian circulation emphasize accessibility with a humanizing element included in their design. Accessible pathways connect almost every place within the community, also allowing handicapped seniors to move around freely. Corridors with ceilings placed in the central pathways show great humanitarian considerations in the design process. These corridors are terrific places for outdoor exercise during poor weather (Figure 5.9).

Green Space Analysis

This thesis categorizes the green spaces in the CCRC into three categories based on their functionalities: garden green space, peripheral green space, and commercial green space (Figure 5.10). The garden green space mainly serves as a public area for daily exercise. The garden green space includes the entire accessible garden space inside and surrounding the five residential units, as well as the green space inbetween the two multi-functional buildings. The peripheral green space takes advantage of naturally arranged woodland and separates the community from the outside traffic. Naturally arranged woodland effectively reduce outside noise while providing large amounts of oxygen that benefits the senior residents. Aside from that, naturally arranged woodland also separate the garden space within the residential units from the green space inbetween them.

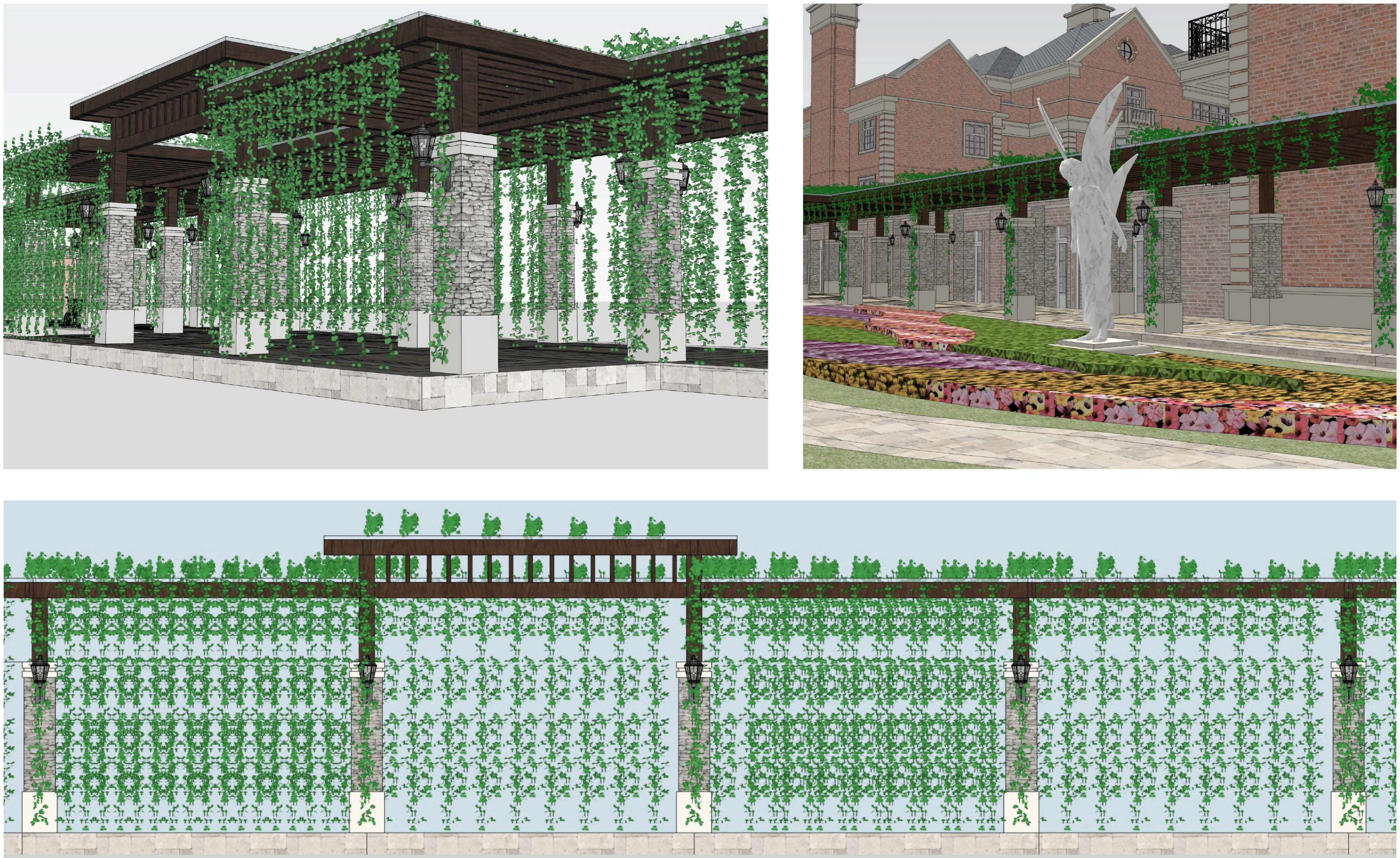


Figure 5.9 The Perspectives and Section of the Covered Walkway
Figure Source: Provided by Steinberg Architects Group

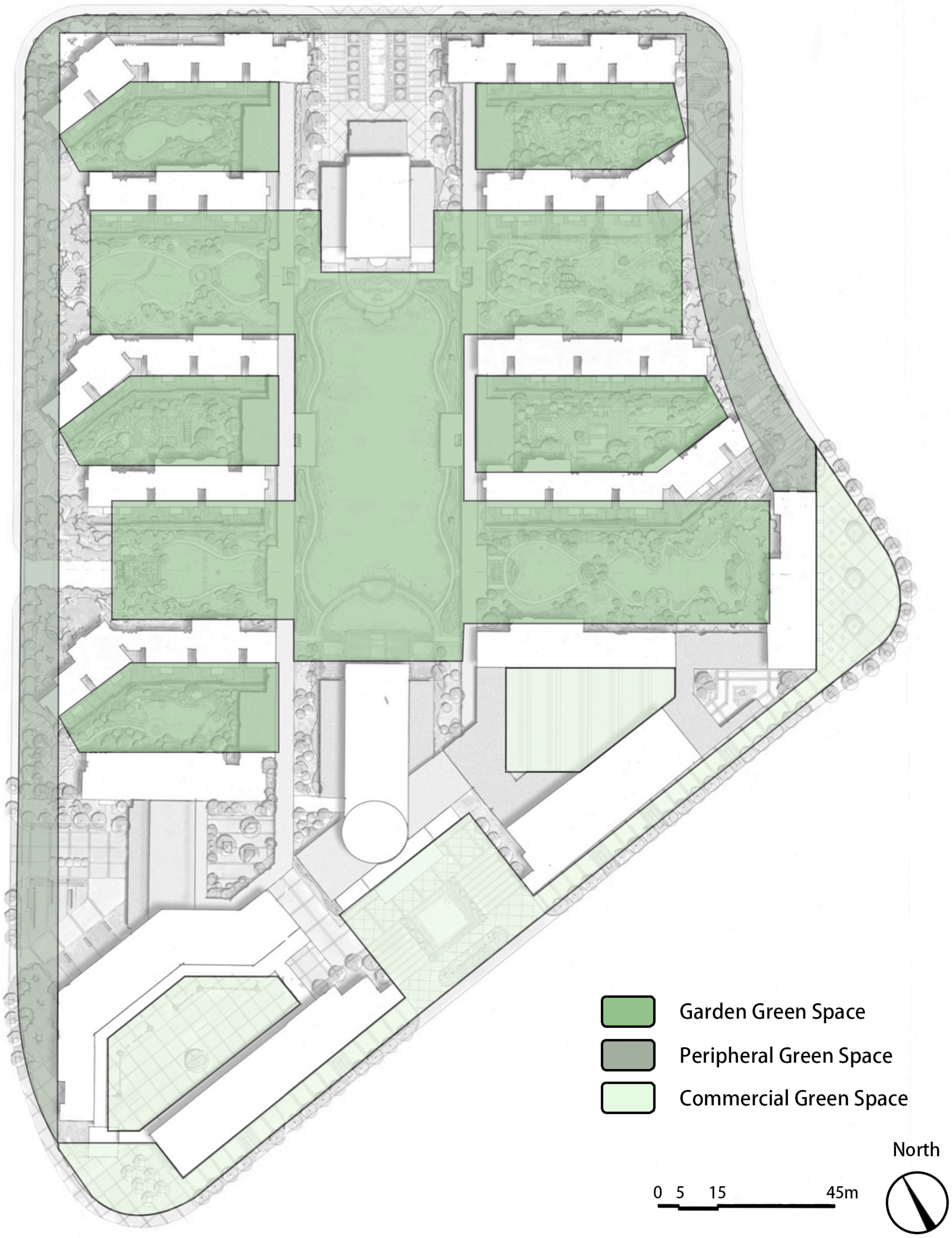


Figure 5.10 The Types of Green Space of the CCRC
Figure Source: Drawn by Yiming Huang

Commercial green space refers to the green space in the commercial district, and it serves as a relaxing space for exhausted consumers. Therefore, commercial green space features hard covered ground with trees, pools, and benches for people to sit and rest, while offering a sidewalk tree canopy to create cooling shade.

5.3 Design Concept

The culture of health preservation has been selected as a new design concept to apply to the therapeutic gardens at the DSC for two reasons: First, using the notion of health preservation in Chinese culture as a design concept can offer a holistic approach and methodology for therapeutic garden design. Second, the notion of health preservation in Chinese culture can provide achievable therapeutic benefits. The Five Elements Theory has been utilized as a holistic approach for diagnoses and the treatment of diseases in traditional Chinese medicine for over a thousand years. Therefore, under the guidance of the Five Elements Theory, the therapeutic garden design can assist the elderly in restoring their physical and mental health and finally achieve the goals of disease prevention and health preservation.

According to the theoretical description of traditional Chinese medicine, the state of balance between humans and nature found in the notion of health preservation is represented by the balanced relationship of the five elements. There is a relationship of mutual generation and restriction among the five elements (metal, wood, water, fire, and soil). This relationship associates the five elements with the five organs (lung, liver, kidney, heart, and spleen) and the five modes of sensory perception (smell, vision, hearing, touch, and taste) of the human body, respectively. In addition, by applying the factors associated with the five elements in the natural environment, human emotions can be adjusted, and the functional mechanisms of the five organs and the five sensory perceptions of the human body can be restored, thus reaching a healthy state of balance. For example, traditional Chinese medicine emphasizes that more attention should be paid to the protection of the lungs in the fall, which corresponds to the metal element. In the fall, the lungs would become the most vulnerable because of the dry weather, which triggers respiratory diseases and affects the sense of smell. Ginkgo fruits, which are associated with metal elements, are often used in traditional Chinese medicine for lung health. In the spring, which corresponds to the wood element, liver diseases tend to occur frequently. Eating green vegetable such as spinach or celery, which represent the wood element, can help people nurse their liver and recover their vision. In winter, which corresponds to the water element, deficiency of the kidney tends to occur and is accompanied with symptoms of tinnitus, due to the lowering of the outdoor temperature. Eating black food such as black sesame seeds or black beans, which represent the water element, can promote the health of the kidneys. In summer, which corresponds to the fire element, heart diseases tend to occur, due to the hot weather. Red pomegranates, which represent the fire element, are very beneficial for cardiovascular health. Pomegranates have been proven to reduce blood pressure and to soften blood vessels. In late summer, which corresponds to the soil element, the rainy and humid weather tends to damage the spleen, which results in indigestion and a poor appetite. Corn and pumpkin, which represent the soil element, can help restore the spleen. The new design concept emphasizes a holistic view toward humans and nature, thus achieving the goal of curing and rehabilitating patients through the mutual care between humans and nature in the whole system.

In terms of the therapeutic garden design for the CCRC, the new design concept generated from the notion of health preservation is applied to the five courtyard spaces. The courtyard spaces are classified into five themes according to the Five Elements Theory, with each theme corresponding to a specific element. Based on the five elements, the correspondence between garden users and garden design has been built. This correspondence offers a living guidance for the elderly residents with their respective demands (Figure 5.11). The courtyard design of the CCRC mainly aims to meet the elderly's pursuit and demand for a high quality life as well as to provide them with desirable therapeutic gardens for health preservation. In each garden, plant materials will be allocated based on the corresponding connections between the five elements and the five organs of the human body. For example, in the garden that applies the wood element, cypress will be used to relieve the liver problems of patients and to regulate the anger emotion. Thus, a series of problems including visual decline produced by liver diseases can be minimized. The shapes and colors associated with each element will influence the design and formation of each garden. For example, the meandering path and vegetation in the flowing-shaped pattern of the water garden, the shape which belongs to the water element. The dark color, which represents the water element will be utilized everywhere in the water garden, such as black table and chairs. In addition to the courtyard space design, the landscape design of green spaces inbetween residential units in the CCRC will also comply with Marcus' suggestions for therapeutic gardens and the specific guidelines for senior populations, with the aim to build a green space for relieving their pressure and restoring the physical and mental health of the aged residents and their visiting relatives.

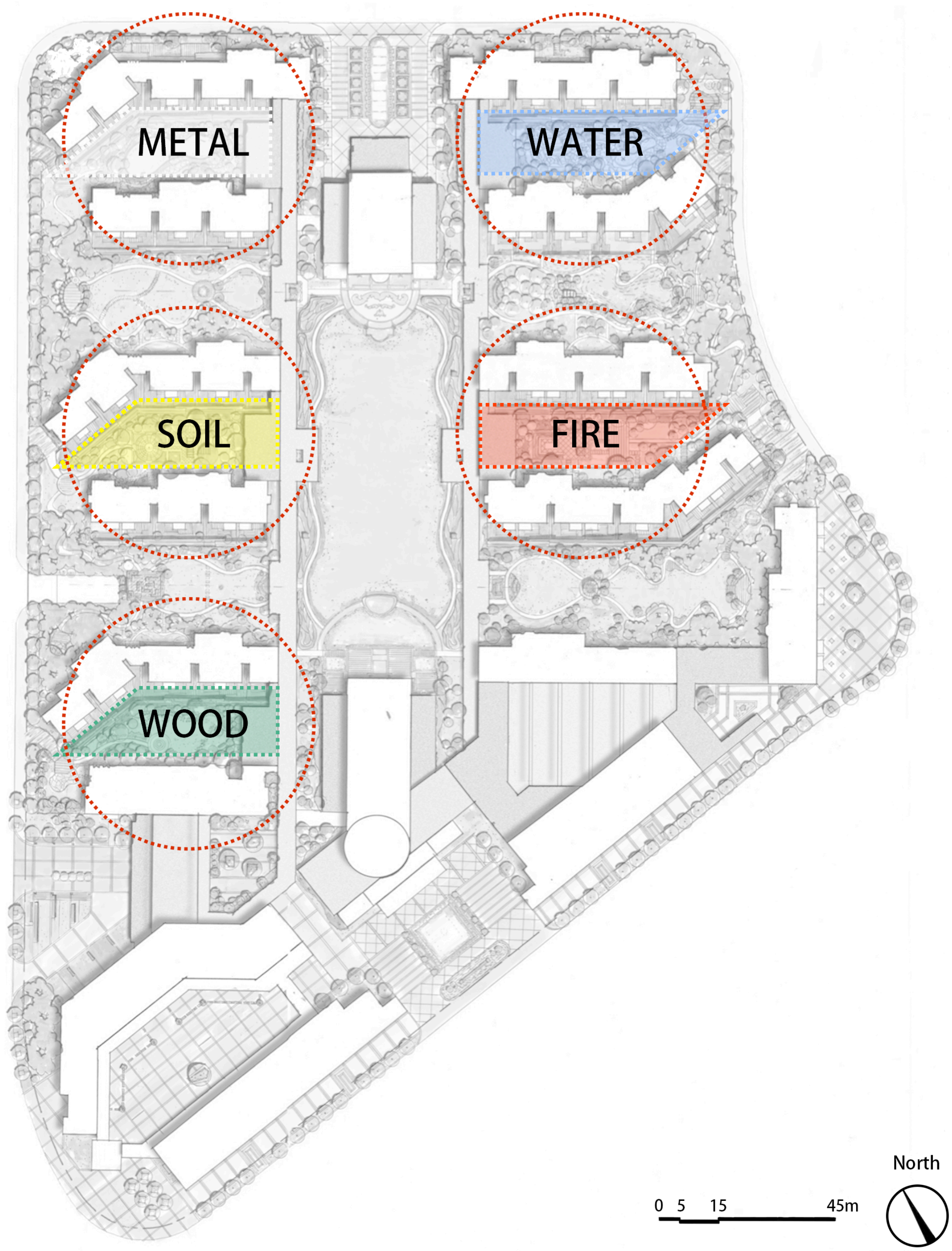


Figure 5.11 Design Concept for the CCRC
Figure Source: Drawn by Yiming Huang

5.4 Master Plan of the CCRC

According to the previous analysis of green spaces, the landscape design for the CCRC contains three components: garden green spaces, natural shielded green spaces, and commercial green spaces (Figure 5.12). As discussed in chapter three, enclosed space can provide the senior residents with a safe and private environment, which may increase their sense of control; and semi-open space can offer a green place for senior residents to spend time with their families as well as a recreational playground for visiting children. The following section will fully illustrate the five courtyard gardens and the four gardens inbetween the residential units.

Naturally shielded green space mainly adopts a layout with dense natural woodlands in order to separate the community from the outside traffic and to isolate the disturbance of traffic noise. At the same time, the woodlands can exhale a very large amount of oxygen, which builds a desirable ecological environment to benefit the senior residents. In addition, the woodlands serve to separate the five courtyard spaces from the green spaces in between the residential units. Thus, the elderly residents are offered the privacy of enclosed courtyard spaces while removing their sense of being limited. Furthermore, the registration office for visitors is located at the entrance of each residential unit, which reinforces the necessary privacy and safety of the courtyard spaces.

The landscape design for commercial green space mainly consists of canopy trees and recreational facilities, which try to provide the exhausted customers with shaded places to sit and rest. In addition, considering the accessibility and the safety of the senior residents, security checkpoints and ramps for wheelchair users have been placed between commercial streets and residential areas.

Figure 5.12 Master Plan of the CCRC
Figure Source: Drawn by Yiming Huang

5.5 Garden Green Space Design of the CCRC

Green Space inbetween Residential Units

The CCRC contains four semi-open green spaces in between residential units, which mainly serve as places for the senior residents and their relatives to visit. Therefore, the four green spaces aim at providing them a comfortable environment for socialization, exercise, leisure, and recreation. These four green spaces maximize the creation of lawn areas by utilizing a design of symmetrical path systems, which offer places for gathering and other outdoor activities. Two symmetrical meandering paths provide the senior residents exercise trails. The node designs offer them multiple spaces for socialization, leisure, and recreation. Additionally, the flower parterres near the covered walkway provide an opportunity for senior residents to interact with nature during the poor weather.

Enlargement one refers to the northwestern green space inbetween the residential units (Figure 5.13). Two symmetrical paths link the covered walkway, the fountain, and the wooden kiosk. The node designs include a wooden gallery at each of the two ends of the paths and a fountain located in the central area between them. The wooden kiosk provides the senior residents and their families and friends a space for relaxation and communication. The water feature at the center of the space also offers a place for them to pause to appreciate the scenery. The central lawn area in between the two paths can be used as a place for outdoor activities such as wandering, exercise, and a family barbecue.

Enlargement two illustrates the landscape of the southwestern green space in between the residential units (Figure 5.14). Likewise, two symmetrical arc paths connect the covered walkway and the hedge maze. The hedge maze at the end of the two paths provides a recreational place for young children who are visiting the elderly residents.

Enlargement three refers to the northeastern green space in between the residential units (Figure 5.15). In addition to the symmetrical path system, the small square, with arranged canopy trees, located at the entrance of this green space, provides a suitable place for gathering and exercise after the noontime.

Enlargement four illustrates the landscape of the southeastern green space in between residential units (Figure 5.16). This green space provides a large lawn area and open viewings. The symmetrical meandering paths provide an exercise trail for aged residents, so that they can relax themselves in nature.

Courtyard Space within Residential Units

The CCRC contains five courtyard spaces within its residential units, primarily serving senior residents. Considering how difficult it is for most of the senior residents to move their bodies, courtyard spaces within the residential units are more accessible for them and in turn can encourage them to visit the gardens frequently. In addition, visiting permission is required to increase the safety and privacy of the senior residents who live in the unit. Therefore, the design concept derived from the notion of health preservation has been applied to such accessible and enclosed courtyard spaces, which may maximize the therapeutic benefits of the gardens. Since the new design concept originates from the notion of health preservation in Chinese culture, it can fully demonstrate the harmonious relationship between humans and nature, which considers humans and their emotions as integral components of the garden design process.

The specific application of the new design concept in the therapeutic garden design is embodied in the plant species selected on the basis of the Five Elements Theory. According to the relationship between the colors of plant flowers or fruits (white, green,

LEGEND

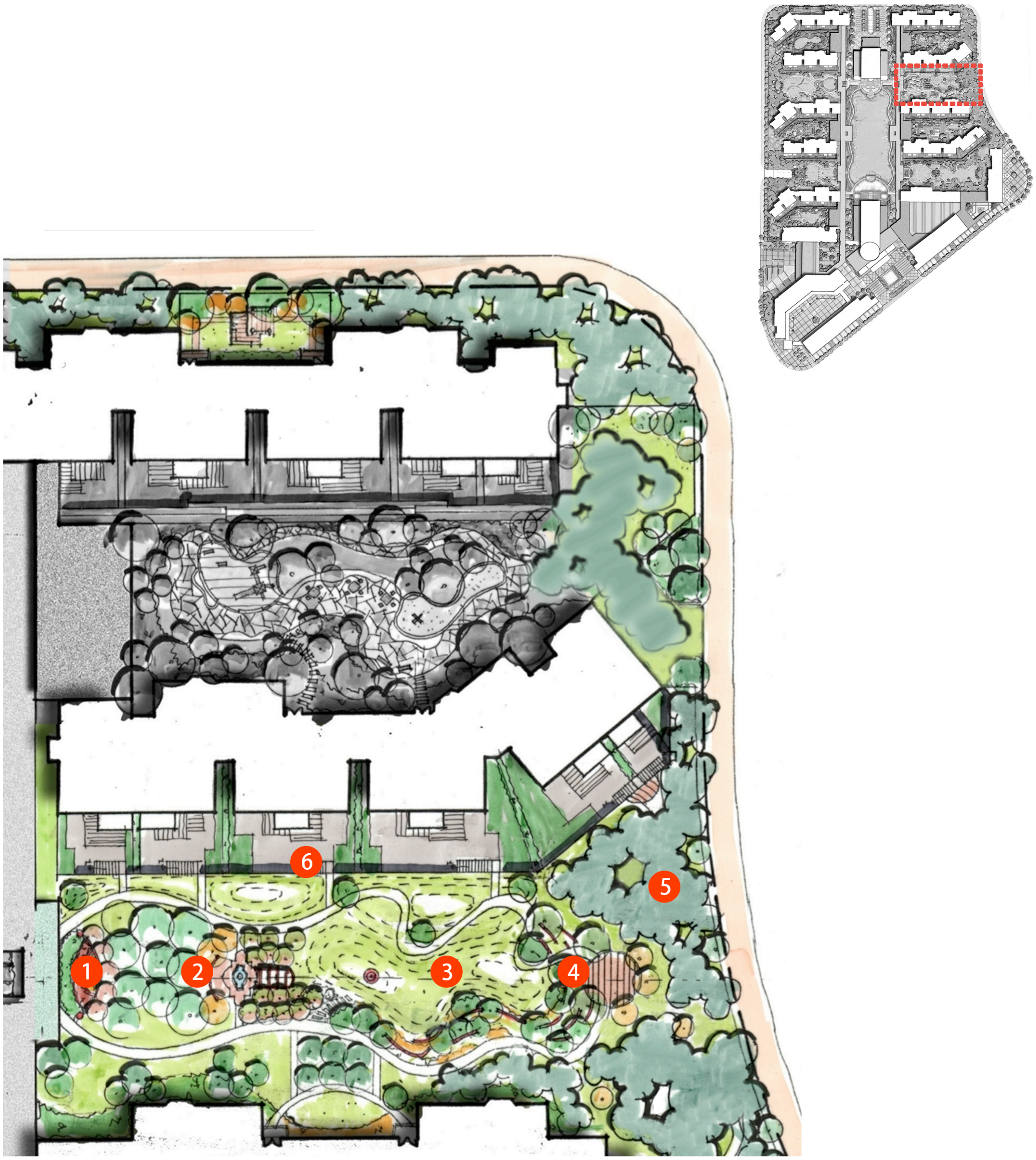
1. Landscape Lawn
2. Water Fountain
3. Paving Stones
4. Wooden Gallery
5. Shielded Vegetation
6. Terrace Parterre
7. Sunken Garden
8. Dense Woodlands

Figure 5.13 Enlargement one: northwestern green space
Figure Source: Drawn by Yiming Huang

LEGEND

1. Landscape Parterre
2. Stone Sculpture
3. Paving Stones
4. Hedge Maze
5. Dense Woodlands

Figure 5.14 Enlargement two: southwestern green space
Figure Source: Drawn by Yiming Huang



0 6 12 24 m

LEGEND

1. Landscape Parterre
2. Canopy Square
3. Microtopographic Lawn
4. Terrace Stones
5. Dense Woodlands
6. Sunken Garden

Figure 5.15 Enlargement three: northeastern green space
Figure Source: Drawn by Yiming Huang

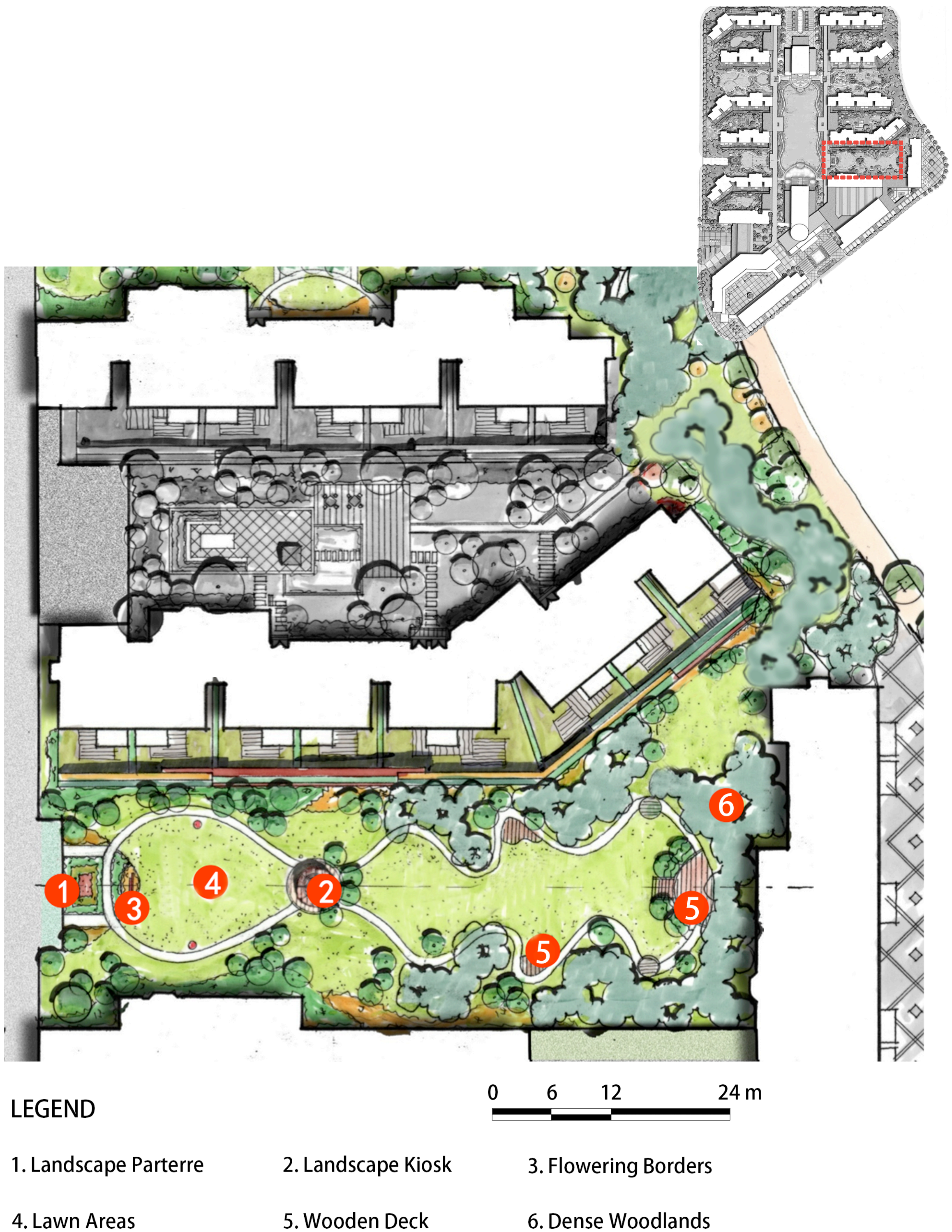


Figure 5.16 Enlargement four: southeastern green space
Figure Source: Drawn by Yiming Huang

black, red, and yellow) and the five corresponding elements (metal, wood, water, fire, and soil respectively), the plants are divided into categories that represent the attributes of the specific element. In this way, the plant materials can produce positive benefits and therapeutic effects to the corresponding organs of the human body, regulate humans' emotional feelings, and relieve a series of clinical symptoms caused by the diseases of the organs. For example, according to the clinical experience of traditional Chinese medicine, lung diseases in senior residents would usually be accompanied with a loss of the sense of smell. Senior residents with cardiovascular diseases tend to feel numb in their limbs. Most senior residents with spleen problems have abnormal appetites. Senior residents with liver diseases usually suffer from the decline of vision. Kidney diseases in senior residents are often accompanied with tinnitus, or even with the loss of hearing. Therefore, plants with white flowers or fruits can not only benefit their lungs, but can also slow down the decline of their sense of smell. Plants with red flowers or fruits can promote a healthy heart, thus reinforcing the residents' control over their limbs; plants with yellow flowers or fruits can promote the health of the senior residents' spleen, stimulate their appetite, and accelerate their digestion. Evergreen plants can contribute to the health of their liver, relieve eye fatigue, and help recover vision. Plants with black or dark flowers or fruits can benefit the health of the kidney, and alleviate such symptoms as tinnitus. This systematic plant classification can produce pertinent therapeutic effects according to the respective physical condition of senior residents. Detailed design descriptions of each courtyard space within the residential units in the CCRC will be illustrated in the next sections.

Metal Garden

The garden representing the metal element targets senior residents suffering from lung diseases. Clinically, the elderly often suffer from lung diseases, which are accompanied by respiratory symptoms. The following plant materials with white flowers or white fruits (which belong to the metal element) have been selected to formulate a planting plan for the metal garden (Table 5.1 and Figure 5.17). According to traditional Chinese medicine as well as Chinese cultural understanding, these plants can promote healthy lungs in the elderly and relieve them of the olfactory deterioration caused by respiratory diseases. For example, Ginkgolic acid and ginkgo fruits have been demonstrated to improve asthma. Flowering period indicates that the species can be selected for continuous landscape viewing from early spring to late autumn.

Table 5.1 The Species of Plants for the Metal Garden
Table Source: Drawn by Yiming Huang

	COMMON NAME	**SCIENTIFIC NAME**	**FLOWERING PERIOD**
TREE	Ginkgo	*Ginkgo biloba*	April
	Southern Magnolia	*Magnolia grandiflora*	May-July
	Chinese Magnolia	*Magnolia denudata*	March-May
SHRUB	White Champaca	*Michelia alba*	June-August
	Tea	*Camellia sinensis*	October-February
	Japanese Fatsia	*Fatsia japonica*	October-November
	Mound Lily Yucca	*Yucca gloriosa*	June-October
	Gardenia	*Gardenia jasminoides*	June-August

Ginkgo biloba

Magnolia grandiflora

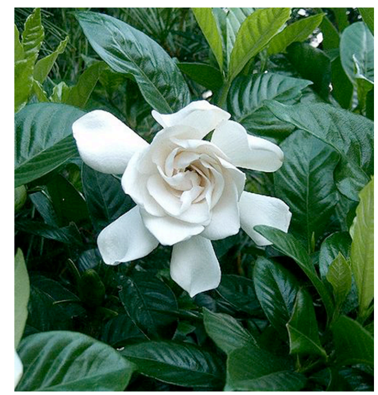
Magnolia denudata

Michelia alba

Camellia sinensis

Fatsia japonica

Yucca gloriosa



Gardenia jasminoides

Figure 5.17 Photos of the Plant Species for the Metal Garden
Figure Source: Wikipedia: http://www.wikipedia.org/
http://www.florida.plantatlas.usf.edu/

The metal garden design synthetically integrates the culture of health preservation and the Five Elements Theory through the use of specific plants with white flowers or fruits, and landscape materials that have round forms, an associated shape with the metal element in the Five Elements Theory (Figure 5.18). It also complies with Marcus's four key suggestions for therapeutic garden design (Figure 5.19). First, the design fosters and affirms a sense of control in the senior residents. The garden design places shrubs and canopy trees close to the side of the walls and uses them as a green shield to increase the privacy and the safety of the garden users. The lower shrubs are used to allow visual access into gardens through windows. The clear path system can direct senior residents to the space for socialization or croquet activity, which may increase their recognition of their surroundings and thus enhance their control of the space. Second, the design encourages the senior residents to give and receive social support. The small space close to the croquet field can provide a sitting place for senior residents to watch croquet games and to converse with others. Watching croquet games may offer an opportunity for impromptu social connections. Third, the design enables the senior residents to engage themselves in exercise and movement. The lawn area at the center of the garden is mainly used for croquet games. Croquet games offer an appropriate and necessary aerobic activity to senior residents, which can strengthen the health of their lungs. Last, the design provides the senior residents natural distractions so that their thoughts and feelings are redirected. For example, aromatic plant materials, such as gardenia and jasmine, have been selected for the planting plan of the metal garden. These plants can bring senior residents a refreshing olfactory experience, which allows them to get rid of worries and sorrows.

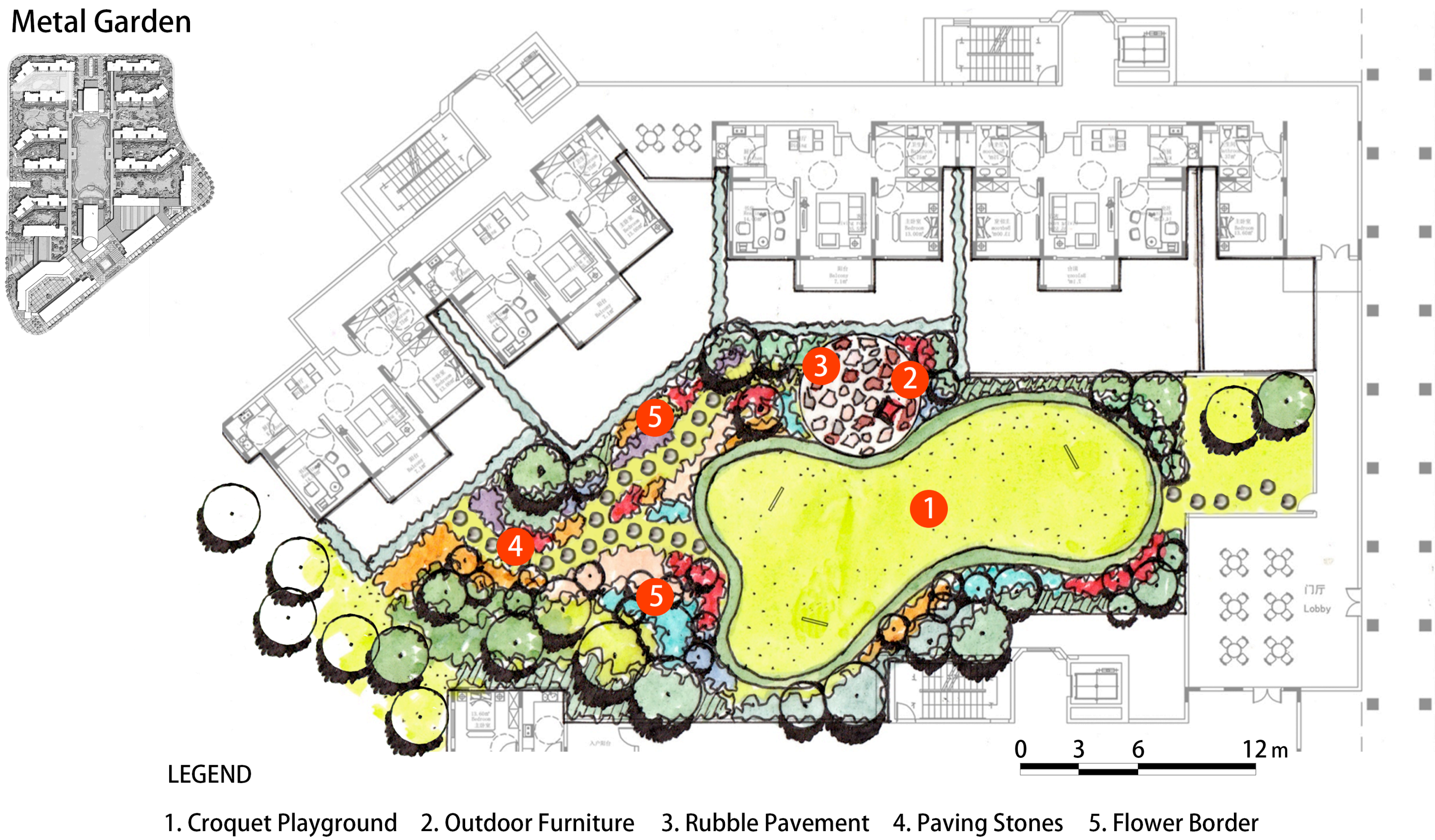


Figure 5.18 Master Plan of the Metal Garden
Figure Source: Drawn by Yiming Huang

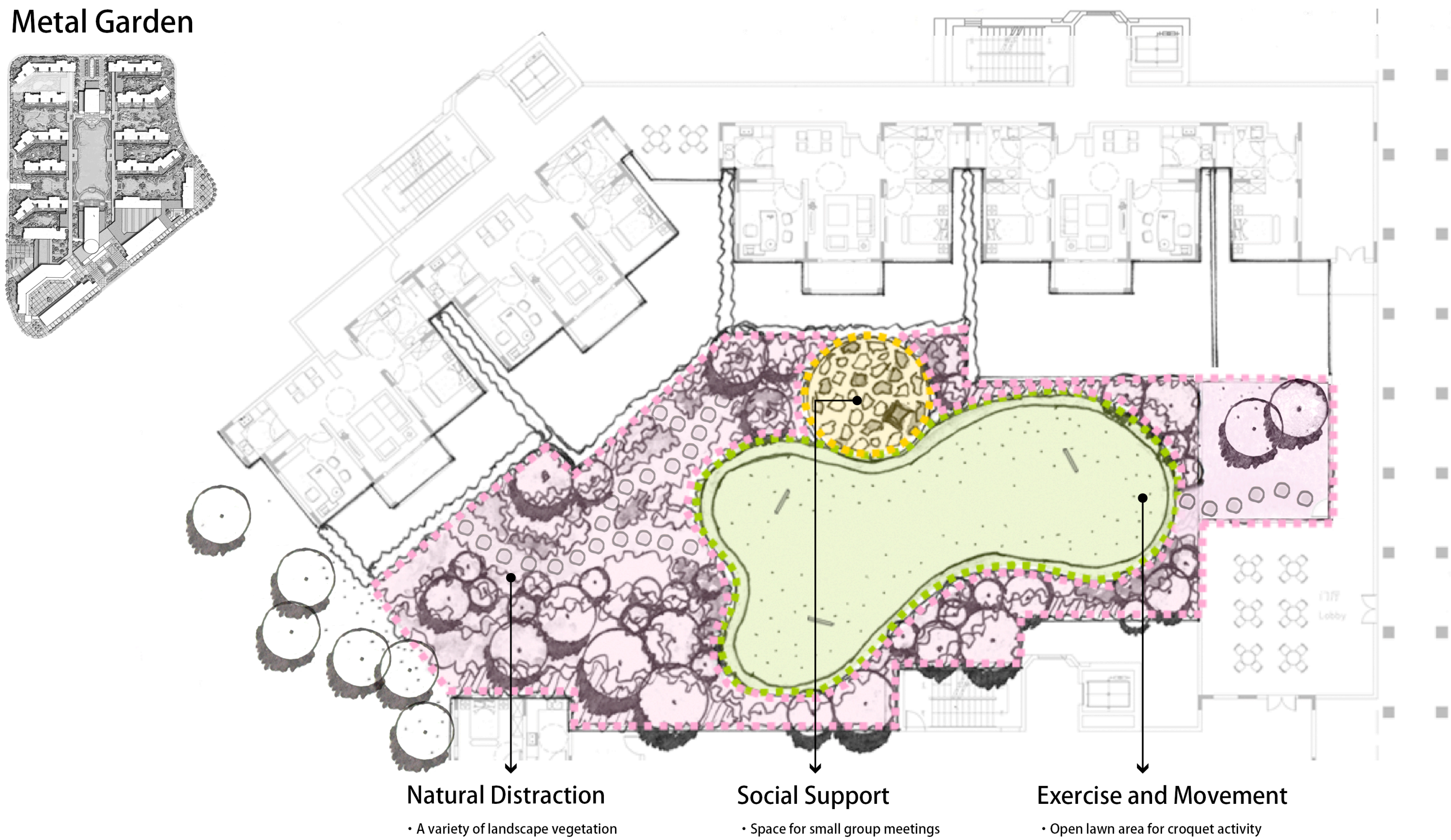


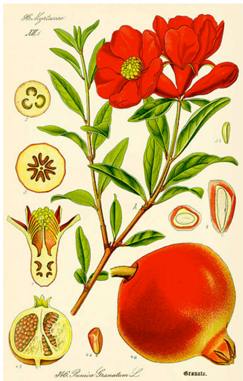
Figure 5.19 Illustration of Design Basis for the Metal Garden
Figure Source: Drawn by Yiming Huang

Fire Garden

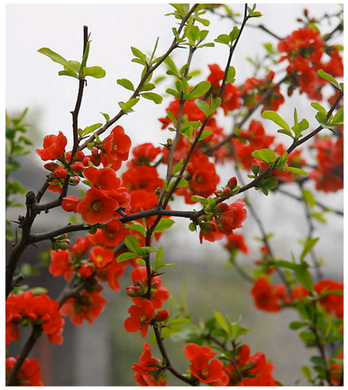
The garden associated with the fire element focuses on benefiting senior residents suffering from heart diseases. Clinically, the elderly often suffer from heart diseases, which are accompanied by the symptom of numb limbs. The following plant materials with red flowers or red fruits (which belong to the fire element) are selected for the planting plan of the fire garden (Table 5.2 and Figure 5.20). According to traditional Chinese medicine and Chinese cultural understanding, these plants can promote a healthy heart in the elderly and relieve their tactile deterioration. For example, pomegranates can reduce high blood pressure and soften blood vessels. Flowering period indicates that plant species can be selected in such a manner that continuous landscape viewing is possible throughout the seasons.

Table 5.2 The Species of Plants for the Fire Garden
Table Source: Drawn by Yiming Huang

	COMMON NAME	**SCIENTIFIC NAME**	**FLOWERING PERIOD**
TREE	Crape Myrtle	*Lagerstroemia indica*	June-September
SHRUB	Chinese Rose	*Rosa chinensis*	March-November
	Heavenly Bamboo	*Nandina domestica*	October-April
	Chinese Azalea	*Rhododendron simsii*	April-May
	Chinese Firethorn	*Pyracantha fortuneana*	March-April
	Flowering Quince	*Chaenomeles speciosa*	April
	Pomegranate	*Punica granatum*	May-June



Punica granatum



Chaenomeles speciosa

Lagerstroemia indica

Rosa chinensis

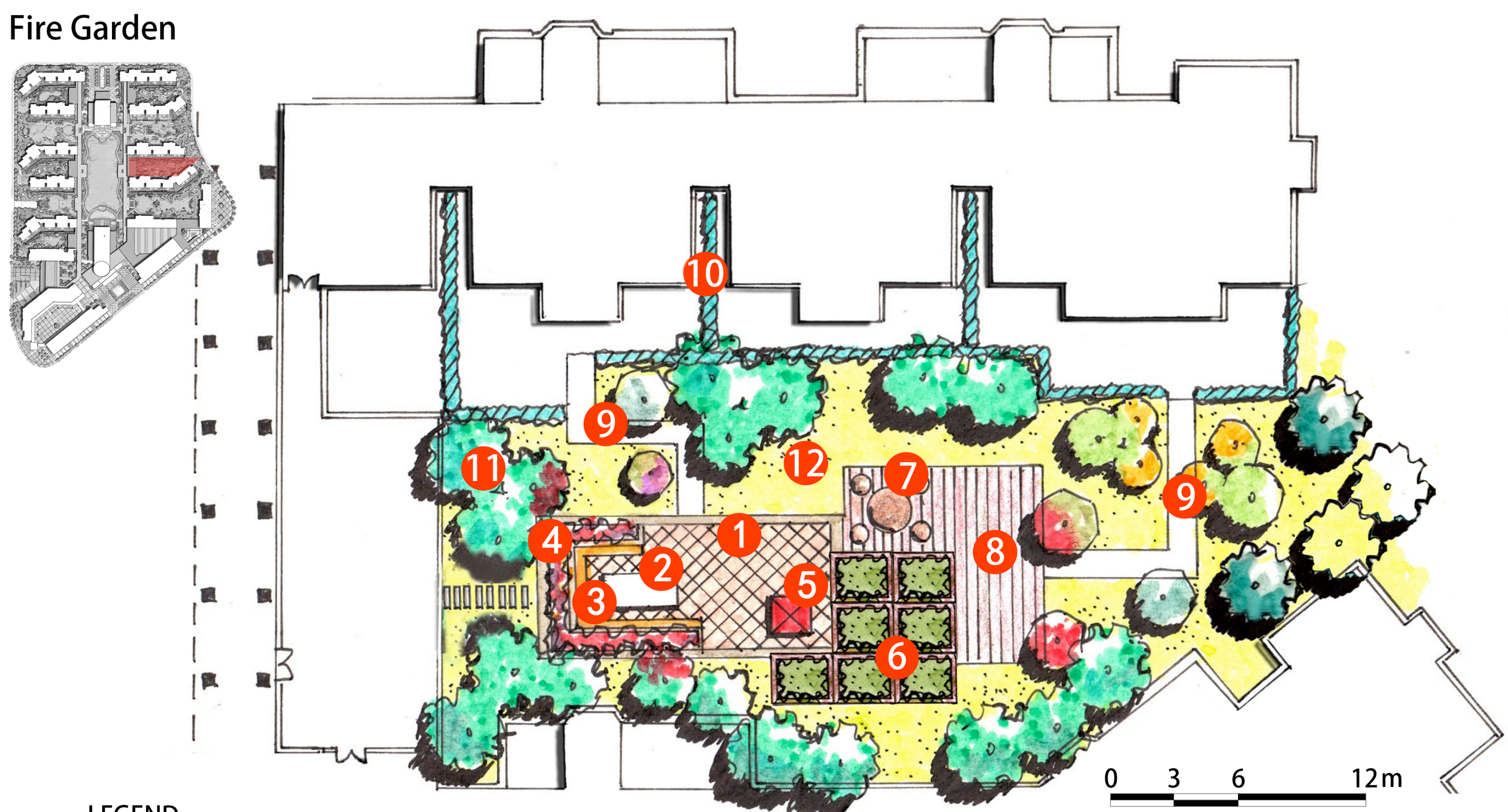
Nandina domestica

Rhododendron simsii

Pyracantha fortuneana

Figure 5.20 Photos of the Plant Species for the Fire Garden
Figure Source: Wikipedia: http://www.wikipedia.org/
http://www.florida.plantatlas.usf.edu/

The fire garden design uses plant materials with red flowers or fruits and bases the design form on polygon shapes (Figure 5.21). It also complies with Marcus's four key suggestions for a therapeutic garden design (Figure 5.22). First, the design fosters and affirms a sense of control in the senior residents. When the residents can control their surrounding environments, their anxiety will obviously decline. In the fire garden, planting beds, pavements, and ramps may increase the residents' sense of control. Senior residents can also become garden designers and can grow their favorite plants in the planting beds in the central field. Thus, the landscape of the garden may vary with the changes in the plant materials they have grown. In addition, different types of pavements can help residents differentiate the multiple spaces and increase their recognition of the space. The ramps that link the gardens and the residential buildings can offer convenience for senior wheelchair users or other elderly residents who walk at a slow pace. Second, the design encourages the senior residents to give and receive social support: The movable tables and chairs on the wooden deck can provide the residents with a place for small group communication. Moreover, the movable tables and chairs can be rearranged according to the differing demands of the residents. They can sit in a private space for meditation or create a social group in an open space. Third, the design enables the senior residents to engage themselves in exercise and movement. An open lawn area and a wooden deck in the garden can provide places for the elderly's daily activity. Last, the design provides the senior residents natural distractions so that their thoughts and feelings are redirected. The plant materials with red flowers or fruits may not only create an attraction of natural beauty for senior residents, but also promote a healthy heart.



LEGEND

1. Brick Pavement
2. Stone Table
3. Wooden Bench
4. Flower Border
5. Kiosk
6. Planting Beds
7. Table and Chairs
8. Wooden Deck
9. Pitch Paths
10. Hedge Fence
11. Landscape Trees
12. Lawn Area

Figure 5.21 Master Plan of the Fire Garden
Figure Source: Drawn by Yiming Huang

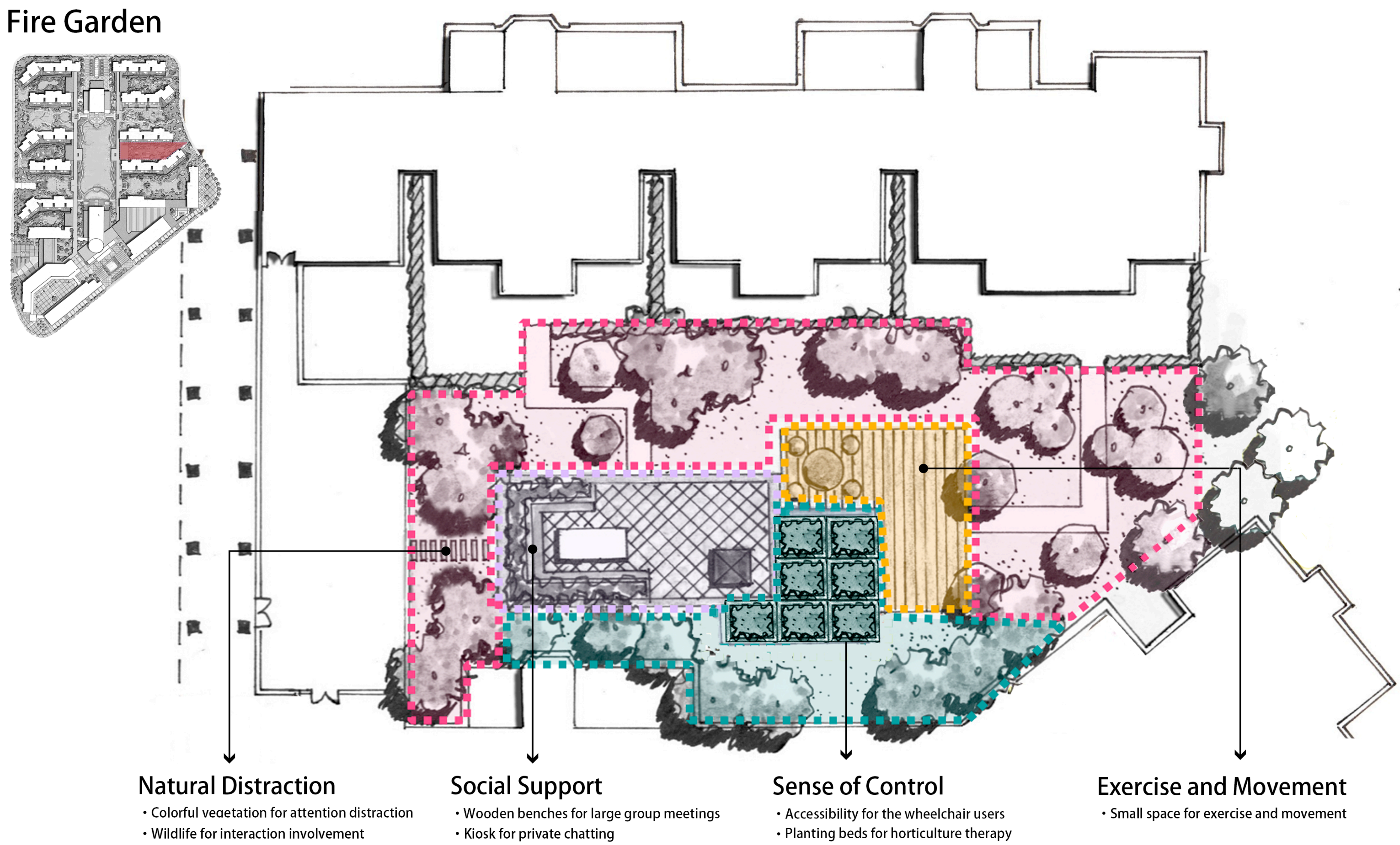


Figure 5.22 Illustration of Design Basis for the Fire Garden
Figure Source: Drawn by Author

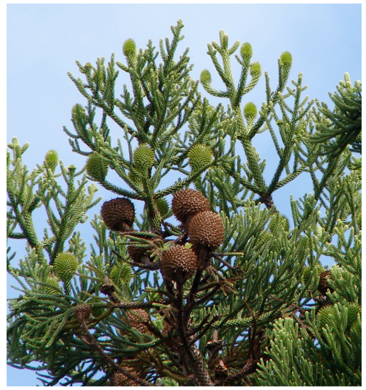
Wood Garden

The garden corresponding to the wood element has specific benefits for the senior residents suffering from liver diseases. Clinically, the elderly often suffer from liver diseases that are accompanied by poor eyesight. Because green flowers are seldom found in nature, the plants associated with wood primarily include the evergreen species. The following evergreen plant materials are selected for the planting plan of the wood garden (Table 5.3 and Figure 5.23). According to traditional Chinese medicine and Chinese cultural understanding, these plants can benefit the liver in the elderly and promote the recovery of vision.

Table 5.3 The Species of Plants for the Wood Garden
Table Source: Drawn by Yiming Huang

	COMMON NAME	**SCIENTIFIC NAME**
TREE	Camphor Tree	*Cinnamomum camphora*
	Hoop Pine	*Araucaria cunninghamii*
	Slash Pine	*Pinus elliottii*
	Chinese Windmill Palm	*Trachycarpus fortunei*
SHRUB	Chinese Box	*Buxus bodinieri*
	Japanese Laurel	*Aucuba japonica*
	Oriental Arborvitae	*Thuja orientalis*
VINE	English Ivy	*Hedera helix*

Cinnamomum camphora



Araucaria cunninghamii

pinus elliottii

Trachycarpus fortunei

Buxus bodinieri

Hedera helix

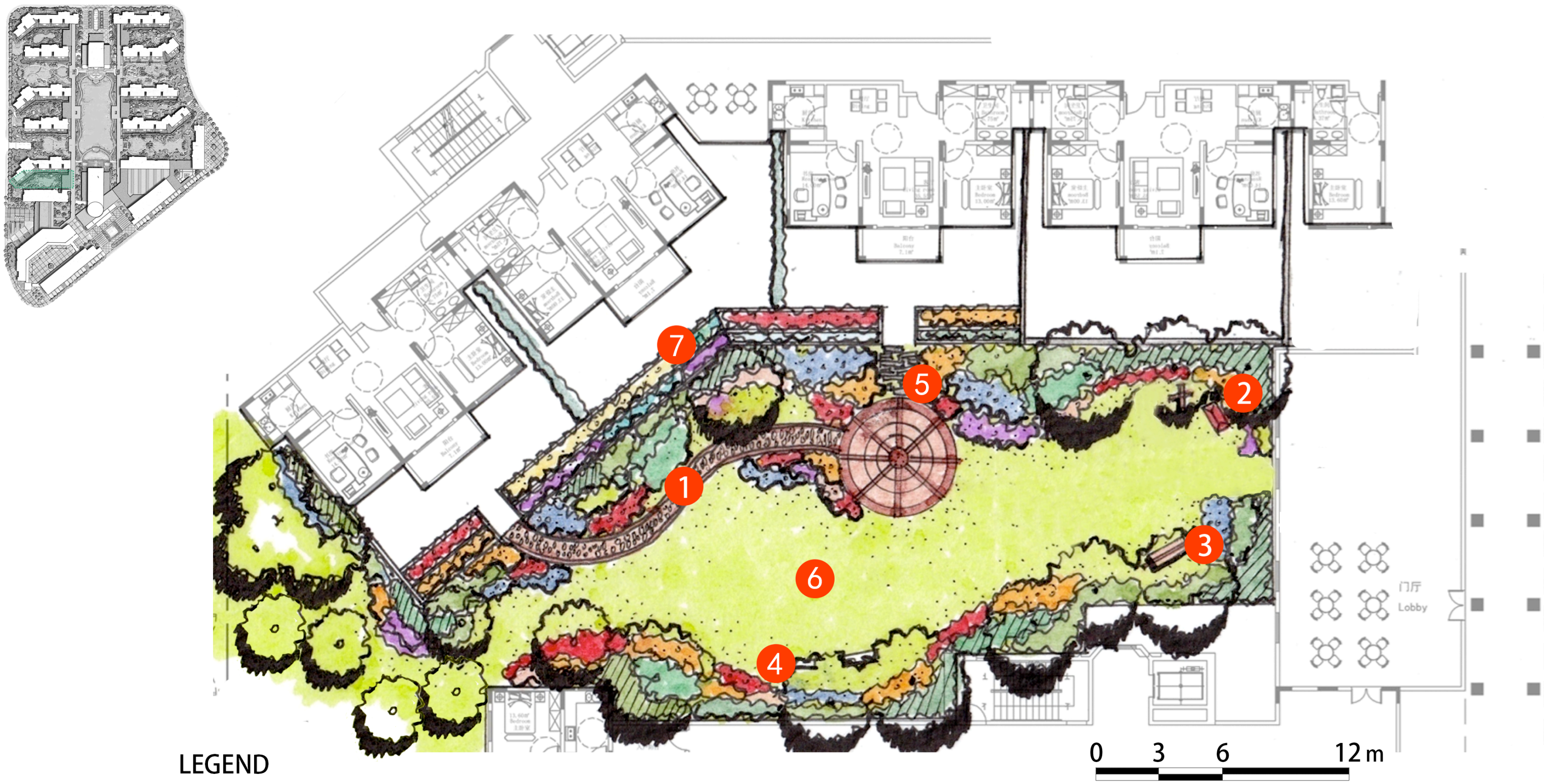
Aucuba japonica

Thuja orientalis

Figure 5.23 Photos of the Plant Species for the Wood Garden
Figure Source: Wikipedia: http://www.wikipedia.org/
http://www.florida.plantatlas.usf.edu/

The wood garden design follows Chinese Five Elements Theory by using linear shapes and green color plant materials (Figure 5.24). It also complies with Marcus's four key suggestions for therapeutic garden design (Figure 5.25). First, the design fosters and affirms a sense of control in the senior residents. In order to increase the sense of control of senior residents, a simple paved stone walkway and a rubble walkway are designed in the wood garden to offer a clear direction and orientation. Second, the design encourages the senior residents to give and receive social support. Several places for social activities have been proposed in the garden. The kiosk in the garden can provide residents with a shady and cool place for rest, communication, and recreation after the noontime. The chairs around the lawn area can provide the residents places for independent meditation or small-scale social connections. Third, the design encourages the senior residents to give and receive exercise and movement. The lawn area at the center of the garden primarily provides residents with a place for various activities and exercise, depending on their demands. The soft lawn can bring senior residents a comfortable feeling for walking. In addition, the cobblestone footpath leading to the kiosk can provide residents with many options for various health-promoting activities. Fourth, the design provides the senior residents natural distractions so that their thoughts and feelings are redirected. The shrubs and the canopy trees in the wood garden, basically designed at the side of the buildings, create an open viewing area in the center of the garden. This open viewing area enables long distance views from the opposite side of the lawn area, which are regarded as helpful for eyesight in Chinese culture. Personal bird feeders, designed to be placed at the entrance of the garden, can provide opportunities for senior residents to interact with nature, which may enrich their daily activities and help them develop positive habits.

Wood Garden



LEGEND

1. Rubble Walkway
2. Bird Feeder
3. Swing
4. Wooden Bench
5. Paving Stones
6. Lawn Area
7. Flower Border

Figure 5.24 Master Plan of the Wood Garden
Figure Source: Drawn by Yiming Huang

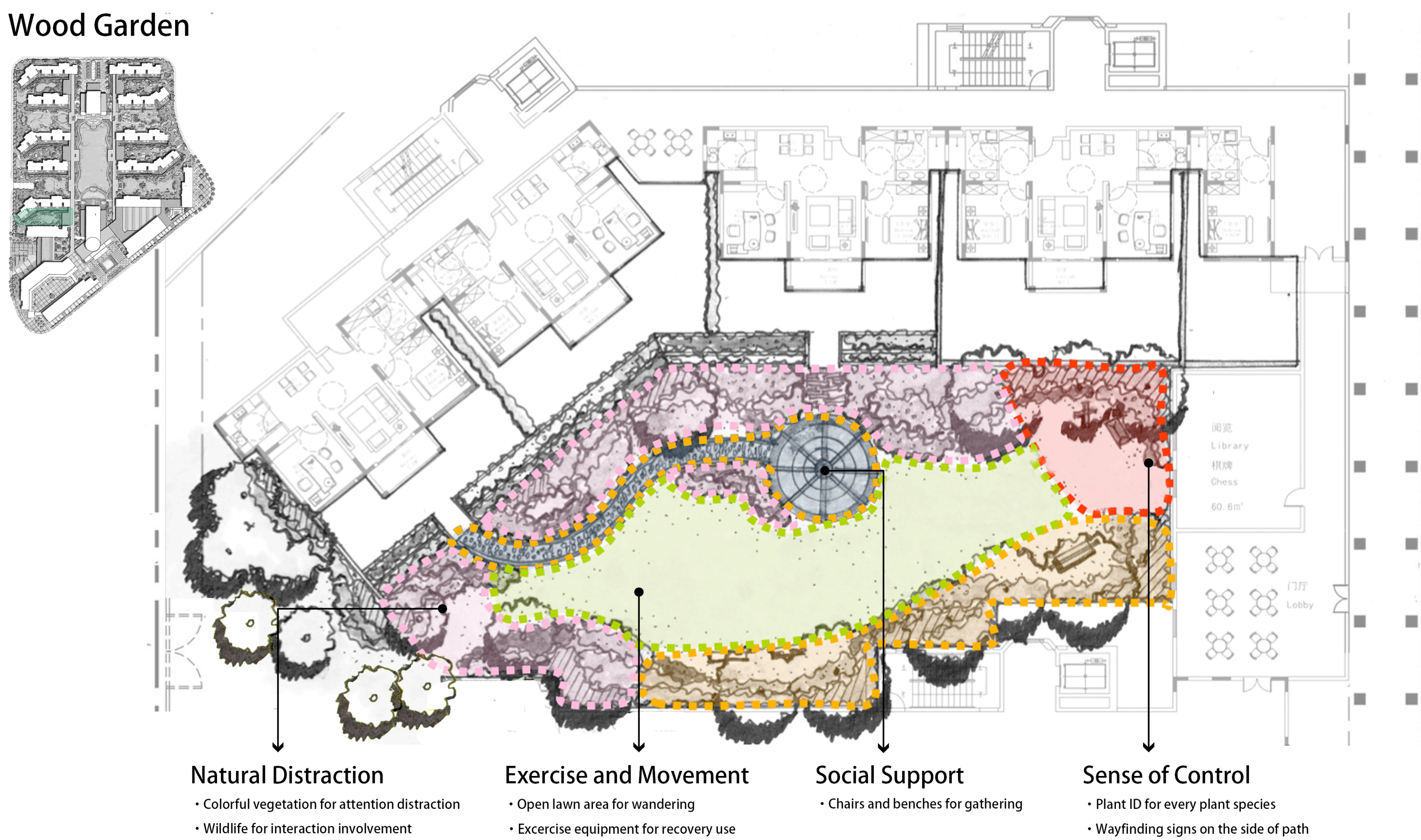


Figure 5.25 Illustration of Design Basis for the Wood Garden
Figure Source: Drawn by Yiming Huang

Soil Garden

The garden belonging to the soil element is proposed for those senior residents suffering from spleen diseases. Clinically, the elderly often suffer from spleen diseases that are accompanied by symptoms of dyspepsia. The following plant materials with yellow flowers or fruits (which belong to the soil element) are selected for the planting plan of the soil garden (Table 5.4 and Figure 5.26). According to traditional Chinese medicine and Chinese cultural understanding, these plants can contribute to a healthy spleen in the elderly, stimulate their appetite, promote good digestion and absorption, and relieve a series of problems caused by spleen diseases. Flowering period indicates that the species can be selected for continuous landscape viewing from early spring to early winter.

Table 5.4 The Species of Plants for the Soil Garden
Table Source: Drawn by Yiming Huang

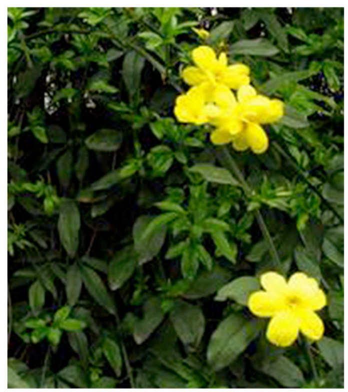
	COMMON NAME	**SCIENTIFIC NAME**	**FLOWERING PERIOD**
TREE	Glossy Shower	*Senna surattensis*	October-December
	Goldenrain Tree	*Koelreuteria paniculata*	June-July
SHRUB	Orchid Tree	*Aglaia odorata*	July-August
	Sweet Osmanthus	*Osmanthus fragrans*	September-October
	Winter Jasmine	*Jasminum mesnyi Hance*	March-April
	Forsythia	*Forsythia suspensa*	March-May
HERB	Yellow Chamomile	*Cota tinctoria*	August-October

Senna surattensis

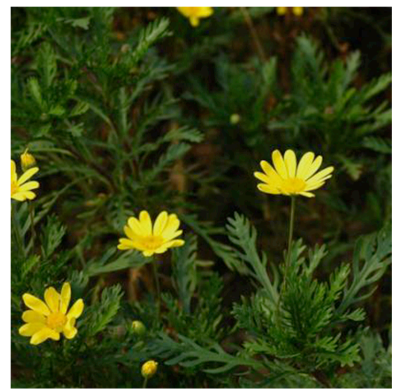
Koelreuteria paniculata

Aglaia odorata

Osmanthus fragrans



Jasminum mesnyi



Cota tinctoria

Forsythia suspensa

Figure 5.26 Photos of the Plant Species for the Soil Garden
Figure Source: Wikipedia: http://www.wikipedia.org/
http://www.florida.plantatlas.usf.edu/

The soil garden design uses the specific plants with yellow flowers or fruits and landscape materials that have square forms associated with the soil elements (Figure 5.27). It also complies with Marcus's four key suggestions for therapeutic garden design (Figure 5.28). First, the design fosters and affirms a sense of control in the senior residents. Senior residents can grow edible plants in the planting fields of the garden, thus increasing their passion of garden activity, helping them establish confidence, and reinforcing their sense of accomplishment. In addition, different types of pavements can help residents differentiate the multiple spaces and increase their recognition of the space. The ramps that link the gardens and the residential buildings can offer convenience for senior wheelchair users or other elderly residents who walk at a slow pace. Second, the design encourages the senior residents to give and receive social support: The movable tables and chairs on the wooden deck can provide the residents with a place for small group communication. Moreover, the movable tables and chairs can be rearranged according to the differing demands of the residents. They can sit in a private space for meditation or create a social group in an open space. Third, the design enables the senior residents to engage themselves in exercise and movement. A cobblestone footpath has been introduced in this garden for the daily exercise and movement of the residents. According to traditional Chinese medicine, cobblestones of different shapes can stimulate the acupuncture points of the foot, which correspond to the organs of the human body. Last, the design provides the senior residents natural distractions so that their thoughts and feelings are redirected. The plant materials with yellow flowers or fruits may not only create an attraction of natural beauty for senior residents, but also promote a healthy spleen.

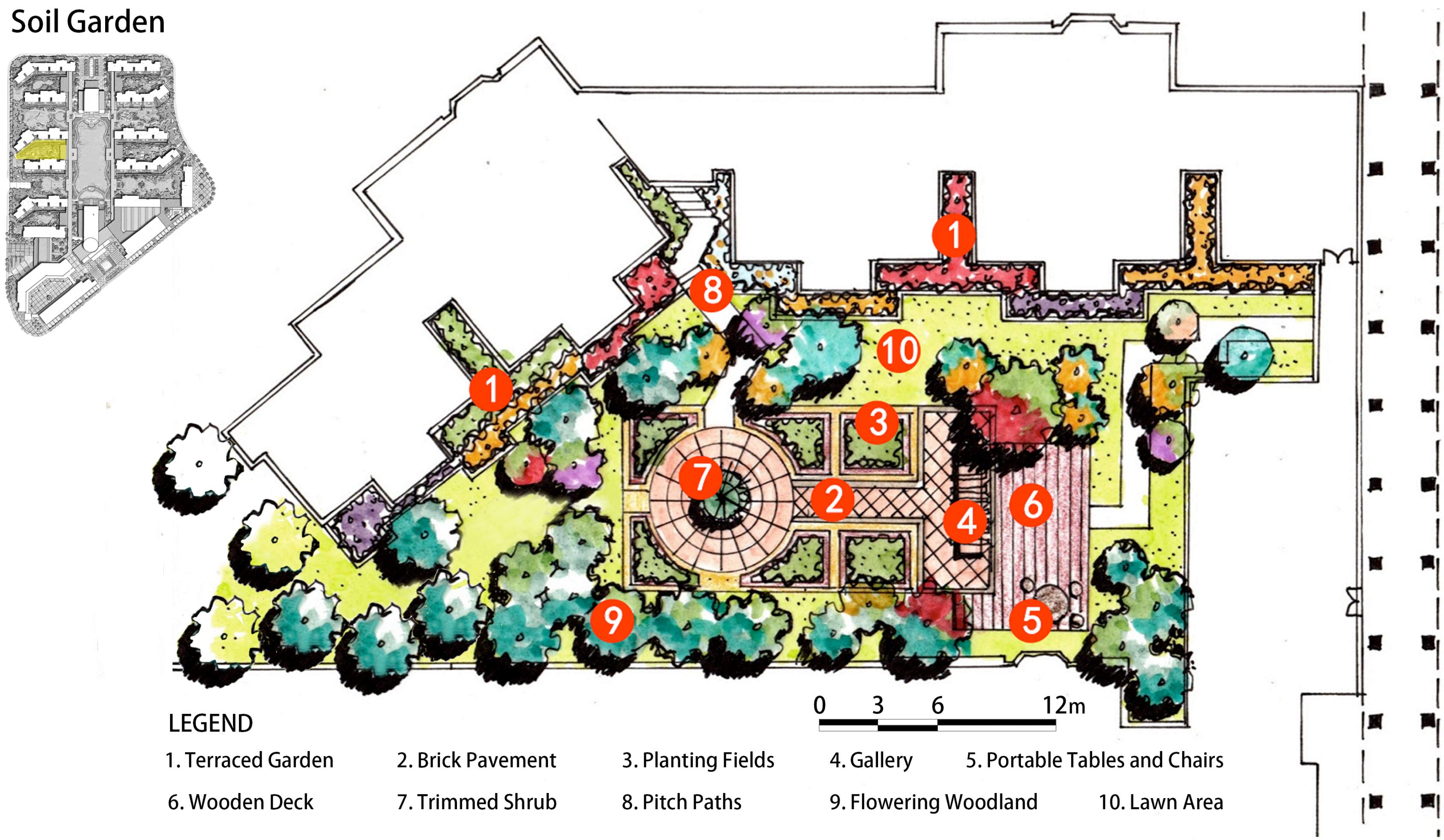


Figure 5.27 Master Plan of the Soil Garden
Figure Source: Drawn by Author

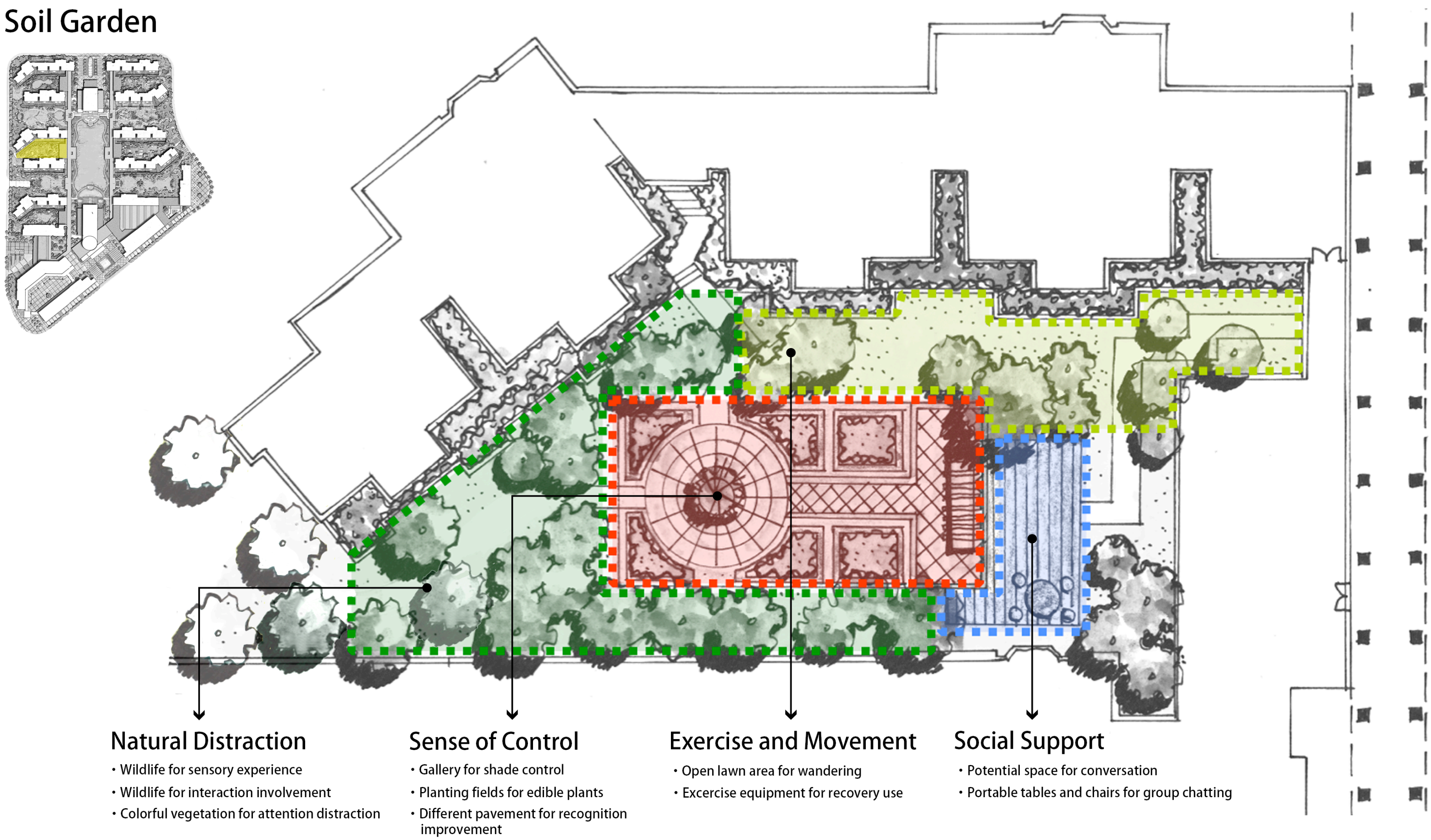


Figure 5.28 Illustration of Design Basis for the Soil Garden
Figure Source: Drawn by Yiming Huang

Water Garden

The garden symbolizing the water elements mainly serves those senior residents suffering from kidney diseases. Clinically, the elderly often suffer from kidney diseases that are accompanied by symptoms of tinnitus or even hearing loss. The following plant materials with black or dark flowers or fruits (which belong to the water element) are selected for the planting plan of the water garden (Table 5.5 and Figure 5.29). According to traditional Chinese medicine and Chinese cultural understanding, these plants can contribute to healthy kidneys in the elderly and relieve series problems caused by kidney diseases. For example, the fruits of the glossy privet are used to alleviate of the symptoms of tinnitus, which is often caused by kidney diseases. Flowering period indicates that the species can be selected for continuous landscape viewing from early spring to early autumn.

Table 5.5 The Species of Plants for the Water Garden
Table Source: Drawn by Yiming Huang

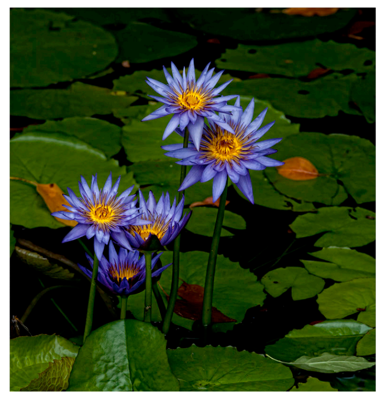
	COMMON NAME	SCIENTIFIC NAME	FLOWERING PERIOD
TREE	Glossy Privet	*Ligustrum lucidum*	July
	Yew Plum Pine	*Podocarpus macrophyllus*	May
	Black Nightshade	*Solanum nigrum*	June-September
HERB	Mondo Grass	*Ophiopogon japonica*	May-September
HYDROPHYTE	Water Lily	*Nymphaea tetragona*	June-August
	Bullrush	*Typha orientalis*	April-September

Ligustrum lucidum

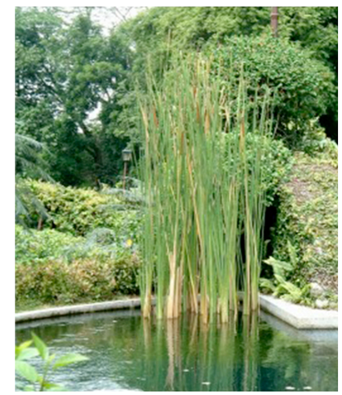
Podocarpus macrophyllus

Solanum nigrum

Ophiopogon japonica



Nymphaea tetragona



Typha orientalis

Figure 5.29 Photos of the Plant Species for the Water Garden
Figure Source: Wikipedia: http://www.wikipedia.org/
http://www.florida.plantatlas.usf.edu/

The water garden integrates the culture of health preservation through the use of specific plants with dark flowers or fruits, and landscape materials that have flowing shapes, an important shape in the water element in Chinese medicine (Figure 5.30). It also reflects Marcus's four key suggestions for therapeutic garden design (Figure 5.31). First, the design fosters and affirms a sense of control in the senior residents. Perception of surroundings, directory signs, and accessibility are the three design considerations needed for designing the water garden in order to increase the residents' sense of control. Senior wheelchair users can access every corner of this garden. Movable tables and chairs can also offer convenience to these wheelchair users, which increases the opportunity for them to participate in social activities. Second, the design encourages the senior residents to give and receive social support: A meandering path creates several semi-private spaces, with the purpose to offer the residents spaces for leisure, socialization, and the appreciation of nature. Third, the design enables the senior residents to engage themselves in exercise and movement: Recreational space with exercise facilities is proposed for residents' daily activities. In addition, the meandering path is also suitable for simple exercise and movement for residents, such as strolling. Fourth, the design provides the senior residents natural distractions so that their thoughts and feelings are redirected. The raised water pool may prevent senior residents from dropping in the water. The fountain and the sculpture in the water pool can enrich the residents' auditory experience. In addition, the aquatic plants can bring a variety of wildlife and create rich natural attractions in the summer.

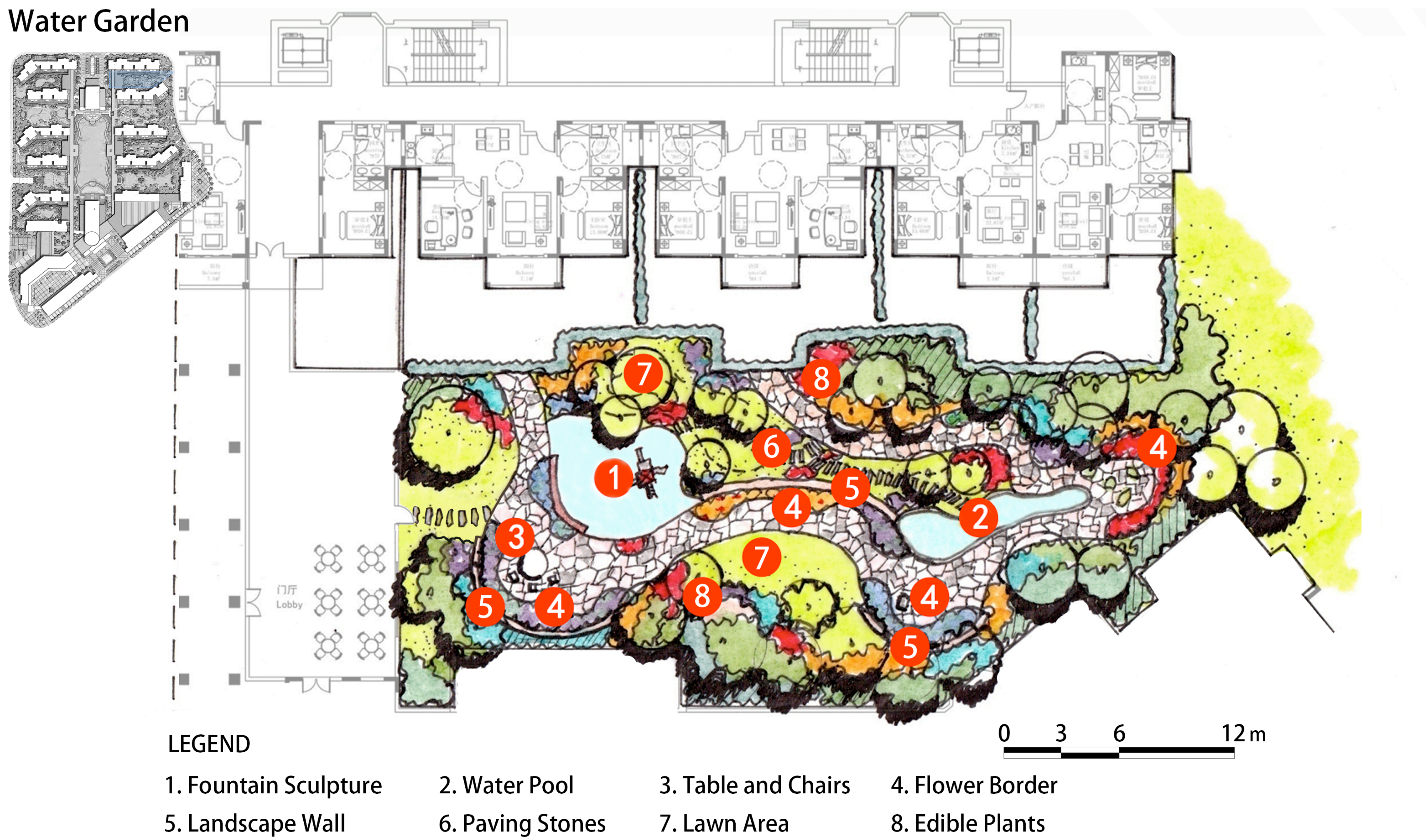


Figure 5.30 Master Plan of the Water Garden
Figure Source: Drawn by Yiming Huang

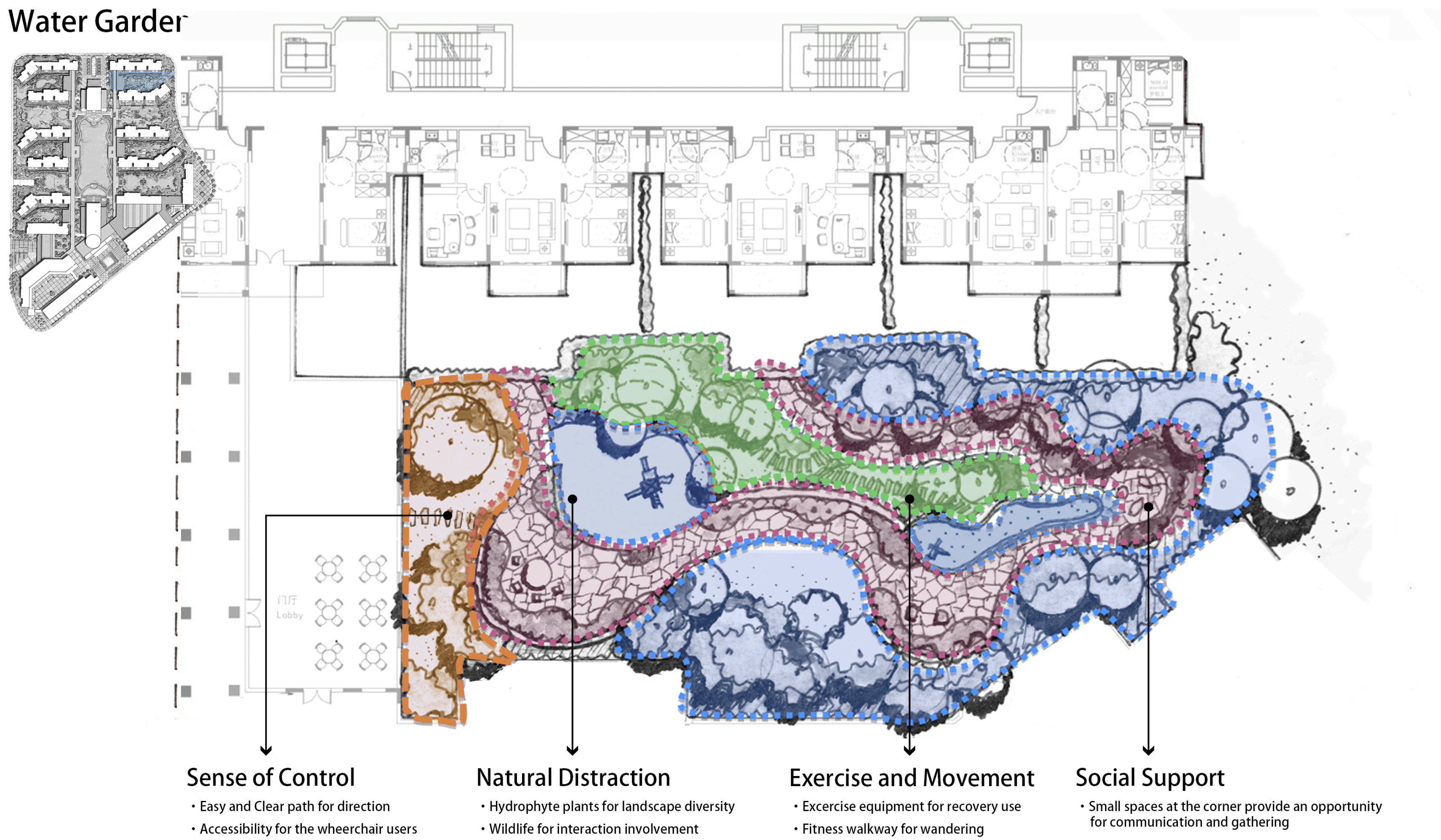


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Figure 5.31 Illustration of Design Basis for the Water Garden
Figure Source: Drawn by Yiming Huang

CHAPTER 6

CONCLUSION

This thesis began by identifying the lack of and therefore the need for research on therapeutic garden design to address a culturally specific population in therapeutic garden design. This thesis reviewed Western theories and pre-existing design suggestions for general therapeutic garden design. The author also offered an analysis on the attributes of an ideal environment for the Chinese elderly residents based on the physiological and psychological characteristics of seniors. In addition, the introduction of the health preservation notion as well as traditional Chinese medicine led to the establishment of new principles for plant material selection guided by the Five Element Theory. Finally, the new design concept produced in this thesis was integrated into the existing framework for designing therapeutic gardens and was applied to the Dongtan Senior Community in Shanghai, China.

The thesis aims to create therapeutic gardens suitable for Chinese residents. Therapeutic garden design for a culturally specific population, however, means more than adapting design principles to a specific site or context. It requires the creation of a sense of belonging both culturally and emotionally. Thus, to maximize the benefits, therapeutic gardens should promote the cultural identity of their residents and offer them emotional acceptance. On the one hand, this thesis acknowledges the discrepancy in the Western and Eastern understandings of the relationship between humans and nature and adapts the design concept to the Chinese cultural context. The new design concept advocates a strong connection between humans and nature, and hence represents a better cultural understanding of the Eastern perspectives on nature. Since Chinese seniors often prefer following the traditional Chinese ways of preserving health, the new design concept establishes an appropriate and beneficial way for residents to promote their health. Knowing how Chinese seniors value traditional culture, therapeutic garden designs that heavily involve notions such as health preservation will certainly embrace their respect and their adoption of the new design concept.

On the other hand, this thesis also seeks ways to answer two questions: (1) how to integrate Chinese culture into western therapeutic garden design, and (2) how to translate the connotations of Chinese culture into the vocabulary of therapeutic design. To answer the two questions, some specific connections between the human body and the natural environment were drawn. Specifically, a correspondence among the plant materials, the five senses, and the organs of the human body was identified by using the Five Elements Theory. This correspondence guided the selection of plant materials and colors and shapes of hardscape materials such as the pavers, walls, site furnishings, railings, gazebos, etc. used in each of the five courtyards to echo Chinese culture while simultaneously benefiting sensory perceptions and the organs of the human body. These elements, therefore, offer a perfect translation of Chinese culture into specific design vocabularies and physical design features. To summarize, the new design concept inspired by Chinese culture, the notion of health preservation and the Five Element theory in particular, assist in creating an organic blend of therapeutic garden theories with a touch of the Chinese context.

The Dongtan Senior Community (DSC) has proven to be an ideal site to apply the design concept developed in this thesis. Since the DSC consists of five separate private gardens, each can be associated to an element that represents a corresponding organ of the human body. Challenges, however, will also arise when applying the design concept elsewhere. A major challenge is to revise the proposed design concept in order to adapt it to the sites with more or fewer separated gardens. Specifically, if a site has more than five separated gardens, it can choose to build other themed gardens in addition to the five themes named in this thesis. Whereas if a site has fewer gardens, each garden will implement multiple themes targeted at a mixed population. It is critical that the designer be aware of the design concept for therapeutic garden designs as a whole since Chinese culture emphasizes the unity of humans and nature, especially the mutual harmonious functioning of the organs of the human body.

Because this thesis extensively uses Chinese medicine to guide its designs, another challenge for producing a wider range of the adoption of its findings is that, while traditional Chinese medicine has proved effective in its extensive clinical record for more than a thousand years, its lack of a modern scientific theoretical grounding may make it vulnerable and therefore susceptible to doubt. Fortunately, Chinese seniors and Chinese people in general have great faith in traditional Chinese medicine. Hence, this challenge is not serious enough to prevent the design from gaining popularity in China.

In addition to these challenges, several opportunities for further research on the classification of plant materials are worth noting. For example, this thesis used the color of the flower or fruit as the key determinant for classifying plant materials, a mainstream principle of plant classification. Other principles of classification could lead to different choices of plant materials, which might strengthen or weaken their therapeutic effectiveness. Thus, future research on classification could produce additional useful insights and improvements to the design concept developed in this study.

Finally, although the DSC is an experimental therapeutic garden, its therapeutic benefits cannot be ignored. Without a more thorough evaluation, however, it is almost impossible to claim that the design presented in this thesis is successful. Specifically, usage analysis, evaluations of users' preferences, and assessments of the therapeutic benefits of plant materials are essential to determine the accomplishments of the design intentions, as well as the adoption rate of the features in the garden. They also help in further developing guidelines, design concepts, and plant selection in order to better address the needs of Chinese senior residents.

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