Landscape Ecol (2009) 24:1015–1026
DOI 10.1007/s10980-009-9350-z

RESEARCH ARTICLE

Sustainable landscape architecture: implications of the Chinese philosophy of "unity of man with nature" and beyond

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Received: 3 January 2009 / Accepted: 23 March 2009 / Published online: 9 April 2009

Abstract As the world population continues to grow and as global urbanization continues to unfold, our ecosystems and landscapes will be increasingly domesticated and designed. Developing and maintaining sustainable landscapes have become one of the most challenging and imperative tasks for scientists and stakeholders of all sorts. To accomplish this task, landscape ecology and landscape architecture can and must play a critical role. Landscape architects intentionally modify and create landscapes, and their imprints and influences are pervasive and profound, far beyond the physical limits of the designed landscapes. As an interdisciplinary and transdisciplinary enterprise that integrates the science and art of studying and influencing the relationship between spatial pattern and ecological processes, the theory, methods, and applications of landscape ecology are directly relevant to sustainability. However, neither landscape ecology nor landscape architecture is likely to achieve its expected goal if they are not truly integrated to produce a sustainable landscape architecture. In this paper, we argue that the ancient Chinese philosophy of "unity of man with nature" and its associated design principles can provide useful guidelines for this integration as well as for the development of a sustainable landscape architecture. We discuss several principles and models of Chinese landscape architecture, including "unity of man with nature" philosophy, "peach blossom spring" ideal, "world-in-a-pot" model, and Feng–Shui theory, and their implications for developing a sustainable landscape architecture. Although differences in the philosophical roots and design traditions between Eastern and Western landscape architecture will continue to exist, interactions and integration between the two will continue to increase under the theme of sustainability. To promote the translation of scientific knowledge into practice, we urge landscape ecologists to work proactively with landscape architects to integrate pattern–process–scale and holistic perspectives into the design and planning of landscapes.

Keywords Landscape architecture · Sustainability · Landscape design and planning · Human–nature relationship · Unity of man with nature · China

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Published online: 09 April 2009

Introduction

As the world is increasingly dominated by humans, its ecosystems and landscapes have become ever more domesticated (Kareiva et al. 2007; Vitousek and Mooney 1997). One only needs to think of the exponential growth of the human population to be startled by the magnitude and change rate of anthropogenic influences on planet earth. The world population took more than 10,000 years to increase from 5 million to 1 billion by 1830, but the time interval to reach the second, third, fourth, fifth, and sixth billion decreased to 100, 30, 15, 13, and 12 years, respectively (Kaufman and Franz 1996; United Nations 2004; Wu 2008a). Rapid human population growth has resulted in pressing environmental problems around the world, including biodiversity loss, global climate change, land degradation, water and air pollution, and natural resource depletion. Most of the future population increase will occur in cities, and urbanization will continue even after human population has reached a steady state (United Nations 2004; Wu 2008a). As cities increasingly become the primary habitat for humans, our landscapes will be ever more designed (Wu 2008b). Thus, global sustainability will increasingly depend on proper designing, planning, and management of urban landscapes.

Landscape architecture, often defined as the art of spatially arranging land and objects upon it for human use and enjoyment, involves the design, planning, and management of landscapes and their constituent elements for a variety of purposes and on a range of scales. A comprehensive definition of landscape architecture by the American society of landscape architects (ASLA 2009) makes explicit the broad scope and diverse topics in this field:

> Landscape architecture encompasses the analysis, planning, design, management, and stewardship of the natural and built environments. Types of projects include: residential; parks and recreation; monuments; urban design; streetscapes and public spaces; transportation corridors and facilities; gardens and arboreta; security design; hospitality and resorts; institutional; academic campuses; therapeutic gardens; historic preservation and restoration; reclamation; conservation; corporate and commercial; landscape art and earth sculpture; interior landscapes; and more.

Clearly, landscape architects intentionally modify and create landscapes of different kinds and various sizes. The imprints and influences of landscape architects are especially profound and pervasive on urban landscapes across the world. These anthropogenic impacts, of course, do not stop at the physical limits of the designed landscapes. As the renowned architect Sim Van der Ryn put it: "In many ways, the environmental crisis is a design crisis. It is a consequence of how things are made, buildings are constructed, and landscapes are used. Design manifests culture, and culture rests firmly on the foundation of what we believe to be true about the world" (quoted in McLennan 2004, p. xiii). Landscape architecture itself is an interdisciplinary enterprise that inherits traditions of the past, creates reality in the present, and anticipates changes in the future. Although some may argue that landscape architecture is really future-oriented as architects are always creating a future state of the landscape, traditional design principles and models often persist through time and across landscapes. While socioeconomic processes are widely recognized as the primary driver for land use and land cover change, the role of landscape architects in shaping our landscapes is yet to be fully appreciated by most ecologists.

Given the increasing need for sustainable development worldwide and the widely recognized transdisciplinary goals of landscape ecology (Naveh 1991, 2007; Potschin and Haines-Young 2006; Wu 2006), integration between landscape ecology and landscape architecture in theory and practice is imperative (Nassauer and Opdam 2008). Here we argue that the time-honored Chinese philosophy of "unity of man with nature" and its associated design principles can provide useful guidelines for this integration as well as for the development of a sustainable landscape architecture. We first discuss the traditional principles and models of Chinese landscape architecture, and then compare and contrast Eastern and Western landscape architectural traditions and perspectives. Finally, we discuss the relevance and implications of these principles and models for developing a sustainable landscape architecture.

Traditions and perspectives of Chinese landscape architecture

China is the "mother of gardens" (Wilson 1929). Garden design of different kinds and sizes constitutes a substantial part of the landscape architecture profession in general, and has occupied a central place in Chinese landscape design and planning in particular. Traditional Chinese landscape architecture is rooted in the dialectic philosophy of "unity of man with nature" and Yin–Yang dualism, shaped by the ideals and models of "peach blossom spring" and "world-in-a-pot," and guided by the principles of Five-Elements, Eight-Trigrams, and Feng–Shui (Fig. 1). Since the twentieth century, the ideas and principles of Chinese landscape architecture have been increasingly recognized and practiced around the world (March 1968; Ren 2000; Xu 2003; McLennan 2004; Mak and Ng 2005; Hong et al. 2007). At the same time, the influences of Western landscape architecture in China have increased at an accelerating rate (Wang 2004; Wang and Ye 2004; Carreiro et al. 2008; Chen 2008). Here we briefly discuss several key traditional Chinese design perspectives and models that still have broad influences today in China.

The "unity of man with nature" philosophy

The ideals and practices of Chinese landscape architecture have been profoundly influenced by ancient Chinese philosophies and cultural traditions (Chen 2008; Zhou and Chen 1992). The unifying theme of ancient Chinese philosophies and cultural traditions is "unity of man with nature" or "harmony between man and nature" ("天人合一"). This theme is consistent with the central tenet of Taoism, a celebrated Chinese philosophy developed by Lao Zi, which asserts that humans should harmonize with the rhythms of nature. Harmonious coexistence between humanity and nature, as a background assumption, has been epitomized in the principles guiding Chinese landscape architecture since its origin. In today's terminology, "unity of man with nature" means that human activities, including their architectural creations, should be integrated within natural patterns and processes so that harmony between man and nature can be achieved. In the context of landscape architecture, this does not mean to "go back to nature" or "return to a primitive lifestyle;" rather, it supports the dialectic design principle of "from nature but beyond nature." In other words, landscape design and planning should follow and take advantage of the natural rhythms and ecological principles of a particular location. At the same time, nature must be modified, and artificial elements must be incorporated to meet the social, economic, and cultural needs of humans who reside in the landscape.

Early Chinese gardens began to appear about 2,000 years ago, mainly as "the gardens of literati" or "scholar's gardens" (Fig. 2). The design of these

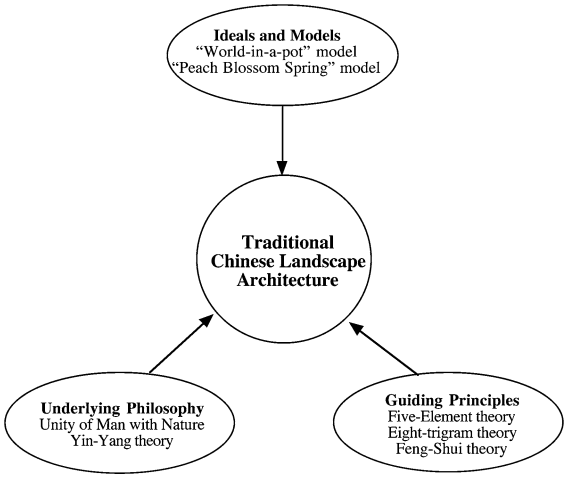

Fig. 1 Philosophical and cultural foundations of the Chinese landscape architecture

Fig. 2 The Lion Forest Garden in Suzhou of southern China—an example of Chinese scholar's gardens (photo by Wu in 2004). Originally built in 1342 A.D. during the Yuan Dynasty, the Lion Forest Garden has been known for its compactly and harmoniously arranged lion-resembling rocks, man-made mountains, bamboo jungles, and a lake surrounded by buildings of various Chinese architectural styles

gardens combined the concepts in Chinese landscape paintings and the poems of idealized bucolic settings. The gardens of literati, often described as "picturesque and poetic," are characteristic of many ancient private gardens, particularly in southern China. These gardens have neither the rudimentary fabrics of folk dwellings nor the symbolic features of power hierarchy and social rites often explicit in feudalistic governmental architecture. Rather, the overall spatial pattern and design details of these gardens reflect the aspirations of the distinguished literati for a spiritual and utopian shelter away from the sociopolitical realities of the time. The design principles of Chinese Scholar's Gardens clearly promoted the idea that humans need to be nurtured by nature, a perspective that seems to be lacking in the traditional Western gardens that often emphasize human mastery of nature.

The "peach blossom spring" ideal

The "peach blossom spring" ("桃花源") is an extremely well-known utopian landscape, reflecting the idealistic aspiration that has long influenced the theory and practice of Chinese gardening and landscape design. It was originally described in a Chinese legend written about 1,500 years ago, and is somewhat similar to the ancient Greek story of Arcadia. The phrase, "peach blossom spring," has become a poetic byword for an ecologically unspoiled and geographically spectacular landscape replete with mountains, water, fertile land, and people harmoniously integrated with their natural environment. This paradise model reflects people's desire for a way of connecting closely with nature to seek peace and minimize interactions with the outside world. Although picturesque landscapes that resemble what was described in the legend of "peach blossom spring" can still be found in some remote mountainous areas of China, the value of this idealistic model in the context of modern landscape architecture is primarily heuristic.

The "world-in-a-pot" model

Another classic model for the design of small-scale Chinese gardens and parks is the "world-in-a-pot" ("壶中天地") model—infinite imagination and expression of nature in a limited and often enclosed space, with ponds representing rivers and oceans, rocks for mountain peaks and ranges, and flowers for biological wonders (some of these features are evident from the Lion Forest Garden in Fig. 2). The traditional Chinese culture acquired its primary characteristics during the Spring and Autumn Period (770–256 BC) and the Warring States Period (475–221 BC), influenced by the geography of its birthplace—the Yellow River basin, also known as the Guanzhong region. The word, "Guanzhong," literally means an area surrounded by passes on four sides. The shape of the Guanzhong region resembles a giant "pot," with surrounding mountains as the "pot walls," the Wei River basin as the "pot interior," the Yellow River and its tributaries as corridors connecting parts of the within-pot world, and Hanguguan as the "pot mouth" through which exchanges with the outside world take place. This geographic setting played an important role in the formation of a culture that tends to favor enclosed structures, stable functions, and self-maintenance as opposed to aggression and expansionism. Thus, the "world-in-a-pot" model is deeply rooted in Chinese cultural tradition, and has long influenced the practice of Chinese gardening and landscape design (Chen 2008; Zhou 1999).

Feng–shui theory

Feng–Shui theory (风水理论), or the theory of Feng (wind) and Shui (water), consists of a set of empirical principles that integrate biophysical landscape features with cultural traditions and religious beliefs to guide the practice of selecting and designing dwelling and burial spaces (March 1968; Ren 2000; Xu 2003; Hong et al. 2007). Feng–Shui theory stems from the Taoist Yin–Yang dualism (阴阳二元论), the Five-Element theory (五行学说), and the Eight-Trigram theory (八卦理论) (Ren 2000; Xu 2003). Yin–Yang dualism is the conceptual basis for both the Five-Element and Eight-Trigrams theory (Su 2006). Yin–Yang dualism emphasizes balancing opposing natural, as well as anthropogenic, forces and organizing evolving parts to achieve the harmony and eternity of the whole (Fig. 3a). The Five-Element theory further articulates how the five essential elements comprising the world are related to each other and how they can be arranged properly to achieve sustainability (Fig. 3b). Related to the Five-Element theory is the

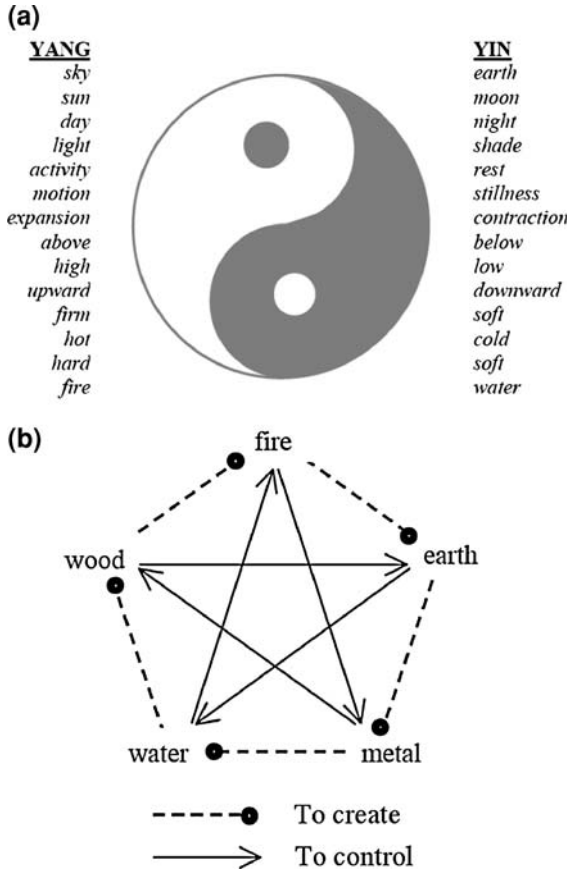

Fig. 3 Schematic representation of the Yin–Yang principle **a** and the five-element doctrine **b** (adapted from Xu 2003). Yin and Yang, often symbolized by the Taiji diagram, are dynamic, interactive, and complementary opposites within a greater whole. The five-element doctrine, guided by the Yin–Yang principle, claims that the material world is composed of five kinds of elements (metal, wood, water, fire, and earth), all of which are related to each other by either a creating–being created relationship or a control–being controlled relationship

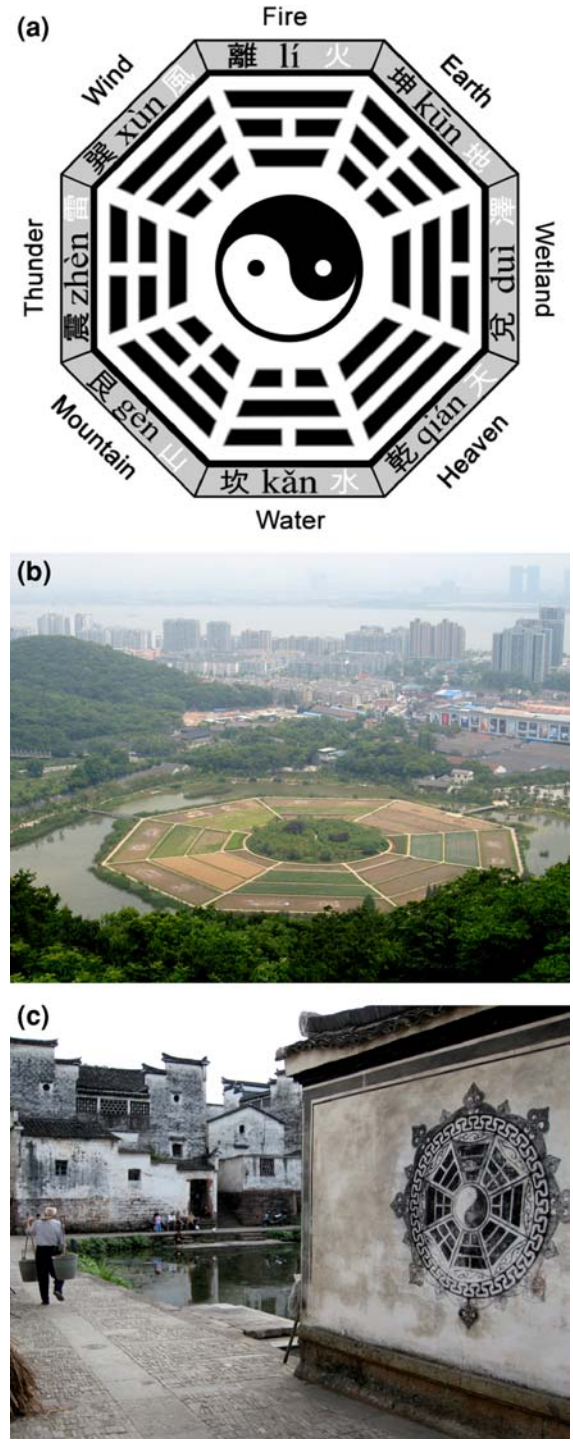

Fig. 4 The Eight Trigram concept and examples in Chinese landscape design. **a** Illustration of the Eight Trigram concept (adapted from http://en.wikipedia.org/wiki/Bagua), exhibiting the key elements of the concept. **b** The Eight-Trigram Field in Hangzhou, Zhejiang Province, China, which was originally designed during South Song Dynasty between 1127 and 1279 (photo by Wu in May 2008). **c** The Zhu-ge Eight-Trigram Village in Lanxi, Zhejiang Province, China, designed and built around 1340 A.D. during Yuan Dynasty (photo by Wu in October 2008). The spatial pattern of the entire village is characterized by a central lake resembling the Yin–Yang diagram in shape and eight alleys radiating out from it, as shown on the memorial wall in the photo ▶

theory of Eight Trigrams, which deals with more components that make up the world and has been commonly used as a tool in Feng–Shui practices (Fig. 4).

Originally developed in China, Feng–Shui theory has long been used in architecture and landscape design and planning in East Asian countries (Xu 2003; Hong et al. 2007), and its influences in the West have also been evident (March 1968; Mak and Ng 2005; Skinner 2001). The main premise of Feng–Shui theory is that the human–environment relationship (or the fate of the occupant of a space) can be influenced either positively or negatively by manipulating Qi (气)—the vital force or energy that drives all change. Two schools of thought on Feng–Shui theory are usually distinguished: the form school focuses on the relationship between the morphological features of the landscape and the movement of Qi; the compass school bases the analysis of Qi on landscape orientations and astrological changes (Ren 2000; Xu 2003; Mak and Ng 2005).

Some differences between Chinese and Western landscape architectural traditions

Many, if not most, differences between Chinese and Western landscape architecture can be traced to their philosophical roots and cultural traditions. In the beginning, both classical Western thinkers—such as the ancient Greeks Democritus, Leucippus, and Aristotle—and classical Chinese thinkers—such as the Taoist philosophers Lao Zi and Zhuang Zi—meditated on the philosophy of nature. Emerging from this period of classical thought, the Western and Eastern perspectives on the natural environment began to diverge. While traditional Chinese culture continued to embrace the power of nature to influence and inform humans, Western culture reacted more audaciously to it. As mentioned earlier, Eastern philosophy emphasized a greater sense of harmony, of being in alignment with the Tao (道), and of being in balance (Ying–Yang dualism). In Europe, there was a stronger emphasis on "taming" the natural world.

There is a greater dialectic quality of socio–ecological relations in Chinese philosophy, a more holistic interplay between man and nature. In this perspective, man is influenced by nature, learns something of himself and his environment as a result, and then becomes more able to live in harmony within the natural world. In traditional Western philosophy, the relationship seems more linear: man is influenced by nature, reacts to nature, and then finds ways to tame elements of nature through technology and policy. The traditional Western philosophy of nature represents the historical antecedent to the modern technocratic approach to economic development that has been adopted around the world, and may even be regarded as an overarching motivation for colonization and imperialism (the often forceful acquisition of foreign lands to gain natural resources). These philosophical and cultural differences manifest themselves in the practice of landscape design and planning. For example, Oriental architecture has a long history of developing structures "in concert" with natural landscapes, using wood as the primary construction material, and emphasizing proper flows of Qi or energy through the environment following Feng–Shui theory. In contrast, Western landscape architecture has a long history of creating more "permanent" monuments that demonstrate human perseverance, uses stone, bricks and mortar as main construction materials, and has no sense of environmental balance that parallels to Qi.

The above comparison is admittedly a simplification of reality, and more comprehensive treatments on this topic can be found elsewhere (e.g., Pregill and Volkman 1999). The main message presented here is that landscape architecture, as well as landscape ecology, is profoundly influenced by cultural traditions and philosophical roots that must be acknowledged and respected. Of course, the ancient philosophy of "unity of man with nature", which seems much in tune with today's theme of sustainability, has not always guaranteed environmentally sustainable design and planning practices in China. At the same time, the traditional philosophy of human control of nature has not precluded sustainable landscape architecture practices in the West.

In the West, conservationists and environmentalists have played an important role in promoting a harmonious relationship between society and nature since the early 1900s. In particular, the land ethic developed by Aldo Leopold has influenced generations of ecologists, architects, and many others of different professions. In his landmark book, A Sand County Almanac, Leopold (1949) clearly recognized the problems with the conquering-nature tradition, and advocated a new land ethic to promote "a state of harmony between man and land." The land ethic evidently echoes the essence of the Chinese

philosophy of "unity of man with nature" as Leopold (1949) wrote:

> The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land. …… In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such.

The Environmental Movement that started in the 1960s also had a major role in promoting design values that seek the integration of—rather than separation between—human and nature (Linehan and Gross 1998; Botequilha Leitao and Ahern 2002). For example, the principles behind "Design with Nature" advocated by the eminent American landscape architect, Ian McHarg (1969), clearly embody the philosophy and ideals of traditional Chinese landscape architecture:

> Our eyes do not divide us from the world, but unite us with it. Let this be known to be true. Let us then abandon the simplicity of separation and give unity its due. Let us abandon the self-mutilation which has been our way and give expression to the potential harmony of man–nature.

In recent decades, theories and principles of Western landscape architecture have been increasingly practiced in China. In particular, the "ecological architecture" model that emphasizes the proliferation and enlargement of green-spaces in urban areas has become popular in China. Terms like "eco-parks," "eco-gardens," "green cities," and "eco-cities" have frequently appeared in books, journal articles, and the public media (Wang 2004; Wang and Ye 2004; Carreiro et al. 2008). The ecological architecture model does not adequately address socioeconomic and cultural dimensions, although ecological design and planning is often considered a type of sustainable landscape architecture in the literature. In the next section, we argue that a sustainable landscape architecture model is more appropriate for developing "sustainable parks," "sustainable gardens," "sustainable cities," and "sustainable landscapes." The development of such a sustainable landscape architecture should be facilitated by the integration of Eastern and Western traditions and principles in landscape design and planning.

Towards a sustainable landscape architecture

Sustainability, a widely recognized common goal for humanity, has become an increasingly dominant theme in design and planning (McLennan 2004; Van der Ryn and Calthorpe 1986; Ahern 2005a, b; Bell and Apostol 2008). Although the term has been defined in many ways, sustainability often refers to the ability of a coupled human–nature system to persist at a desirable state for multiple generations in the face of anthropogenic and environmental perturbations and uncertainties. The closely related term, sustainable development, is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development (WCED) 1987). Sustainability science is an emerging transdisciplinary field that focuses on the dynamic relationship between nature and society (Kates et al. 2001), and overlaps extensively with what holistic landscape ecology attempts to accomplish (Wu 2006; Naveh 2000).

Sustainability, holistic and humanistic sciences, and transdisciplinarity are different ways of conveying the same fundamental idea: living with nature, not separate from it, which is the essence of "unity of man with nature". A sustainable landscape architecture not only embraces this idea but also translates it into reality on the ground. To develop a sustainable landscape architecture, landscape ecology and sustainability science need to be integrated into the theory and practice of landscape design and planning. As landscapes in China become increasingly human-dominated, sustainable design principles and practices are needed more than ever, from small individual gardens to entire cities and regions. Traditional Chinese landscape architecture, however, is inadequate to meet these challenges because it has been narrow in scope and insufficient in content to contribute effectively to sustainable development (Chen 2008). For example, in many Chinese landscape gardens, ecological functions are isolated from the production activities and livelihoods of humans; many models for urban development are simply enlarged versions of such gardens (Chen 2008). All of

these reflect a long tradition of Chinese landscape garden design in which aesthetics is prominently featured whereas socioeconomic needs for people are inadequately considered (Yu 2006).

To improve the situation, we propose a conceptual framework for a sustainable Chinese landscape architecture that is built on the philosophy of Unity of Man with Nature and Chinese landscape and architectural traditions and also incorporates the principles and methods of landscape ecology and sustainability science (Fig. 5). Furthermore, sustainable landscapes are more likely to be developed and maintained if the three pillars of sustainability—environment, economy, and society—are simultaneously considered. Musacchio (2009) discussed six elements of landscape sustainability (or six E's): environment, economy, equity, aesthetics, ethics, and (human) experience. Accordingly, we believe that three functions need to be considered for designing sustainable landscapes, be they parks, cities, or regional landscapes.

The first function is the production of goods and services that generate economic benefits. The early Chinese gardens and artificial landscapes clearly emphasized the function of material production. The original meaning of the Chinese character of "garden" was a "fenced place for animals" (囿) or "an enclosed area for vegetables" (圃). Today, urban gardens and parks may produce commercial flowers, fruits, and vegetables, and these products can also add unique features to attract tourists (Chen 2008). In China, this production function of gardens gradually disappeared as the gardens of literati and other forms of private gardens became dominant. However, in countries like China, where urban areas are already overpopulated, the production function will become increasingly necessary to allow the persistence of designed green-spaces and landscapes.

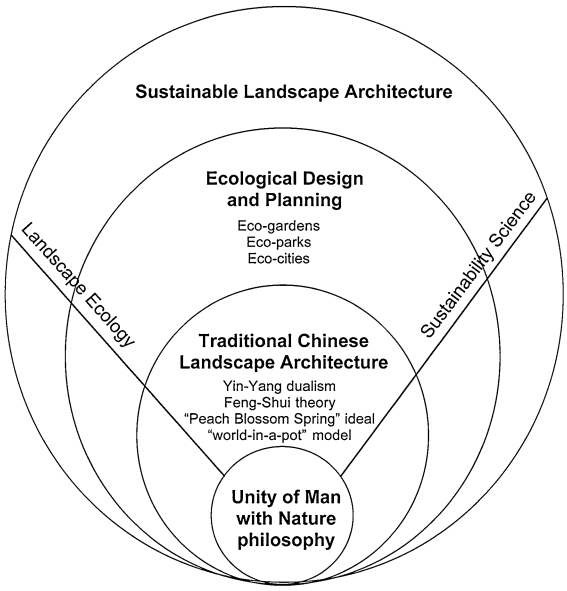

Fig. 5 A conceptual framework for a sustainable Chinese landscape architecture

The second function is the provision of life enrichment services, including creating spaces, facilities, and opportunities for recreation, healthy living, and social functions. Gardens, parks, cities, and urban landscapes are spatial extensions of living spaces for humans, and they need to be designed to satisfy human needs for a better quality of life in a given socioeconomic and cultural setting. To achieve this goal, we need to design landscapes that meet aesthetic, ethical, and cultural requirements, as well as to ensure equal accessibility for economically and socially disadvantaged parts of the population. This function addresses four of the six E's (equity, aesthetics, ethics, and experience) as discussed by Musacchio (2009).

The third function is ecological conservation. Sustainable landscapes need to maintain an adequate level of biodiversity and ecosystem functioning not at the expense of, but rather in balance with, the other two functions. For example, human-dominated environments can be an important haven for biodiversity. In addition to conserving biodiversity through protected areas, it is important, and sometimes imperative, for "inventing, establishing, and maintaining new habitats to conserve species diversity in places where people live, work, or play"—the goal of reconciliation ecology (Rosenzweig 2003a, b). Preservation and restoration may focus on rare or interior species that cannot survive in human-dominated landscapes, whereas reconciliation can help conserve other species in designed landscapes (Rosenzweig 2003a). Indeed, reconciliation ecology is a prime example of integrating biodiversity science, landscape ecology, and landscape architecture. In general, biodiversity conservation must go beyond the reserves themselves and take a landscape-level approach (Poiani et al. 2000; Lindenmayer et al. 2009; Wiens 2009; Wu 2008c). In addition, urban green-spaces can play an important role in improving air quality by absorbing particulates and pollutants

(e.g., ozone, chlorine, sulfur dioxide, nitrogen dioxide, fluorine), sequestering atmospheric CO_2, reducing soil erosion and purifying water, providing habitats for plants and animals, alleviating noise pollution, and moderating local/regional climate to save energy consumption (i.e., reducing urban temperature in summer and heat loss in winter).

Several design examples of applying these principles were discussed in depth in Chen (2008). Here we only mention one of them to illustrate some key ideas. Zhong-Tai Ecological Park in Hangzhou, China combines the classic Chinese landscape design traditions with sustainability principles and emphasizes a balanced relationship among the production of goods, recreation for local residents, and ecological conservation (Chen 2008). The park, covering an area of 3.3 square kilometers, has tree nurseries and flower gardens that are suited to local environmental conditions, providing an important source of economic income in addition to its role in maintaining biodiversity and ecosystem services. It also encompasses housing units of traditional Chinese styles with spectacular views. Overall, the design of the park highlighted both the cultural values of promoting harmony between man and nature and the material values of favoring ecological integrity. Together with West Lake, West-Brook Wetland, and Green-Mountain Lake, Zhong-Tai Ecological Park is an integral part of the Greater Hangzhou metropolitan landscape, which has multiple ecological, economic, and social functions.

To develop a sustainable landscape architecture, we also need to seek conceptual and methodological similarities and interfaces between landscape ecology and landscape architecture. For example, in the landscape architecture literature, "gardens" commonly connote small and intensively designed and managed areas that are often located around domestic dwellings. "Landscapes," on the other hand, frequently refer to larger areas that encompass different kinds of natural and human-made elements such as natural ecosystems or their fragments, gardens, parks, roads, water bodies, central business districts, and residential areas. In landscape ecology, these different landscape elements are generally called "patches," and "landscapes" are perceived as hierarchically structured patch systems in which larger patches are composted of smaller patches (Pickett and Cadenasso 1995, 2008; Wu and Loucks 1995; Wu and David 2002). Because the concept of "landscape" emphasizes the spatial heterogeneity of a geographic area more than its spatial extent, a garden, park, city, or metropolitan region each can be considered a landscape when its internal spatial pattern is of interest. Thus, a number of concepts and principles in landscape ecology, such as patch dynamics, pattern–process–scale relationships, and landscape connectivity, can and should be applied in landscape architecture (e.g., Wu 2008a; Nassauer and Opdam 2008; Ahern 2005a, b; Pickett and Cadenasso 2008; Opdam 2007; Termorshuizen et al. 2007).

Conclusion

From a historical perspective, the relationship between man and nature has changed as human population increased and technology advanced. When the world was not yet dominated by *Homo sapiens*, humans feared and worshiped nature. Beginning with the Age of Imperialism (1800–1914) and empowered by the Industrial Revolution, domination and appropriation became the prevailing theme in man's interaction with nature. Not until the later half of the twentieth century did a global awareness of environmental issues emerge. Currently, in informed and conscientious circles, the dominant theme of the relationship between man and nature is one of reconciliation and harmony. This theme echoes the essential principles of "unity of man with nature", an ancient Chinese philosophy that was manifest in traditional Chinese garden and landscape design.

Landscape architecture has an important and unique role to play in developing and maintaining sustainability on local, regional, and global scales. Landscape architecture deals directly with the relations between man and nature, and its theory and practice are influenced significantly by the philosophies and ideals about how humans should relate themselves to nature. Unity of man with nature and its derivative design ideals can help facilitate the development of a sustainable landscape architecture. Although differences in the philosophical roots and design traditions between Eastern and Western landscape architecture will continue to exist (inevitably and rightly), interactions and integration between the two will continue to increase under the theme of sustainability and through the process of globalization.

Landscape ecology should play a critically important role in achieving this goal of developing and maintaining sustainable landscapes and regions (Naveh 2007; Wu 2006; Nassauer and Opdam 2008; Ahern 2005a, b; Musacchio 2009; Forman 1990, 2008; Musacchio and Wu 2004; Termorshuizen and Opdam 2009). Recognizing these needs as well as the cross-disciplinary nature of the field, Wu and Hobbs (2007) defined landscape ecology as an interdisciplinary and transdisciplinary enterprise that integrates the science and art of studying and influencing the relationship between spatial pattern and ecological processes on multiple scales. Landscape ecology needs to further develop its capacities to build bridges to other disciplines (Fu et al. 2008; Metzger 2008) and to broaden and consolidate its transdisciplinary basis (Naveh 2007; Wu 2006).

Landscape ecology and landscape architecture need more interactions and further integration. As Golley and Bellot (1991) put it well: "there is a close relationship between landscape ecology and planning and design. We can move back and forth from one to the other, with landscape ecology providing information to the planner–designer, and the planned and designed landscapes serving as field experiments to test hypotheses for the landscape ecologist." In particular, to promote the translation of scientific knowledge into practice on the ground, landscape ecologists need to work proactively with landscape architects to integrate pattern–process–scale and holistic perspectives into the design and planning of landscapes (Nassauer and Opdam 2008). Examples of such integration exist (e.g., Botequilha Leitao and Ahern 2002; Ahern 2005a, b; Termorshuizen et al. 2007; Opdam et al. 2001; Ahern et al. 2006; Bastian et al. 2006), but much more effort is needed if landscape ecology and landscape architecture are to fulfill their expected responsibility in our common journey to sustainability.

Acknowledgments We thank Chris Clark, David Iwaniec, Jen Litteral, Laura Musacchio, Yun Ouyang, Michael Rosenzweig, Lihua Yang, and Tong Wu for reviewing an earlier version of this paper. JW also thanks Michael Rosenzweig for discussions on reconciliation ecology. JW's research on urban ecology and sustainability has been supported partly by the National Science Foundation under Grant No. BCS-0508002 (Biocomplexity/CNH) and under Grant No. DEB-0423704, Central Arizona-Phoenix Long-Term Ecological Research (CAP LTER).

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