

1 **Historical development and practices of lawns in China**

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3 Abstract: Lawn, the most common human-created and culture-shaped habitat in
4 urban green areas, has recently been questioned because of the negative
5 environmental impacts from intensive lawn management. China, a late adopter
6 of lawns, has a great potential to implement sustainable lawns. Based on a
7 literature review, field observations and interviews with local politicians, lawn
8 managers, landscape architects and local residents in Chinese cities, this study
9 seeks inspiration for sustainable lawns within classical Chinese gardening and
10 European examples and identified the drivers of lawn development in China.
11 The definition of lawns has varied over time, which evolves with the changes in
12 the relationship between human and environment. Chinese people's paradigm on
13 lawns is influenced by the trend of westernization and globalization after 1840s.
14 We conclude that shifting the existing paradigm to environmentally friendly
15 lawn aesthetics and bridging the knowledge gap between researchers and
16 practitioners are challenges in achieving sustainable lawns in China. This paper
17 creates a better understanding of the lawn phenomenon in China and is one step
18 ahead in shifting people's paradigm of lawns in countries which are later
19 adopters of lawns.

20 Keywords: Chinese lawns; classical Chinese gardens; intensive management
21 practices; paradigm shift; sustainable lawns.

22 1. Introduction

23 The most common human-created and culture-shaped urban habitat is the lawn, which
24 consists of closely mown grasses and some herbaceous species¹. Lawns in most cities cover
25 significant areas, in some cases up to 70 percent of open urban green spaces², e.g. in private
26 gardens and public parks³. Lawns can therefore be considered one of the most significant and
27 common features in all urban green areas. Researchers have reported environmental problems
28 (poor biodiversity, water pollution, overuse of water etc.) caused by intensive lawn
29 management involving heavy use of herbicides, pesticides and chemical fertilisers, frequent
30 mowing and irrigation in the pursuit of “perfect” lawns (homogeneous, closely-cut grass
31 surfaces)^{4,5,6}. Therefore some have started to question the lawn phenomenon and propose
32 alternative solutions, e.g. in the USA^{7,8}, New Zealand⁹, UK¹⁰, Sweden^{11,12} and France¹³.
33 However, it is still a poorly studied urban feature, especially in countries that are late adopters

1. Byrne, Loren B. *Of looks, Laws and Lawns: How Human Aesthetic Preferences Influence Landscape Management, Public policies and Urban Ecosystems*, in D. Laband, ed., *Emerging Issues Along Urban-Rural Interfaces: Linking Science and Society Conference Proceedings*, Pp. 42-46(Auburn: Auburn University, 2005).

² Urban green spaces are defined as the public and private open spaces in urban areas, primarily covered by vegetation, which include parks, woodlands, street trees and plaza plantings, cemeteries, private gardens, green roofs, community and allotment gardens, sport complexes, and so forth. Source: Haq. S.M.A. Urban green spaces and an integrative approach to sustainable environment. *Journal of Environmental Protection*, 2(5), 601-608.

3. Ignatieva, Maria. Plant material for urban landscapes in the era of globalization: roots, challenges and innovative solutions.’ *Applied urban ecology: A global framework* (2011): 139-151

⁴ Robbins, Paul, and Trevor Birkenholtz. ‘Turfgrass revolution: measuring the expansion of the American lawn.’ *Land Use Policy* 20.2 (2003): 181-194.

⁵ Gu, Chuanhui, et al. The effects of household management practices on the global warming potential of urban lawns. *Journal of environmental management* 151 (2015): 233-242.

⁶ Zhou, Weiquan. *Zhongguo Gudian Yuanlin Shi* [The History of Classical Chinese Garden](Beijing: Tsinghua University Press, 2008).

⁷ Simmons, Mark, et al. The performance of native and non-native turfgrass monocultures and native turfgrass polycultures: An ecological approach to sustainable lawns. *Ecological Engineering* 37.8 (2011): 1095-1103.

⁸ Robbins, Paul. *Lawn people: How Grasses, Weeds, and Chemicals Make us Who We are*. Philadelphia: Temple University Press, 2012.

⁹ Stewart, Glenn H., et al. URban Biotopes of Aotearoa New Zealand (URBANZ) (I): composition and diversity of temperate urban lawns in Christchurch.’ *Urban Ecosystems* 12.3 (2009): 233-248.

¹⁰ Smith, Lionel S., and Mark DE Fellowes. The grass-free lawn: management and species choice for optimum ground cover and plant diversity. *Urban Forestry & Urban Greening* 13.3 (2014): 433-442.

¹¹ Ignatieva, Maria, and Karin Ahrné. Biodiverse green infrastructure for the 21st century: from “green desert” of lawns to biophilic cities. *Journal of Architecture and Urbanism* 37.1 (2013): 1-9.

¹² Ignatieva, Maria, et al. Lawn as a cultural and ecological phenomenon: a conceptual framework for transdisciplinary research. *Urban Forestry & Urban Greening* 14.2 (2015): 383-387.

¹³ Bertoncini, Alzira Politi, et al. Local gardening practices shape urban lawn floristic communities. *Landscape and Urban Planning* 105.1 (2012): 53-61.

34 of lawns, such as China. In Chinese cities, the lawn is still a new landscape feature and
35 directly connected to the process of westernisation and globalisation of urban environments.
36 On top of that, proposals for alternative lawns in Europe have aroused a debate on the
37 definition, origin and development of lawns, since people are accustomed to the mono-
38 cultural, frequently mown area and find it difficult to accept an alternative concept. European
39 researchers have reviewed the origin and definition of lawns in Europe and revisited the
40 conventional meaning of lawns. According to their descriptions, lawns in the past were much
41 more sustainable than those today¹⁴. For example, medieval lawns were more flower-rich and
42 composed of several herbaceous plants¹⁵. Before proposing alternative lawns in China, it is
43 first necessary to go back to the origin, definition and use of lawns, illustrate their rich
44 historical diversity and explore the possibility of different alternative lawns for use in China.

45 Most recent research on lawns in China has mainly focused on lawn management, grass
46 genetics and breeding¹⁶, aiming to create a perfect green carpet. Only a few studies focus on
47 the social and cultural aspects or on the history of lawns. Chen^{17,18} classified lawns as natural
48 or artificial lawns depending on emergence time and whether they were mown or not. In his
49 paper, the definition ‘artificial lawn’ refers to live grassy surfaces designed and established by
50 humans, while in Europe it refers solely to grass-like matting made from synthetic fibres;
51 natural lawn refers to an area resembling grassland with no or minor interference from
52 humans. The reasons behind the evolution of lawns were not analysed in the studies by Chen
53 and specific examples of lawn use in China are not provided either. However, Xia and

¹⁴ Smith, Lionel S., and Mark DE Fellowes. Towards a lawn without grass: the journey of the imperfect lawn and its analogues.’ *Studies in the History of Gardens & Designed Landscapes* 33.3 (2013): 157-169.

¹⁵ Woudstra, Jan, and James Hitchmough. The Enamelled Mead: history and practice of exotic perennials grown in grassy swards. *Landscape research* 25.1 (2000): 29-47.

¹⁶ Shan Huajia, et al. Jin Shinian Zhongguo Caopingye Fazhan Xianzhuang [Recent Development of Turf Grass Industry in China]. *ACTA AGRESTIA SINICA* 21.2(2013): 222-229.

¹⁷ Chen Zhiyi. Chutan Caoping Qiyuan yu Yanhua, Jianlun Caoping de Gainian [Preliminary Probe on Origin and Evolution of Lawn and Turf and its Conception]. *Grassland and Turf* 94 (2001): 9-13

¹⁸ Chen Zhiyi. Zaitan Caoping de Qiyuan Yu Yanhua Jiqi Gainian [Second Probe on Origin and Evolution of Lawn and Turf and its conception: Lawn and Turf in Chinese Characters and Language]. *Grassland and Turf*, 96 (2002):7-12

54 Zhao¹⁹ defined lawn as a surface made up of herbaceous plants, established and managed
55 artificially and having both aesthetic and recreational value. Therefore, the definition of lawns
56 in China is still not unified and can be expected to change with time.

57 In this paper we explore existing knowledge on the historical development and cultural
58 origins of lawns in China, based on a literature review, site visits to the cities of Shanghai,
59 Xi'an and Suzhou of China and interviews with local politicians, lawn managers, landscape
60 architects and local residents. European experience is compared with Chinese contexts, in
61 order to identify possible future prospects for lawn development in China. The following
62 research questions guided the analysis: what are the driving forces for the origin and
63 development of lawns in China? What lessons can be learnt from classical Chinese gardening
64 and European as well as latest Chinese examples when devising more sustainable lawns? Is it
65 possible to change the existing paradigm of lawns in China towards environmental friendly
66 solutions?

67 **2. History of lawns in European countries and China**

68 ***2.1 The origin of lawns***

69 The word *laund* (Old English), which refers to a pastured glade or open space in woods with
70 extensive grazing for livestock, is the origin of the word lawn²⁰. British researchers suggest
71 that the lawn originated in Great Britain and Northern France in the early Middle Ages²¹.
72 Semi-natural meadow-lawns resembled typical landscapes in these two regions, because of
73 the temperate climate with relatively mild winters and warm humid summers, which was ideal

¹⁹ Xia Hanping, and Zhao Nanxian. Zhongguo Caoping Kexue Fazhan Guocheng Zhong Jige Zhide Zhuyi de Wenti [Several Noticeable Problems about China's Turf Science in the Progress of Growth]. *Chinese Landscape Architecture*, 16.5(2000): 13-16

²⁰ Woudstra and James. 'The Enamelled Mead', p. 29-47.

²¹ Smith and Fellowes. 'Towards a lawn without grass', p. 157-169.

74 for the growth of certain grass species. Some of these semi-natural grazed lawns still remain
75 (e.g. Balmer lawn in the New Forest in southern England)²².

76 In China, It was not until the 1960s that the Chinese characters “草” and “坪” were used
77 together to describe a flat area of grasses²³. In the *Encyclopedia of China: Gardening*²⁴, the
78 “草坪” is defined as a surface where short perennial herbaceous plants form a dense carpet
79 that is regularly mown. According to *Shuowen* (one of the oldest Chinese dictionaries,
80 completed around 100 AD), the Chinese Character “草” is generally defined as herbaceous
81 plants²⁵, while “坪” refers to flat ground. In ancient times, the Character “草” was used with
82 other characters such as “百” (hundred, means many), “川” (plain or flat land), “原” (plain) or
83 “无涯” (endless) to depict the beauty of herbaceous plant communities²⁶. China has abundant
84 resources of pastures which are distributed on the arid and semi-arid plateau and mountainous
85 regions of North China and Tibet and cover an area of 2,473,000 km^{2,27} (Figure 2). An open
86 landscape covered with herbaceous plants was appreciated in those regions in ancient times.
87 Evidence of this can be found in some Chinese poems. For example, in the “Ode of Chi Le”
88 written in the Northern and Southern Dynasty (420-589 AD), there are two lines describing the
89 landscape of Mongolian pastures in North China²⁸ that refer to grasses in the pasture so wild
90 and high that cattle and sheep herds are hidden from view:

²² Newton, Adrian. *Biodiversity in the New Forest*. (Devon: Pisces Publications, 2010).

²³ Lyu Shuxiang. *Xiandai Hanyu Cidian* [Contemporary Chinese Dictionary] (Beijing: The Commercial Press, 1960).

²⁴ Wang J. Y. *Zhongguo Da Baike Quanshu: Yuanlin* [Encyclopedia of China. Gardening] (Beijing: Encyclopedia of China Publishing House, 1988).

²⁵ Xu, Shen (100). *Shuowenjiezi* [Shuowen]. (Shanghai: Shanghai Classic Publishing House, 1988).

²⁶ Chen. *Zaitan Caoping de Qiyuan Yu Yanhua Jiqi Gainian* [Second Probe on Origin and Evolution of Lawn and Turf and its conception], p.7-12.

²⁷ Liu Xingpeng. *Zhongguo Caoyuan Huozhai Fengxian Dongtai Fenbu Tezheng Ji Guanli Duice Yanjiu* [Study on Grassland Fire Risk Dynamic Distribution Characteristic and Management Policy]. *Chinese Journal of Grassland* 28.6 (2006): 77-83.

²⁸ Guo Maoqian. *Yuefu Shiji* [Yue Fu Poetry] (Beijing: Chung Hwa Book co., 1979).

91 “The sky is blue, the pasture is growing wild; after the wind flows, the herbs are bent over
92 and the cattle and sheep appear.” (translation by the authors)

93 The nomadic people in North China traditionally used pastures for grazing, socialising and
94 living, which differs from the lifestyle of people from the central and southern part of the
95 country (China proper). In China, 71 per cent of the population is distributed in China
96 proper,²⁹ where the culture is rooted in agrarian civilisation. Throughout the Chinese history,
97 nomadic lifestyle was regarded as inverse of the sedentary, agricultural, hierarchical and
98 culturally sophisticated civilisation, which civilised people of Han Dynasty saw themselves³⁰.
99 Courtyard gardens were built for ornamental instead of practical use (seating, playing and
100 exercise) and owned by the elite³¹.

101 ***2.2 The use of lawns in gardens***

102 *2.2.1 The lawn in medieval times in Europe*

103 In medieval times in Europe, there were several types of grass-dominated surfaces. Some
104 British researchers argue that turf lawns were present in the gardens of the English king Henry
105 II (1113-1189) at Clarendon, Wiltshire, in the early twelfth century. They were also used on
106 bowling greens in England, such as at Southampton Old Bowling Green Club (founded in
107 1299)³². Some medieval lawns were described as including “flower mead”, which was higher
108 than turf lawns and full of flowers and herbs. In tapestries and paintings from medieval times,
109 flower-filled grassy seats and turfed grounds with flowers can be seen³³. Some scholars

²⁹ Yue, Tian Xiang, et al. Surface modelling of human population distribution in China. *Ecological modelling* 181.4 (2005): 461-478.

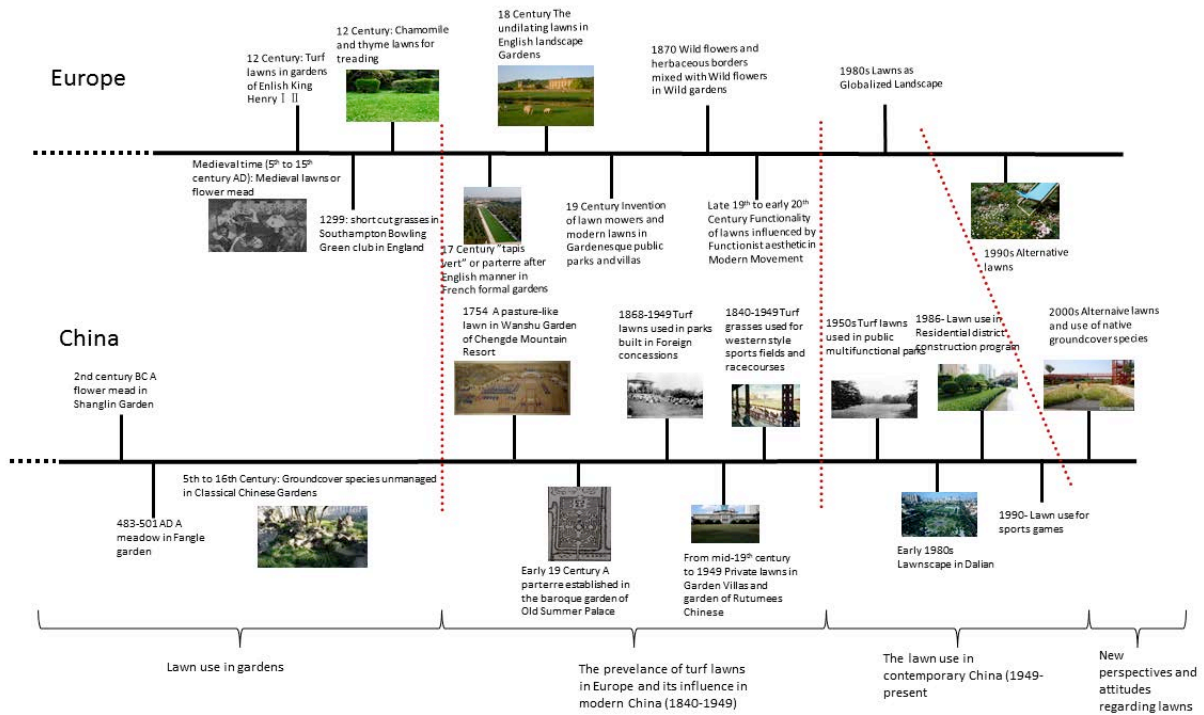
³⁰ MacKay, Joseph. The nomadic other: Ontological security and the Inner Asian steppe in historical East Asian international politics. *Review of International Studies* 42.03 (2016): 471-491.

³¹ Xuan Songnan and Chen Huizhe. Caoping yu Renlei Wenming [Lawns and Human civilization], *Agricultural Archaeology* 3(1996): 36-40.

³² Smith and Fellowes. ‘Towards a lawn without grass’, p. 157-169.

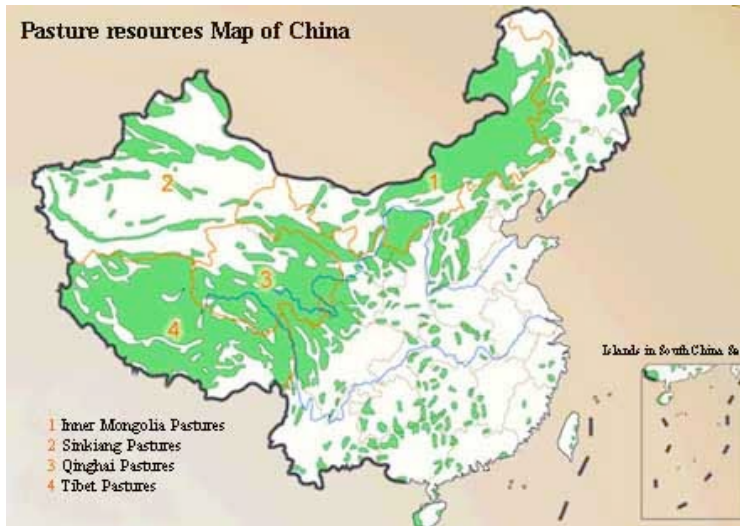
³³ Rohde, E.S. ‘The Garden ii: Lawns’, *The Nineteenth Century and After*, 104(1928), 200-209.

110 believe that such practices were an imitation of a natural meadow full of flowers³⁴.
 111 Chamomile (*Chamaemelum nobile*) and thyme (*Thymus polytrichus*) were used in some
 112 European medieval gardens, because of appreciation of their fragrance³⁵. However, the
 113 chamomile lawn was only grown occasionally as a novelty for its intolerance to cold or
 114 seasonally water-logged conditions. The thyme lawn reappeared in Great Britain in the
 115 Edwardian era, in the early twentieth century. Recently it was also recognised an importance
 116 of thyme flowers for attracting biodiversity, especially bees and butterflies³⁶.



117
 118 Figure 1 Key milestones in the history of lawns in Europe and China (compiled by the author,
 119 2016).
 120

³⁴ Woudstra and James. 'The Enamelled Mead', p. 29-47.
³⁵ Retrieved from www.thymegarden.com/Groundcovers
³⁶ Smith and Fellowes. 'Towards a lawn without grass', p.157-169.



121

122 Figure 2 Map of pasture resources in China Source: <http://amuseum.cdstm.cn>, translated by
123 the author.

124

125 2.2.2 Traditional ground cover in China

126 All plants were not maintained in early classic Chinese garden style “園” of the Shang
127 Dynasty (the seventeenth century BC to the eleventh century BC). Wild animals hunted by the
128 emperor were reared in the garden for eating, using for sacrifice and enjoying their “beauty”.
129 These gardens were fenced and trees were grown and ponds were built to create a living
130 environment for the animals. There were also some vegetables grown in the garden to provide
131 food for royal banquets. Trees were revered and regarded as a symbol of a nationality or tribe.
132 For example, Chinese arborvitae (*Platycladus orientalis*) and Chinese chestnut (*Castanea*
133 *mollissima*) were regarded as a symbol of the Shang Dynasty (the seventeenth century BC to
134 the eleventh century BC) and Zhou Dynasty (1046 BC to 256 BC), respectively. Low
135 herbaceous plant communities (including representatives of Gramineae family) were not
136 appreciated in gardens at that time³⁷.

³⁷ Zhou. *Zhongguo Gudian Yuanlin Shi* [The History of Classical Chinese Garden], p. 40-52.

137 The first record of a prototype of Chinese lawns (a low herbaceous decorative surface which
138 can be compared to the flowering meadow) can be found in “Fu on the Imperial Garden”³⁸. It
139 is an epic poem about Shanglin Garden (the second century BC), one of the oldest royal
140 gardens in Chinese history, which was located in Guanzhong Plain in central China, a region
141 with a temperate climate. This poem even contains a description of a technique for
142 transplanting certain herbs from the wild into gardens for decoration. The meadow consisted
143 of the native species zoysiagrass (*Zoysia japonica* or *Z. sinica*) and sedges (*Carex* spp.) and
144 was bordered with some fragrant flowering herbs and low shrubs, such as gardenia (*Gardenia*
145 *jasminoides*), Du Heng (*Asarum forbesii*), Gaoben (*Ligusticum sinense*), Leopard Lily
146 (*Belamcanda chinensis*) and Myoga (*Zingiber mioga*) and even some orchids³⁹. Later, native
147 herbaceous plants were cut into square slabs with a special knife and transplanted from native
148 meadows to Fangle Garden (499-501 AD) for ornamental purposes. It was the royal garden of
149 Emperor Donghun Hou (483-501 AD). However, during sunny and hot summers, such
150 herbaceous plants withered and died. Establishment techniques for herbaceous plant
151 communities were not sophisticated and frequent irrigation was required⁴⁰.

152 A steppe-like lawn was established in the royal garden of Emperor Kublai Khan in the
153 thirteenth century because the emperor missed the steppes of his home in Mongolia. The
154 construction details of this steppe-like lawn are unknown⁴¹. Another use of steppe vegetation
155 in royal gardens was Wanshu Garden (1703-1792) in Chengde Mountain Resort. This resort
156 was used by the Kangxi, Qianlong and Jiaqing Emperors to escape the summer heat in the
157 capital city of Beijing. Wanshu Garden was characterised by the scenery of the Mongolian
158 steppe, consisting of mainly a species of sedges (*Carex rigescens*, native to northern China)

³⁸ Sima Xiangru. Shanglin Fu [Ode of Shanglin Garden]. In. *Twenty Five Histories* (vol.1). (Shanghai: Shanghai Guji Press, 1986).

³⁹Chen. Zaitan Caoping de Qiyuan Yu Yanhua Jiqi Gainian [Second Probe on Origin and Evolution of Lawn and Turf and its conception], p.7-12.

⁴⁰ Li Yanshou. *Nanshi* (Vol. 5) [History of Southern Dynasties]. Beijing: Chung Hwa Book co. (1974)

⁴¹ Sun Jixiong. *Caoping Xue* [Turf Science]. (Beijing: China Agriculture Press, 2003)

159 grazed by milu deer, which was favoured by the Qianlong Emperor (1711-1799). The steppe
160 district had political and social functions at that time. The emperor usually gave banquets for
161 high officials, nobles of various minority nationalities and foreign envoys on the steppe. Some
162 Mongolian yurts were set for parties, concerts and receptions and removed after the festivity
163 end. The games played during emperor's receptions included wrestling fights, horse races and
164 military exercises as well as the theatre play and fireworks⁴². Giuseppe Castiglione, a painter
165 and missionary from Italy, depicted this activity in his painting named "A banquet given by
166 the Qianlong Emperor in Wanshu Garden" (Figure 3). Qianlong wrote a poem entitled "Eight
167 verses of the green carpet", where he spoke highly of the natural beauty of the pasture and
168 criticised the ground cover planting and carpet used in the courtyard and palace:

169 'The Mountain Resort is rich with fertile soil and abundant grass, covering the hills
170 everywhere, with milu deer feeding and roaming freely; the grass does not grow long,
171 rising no more than one cun (3.3 cm). It can truly be called a green carpet; inspired by the
172 green grass, I have composed this poem.

173 Who can tell me where the utmost of green carpets is? The best of them is just in the
174 Mountain Resort; it is not the furs that were worn by those from western regions, but the
175 pasture for on-horse herdsmen of the Mongolian people; when there is enough rain
176 covering the ground, it has wonderfully become a light green cotton padded mattress;
177 while at the mid-summer time, it is a dark green woollen carpet, covering the hill rocks;
178 singing cranes wander freely on the flat grass, leaving their footprints on the soft thick
179 growth of grass, milu deer feast always not letting the green grass grow long and high; the
180 grass looks less than one chi (33 cm), and actually is only one cun (3.3 cm) long, not like
181 the smell of the burning of incense, yet full of the scent of fragrant grass; how lavish is
182 Emperor Han Wu Di, spreading a woollen rug in his Greenhouse Palace; and the
183 emperors of the Tang Dynasty spreading silk threaded carpet on the ground, they should

⁴² Forêt, Philippe. *Mapping Chengde: the Qing landscape enterprise*. (University of Hawaii Press, 2000).

184 be despised by the famous poet Bai Juyi; Zheng Xuan's grass planting in the yard is truly
185 unneeded; I sometimes write poems like Li He when sitting on the grassland for a rest;
186 viewing the scenes, composing poems, what a thriftiness it is; For my successors, what an
187 example it is'⁴³.



188
189 Figure 3 The painting “A banquet given by Qianlong Emperor in Wanshu Garden” Source:
190 www.dpm.org.cn.

191
192 Emperor Qianlong's preference on such pastoral steppe like landscape is probably related to
193 his origin as nomadic Manchus. The nomadic Manchus first conquered the Han Chinese and
194 then built the Qing Empire⁴⁴. Both Kublai Khan and the Qianlong were conquerors originated
195 from very different environments (north of the Great Wall). Their native regions had a
196 temperate climate, which actually has similarity to many European countries. It is featured
197 with steppe grass grazed by animals⁴⁵. Thus, emperors' internal relationship with the grassy
198 landscape had been reflected in their preference to grasslands or pastures.

199

⁴³ Li Zhiyong et al. Bishushanzhuang Yuzhi Beike Shiwen'Lyutan Bayun' Shangxi yu Yingyi [Analysis and Translation of 'Eight Verses of the Green Carpet']. *Journal of Hebei Tourism Vocational College*. 2(2009): 102-103.

⁴⁴ Lu, Sheldon H. Chinese modernity and global biopolitics: Studies in literature and visual culture. University of Hawaii Press, 2007.

⁴⁵ Ingvar Backeus, et al.. *The Rural Landscapes of Northeast Asia* (Stockholm: Fri Tanke, 2016).

200 Throughout the imperial period, there was very little pasture in China proper for horses or
201 other ungulates. Chinese emperors faced a problem, because horses were especially critical
202 for China's military forces. However nearly all pastures were located in the steppe or Tibetan
203 region and were under the control of peoples; who, from time to time, had military conflicts
204 with the Han Chinese. As conquest dynasties, the Yuan (Mongols) and Qing (Manchus) had
205 solved the problem by incorporating their homelands (grassy surfaces) into their new pleasure
206 grounds⁴⁶.

207 Apart from royal gardens, there are no traces of true "turf" lawns in classic Chinese literati
208 gardens. These gardens started to emerge in the southern region of the Yangtze River from the
209 third century AD. At that time, influenced by the unstable political situation, retired officials
210 and intellectual elites disappointed with their careers switched their interests to enjoying the
211 beauty of nature in the suburban area of the city⁴⁷. The subtropical climate of this region is
212 warm and humid and suitable for growing various plant species. The pastures were not typical
213 landscapes in such climate conditions. Following the ideology of classic Chinese gardening:
214 "although the gardens are artificial, they should appear natural"⁴⁸, the gardeners tried to
215 imitate the mountains, rivers and lush plants in nature by using rocks, water and some selected
216 plants. Traces of human interferences can hardly be detected in these small gardens. In this
217 sense, the concept of transplanting pastures or meadows and imposing intensive management
218 on them was very exotic and could never be accepted in literati gardens.

219 When arranging the plants in the literati gardens, native plant species were used and their
220 ecological character was fully considered. For example, cold-resistant plants such as
221 *Ligustrum lucidum* and bamboos were used in the shady area next to the wall; on the north-

⁴⁶ Bello, David A. Relieving Mongols of Their Pastoral Identity: Disaster Management on the Eighteenth-Century Qing China Steppe. *Environmental History* (2014): 480-504.

⁴⁷ Zhou. *Zhongguo Gudian Yuanlin Shi* [The History of Classical Chinese Garden], p. 117-121.

⁴⁸ Ji, Cheng. *The Craft of Gardens*. Translated by Alison Hardie (London: Yale University Press, 1988).

222 facing side, which has very little sunshine, sweet osmanthus (*Osmanthus fragrans*) and
223 common camelia (*Camellia japonica*) were planted^{49,50}; the shade-tolerant herb lilyturf
224 (*Ophiopogon bodinieri*) was highly valued for the space between stones under terraces (Figure
225 4).



226

227 Figure 4 *Osmanthus bodinieri* used in Zhuozheng Garden, Suzhou (photo by Fengping Yang).

228

229 In classical Chinese gardening, the goal was to create an enclosed landscape where a winding
230 path led to a secluded quiet place⁵¹. Visitors were navigated along this winding path to
231 explore the beauties of the garden. Therefore, the concept of a flat, open large garden area in
232 formal and landscape garden styles does not fit at all into the principle and canon of classical
233 Chinese garden design. In addition, grasses were always ignored by garden owners, especially
234 in literati gardens where every plant and rock had its symbolic meaning, representing the
235 spirit of its owners. For example, lotus flowers (*Nelumbo nucifera*) were regarded as the
236 symbol of purity and having ideals; bamboos were seen as strong-willed, modest noble man
237 with moral integrity; wintersweet (*Chimonanthus praecox*) represented a faithful and strong-
238 willed spirit in harsh conditions; and orchids represented a virtuous spirit. However, grasses

⁴⁹ Li Jinxuan, and Fu Xiaoyu. Qiantan Suzhou Gudian Yuanlin Zhiwu Peizhi [Discussion on Plant Disposition in Suzhou Classical Garden]. *Shanxi Architecture*, 6 (2006): 350-352.

⁵⁰ Wu, Xiaoqiao. Qianyi Woguo Gudian Yuanlin de Zhiwu Peizhi [Discussion on Plant Disposition in Chinese Classical Garden]. *Chinese Landscape Architecture* 15.3 (1999): 33-35.

⁵¹ Wen, Yabin. Fenxi Zhongguo Guding Yuanlin zhong Weishenme meiyou Caoping [Discussion about Why There is no Green Lawn in Chinese Classical Garden]. *Huazhong Architecture* 25.1 (2007): 145,168.

239 were too humble to be included and were often omitted⁵².

240 ***2.3 The prevalence of turf lawns in Europe and its influence in modern China (1840-***
241 ***1949)***

242 Short-cut grass was found to be a good material to shape the complicated patterns of parterres
243 in French formal gardens. Intensively cut green surfaces with low height represented by a
244 monoculture of grasses were found in the “tapis vert” or “green carpet”⁵³ (Figure 5a). It was
245 used in the French bowling greens and English-type parterres of the sixteenth to seventeenth
246 century, where the lawn covered quite large surfaces⁵⁴. The “tapis vert” of Versailles is 335
247 m long and 40 m wide. It was established in the central axis of the garden and kept flat for
248 ornamental use, so that visitors could easily see the chateau as the central dominant object of
249 the garden⁴⁹.

250 At that time, the garden of Versailles (the epitome of French formal gardens) and its elements
251 (including the manicured lawns) were widely copied by European and even Chinese
252 monarchs and nobilities (Figure 5b). The first version of a French formal garden in China,
253 named Changchun Garden, was created in Yuanmingyuan (the old Summer Palace of
254 Qianlong (1736-1795) in Beijing, also known as the “Versailles” of Beijing) by Jesuit priests
255 from France, Italy and Germany⁵⁵. A parterre was built in the garden but was destroyed by
256 Anglo-French troops during the Second Opium War (1857-1860) (Figure 5b).

257 The English landscape gardens in the eighteenth century incorporated gently rolling hills,

⁵² Zhang Zhiyong, and Yang Jun. Zhongguo Gudian Shanshui Yuanlin zhong Zhiwu Peizhi de Lishi Yanbian [Review of the Historical Evolution of the Plants Design in the Chinese Classical Shanshui Garden]. *Modern Landscape Architecture*, 6(2012): 8-11.

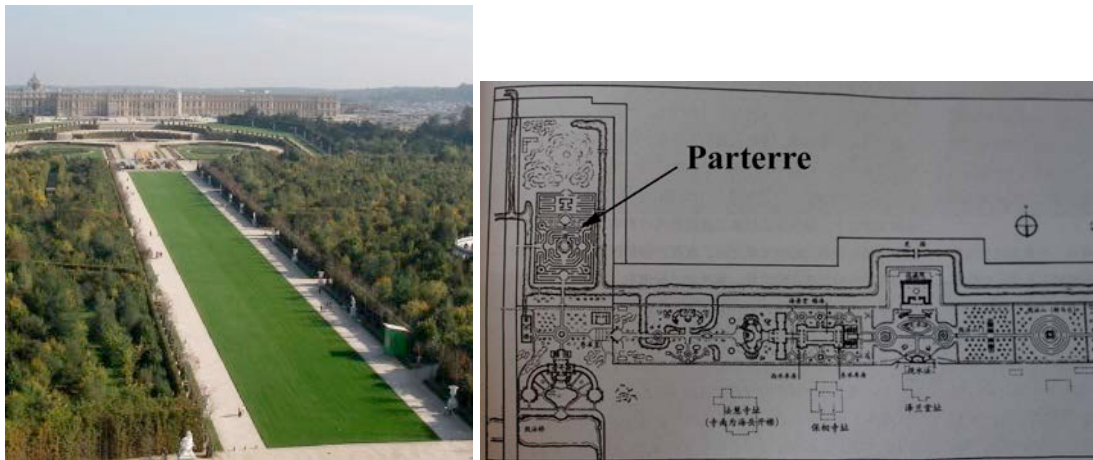
⁵³ Jellicoe, Geoffrey Alan, and Susan Jellicoe. *The landscape of man: shaping the environment from prehistory to the present day* (London: Thames and Hudson, 1995).

⁵⁴ Dezallier D'Argenville, and Antoine Joseph. *The Theory and Practice of Gardening*, trans. John James (London, 1712), 202-3.

⁵⁵ Thomas, Greg M. 'Yuanming Yuan/Versailles: intercultural interactions between Chinese and European palace cultures.' *Art History* 32.1 (2009): 115-143.

258 free-form lakes and groves of trees among vast green pastures on which animals were grazing.
259 This garden style suggested a new way of seeing and appreciating nature. Extended pastures
260 and lawns on estates were grazed or cut by scythe, which was labour-intensive⁵⁶. In the
261 nineteenth century, John Claudius Loudon (1783-1843) developed a gardenesque style of
262 landscape in the first public parks and villa gardens, where the turf lawn was used as a display
263 of exotic plants and flowers⁵⁷. “The deep green colour” and “velvet texture” of the British
264 lawns were achieved through careful maintenance⁵⁸. The invention of the first lawn mower in
265 1832 made easy work of cutting around planting beds and made lawns affordable for even the
266 smallest gardens⁵⁹. Since then, lawns and technology have become inseparable (mechanical
267 mowing, aerating, and sprinkler irrigation)⁶⁰.

268



269

270 Figure 5. a) “Tapis vert” in the garden of Versailles Source: <http://en.chateauversailles.fr>; b)
271 layout of Changchun Garden in Yuanmingyuan Source: Jiao Xiong. *Historical Site Map of*
272 *Yuanmingyuan (Yuanmingyuan Shiji Tukao)*. Beijing: Xueyuan Press (2011).

273 The lawn fitted well with the simplistic and rational aesthetic of the Modernistic movement in

⁵⁶ Sullivan, Chip, and Elizabeth Boult. *Illustrated History of Landscape Design* (New Jersey: John Wiley & Sons, 2010)

⁵⁷ Ignatieva ‘Plant material for urban landscapes in the era of globalization’. p.139-151

⁵⁸ Loudon, John Claudius, and Mrs Loudon (1850). *An Encyclopædia of Gardening*. (London: Spottiswoode and Shaw, 1850).

⁵⁹ Pollan, Michael. *Second Nature: a Gardener's Education*. (New York: Grove/Atlantic, 2007).

⁶⁰ Pam, Robin. ‘Turf Wars: the Front Lawn and the American War on Nature’. *Herodotus*, 16(2006): 25-35.

274 late nineteenth to twentieth century. The utilitarian style of Modernism strongly influenced
275 the construction of domestic buildings and their attached gardens especially in Anglo-
276 American cities. The garden was planned to form a close relationship to the house with a lawn
277 established as extensive as possible. The lawn was seen as an excellent surface for play, walk
278 and rest⁶¹.

279 The “smooth green carpet” was introduced to China after the First Opium War (1839-1842),
280 when five treaty ports (Shanghai, Guangzhou, Fuzhou, Xiamen and Ningbo) were opened to
281 foreign countries (mainly Britain, France and America). Travellers from those countries
282 brought the idea of European lawns to parks and private gardens owned by foreign
283 missionaries and businessmen in these cities⁶². The opium war ended the agricultural society
284 of China and pulled China into the modern age by force. During the next hundred years,
285 Chinese society changed in many ways as a result of conflicts between Chinese culture and
286 the western culture. For example, due to the influence from the modern western civilization
287 people in Shanghai changed working habits and their living standard increased after
288 1840⁶³. These factors accelerated the social necessity of leisure entertainment. Foreign
289 capitalism was introduced with the relationship between humans and the environment.
290 Compared to old Taoist respect of Nature and the role of humans as a small part of
291 cosmological balance, western philosophical vision of humans as a centre of the universe and
292 the “Master” of nature has been accepted⁶⁴. Chinese society was increasing exploiting the
293 environment and negatively affecting it. The lawn, as a western cultural product, was brought
294 to China and adapted to the Chinese “soil” and became the perfect symbol of triumph of Man

⁶¹ Thompson, Ian H. *Rethinking landscape: a critical reader* (London: Routledge, 2009).

⁶² Chen, Chundi. *Planning Urban Nature: Urban Green Space Planning in Post-1949 China: Beijing as a Representative Case Study* (Ph.D. diss., Lincoln University, 2013).

⁶³ Zhou Xiangpin and Chen Zhehua, Shanghai gardens in Transition from the concessions to the Present, in Michel Conan and Chen Whangheng (eds), *Gardens, City Life and Culture* p. 123-139 (Washington, D.C.: Harvard University Press and Dumbarton Oaks Research Library and Collection, 2008).

⁶⁴ Ignatieva, Maria. How to Make Urban Green Verdant and Sustainable: Designing “Wild” Swedish Lawns. *The Nature of Cities*, 1 February, 2017.

295 over Nature⁶⁵. A smooth-shaven lawn with hedges was the major element of the first public
296 park in China, named Waitan Park (now Huangpu Park), which was built in the British
297 concession in Shanghai in 1860⁶⁶. This park had all the attributes of a gardenesque garden,
298 which the lawn occupied 35% of the green space. In the lawn there was a modern gazebo
299 where concerts of western music were given; chairs were set on the lawn, so that park visitors
300 could sit and enjoy these concerts (Figure 6a). Later on, Gujiazhai Park (Figure 8a; now
301 Fuxing Park) and Hongkou Park (now Luxun Park) were built with either a French formal
302 garden style or English picturesque style in the British-American and French concessions in
303 Shanghai. Lawns covered 39 per cent and 25 percent of green spaces in Gujiazhai Park and
304 Hongkou Park respectively (Figures 6b & 7b). However, the parks were not opened up to
305 Chinese people until 1928, following complaints about the inequality from Chinese
306 honourable men. This facilitated the building of the New Garden in 1890, a garden belong to
307 Chinese people alone, and the opening of a large number of private, for-profit gardens (make
308 profit from the entrance fee) owned by Chinese to the public from 1880s. These for-profit
309 gardens had the same layout and design features of classical Chinese gardens and were later
310 altered to show a new face of openness to the public inspired by the Western style public
311 parks in the concession areas⁶⁷. The western style lawn became an essential element and
312 contributed to the expansiveness and openness of the for-profit gardens, which also had a
313 practical function. For example, the big lawn in Zhang Garden could hold thousands of people
314 and was often used as a place for a variety of leisure activities (e.g. circuses, kite fair, birthday
315 parties and weddings) and special public gatherings and speeches⁶⁸. The plants, which were
316 used in such Chinese gardens, lost their symbolic meaning and became a pursuit for novelty

⁶⁵ Mahong, Bao. Environmental History in China. *Environment and History* 10.4 (2004): 475-499.

⁶⁶ Xiong, Yuezhi. Jindai Shanghai Gongyuan yu Shehui Shenghuo [The Parks and Daily Life in Modern Shanghai]. *Social Science* 5(2013): 129-139.

⁶⁷ Zhou and Chen. Shanghai gardens in Transition from the concessions to the Present, p. 123-139.

⁶⁸ Xiong Yuezhi. Wangqing Shanghai Siyuan Kaifang yu Gonggong Kongjian de Tuo zhan [Openness of Private Gardens and Expansion of Public spaces in Shanghai in the Late Qing Dynasty]. *Academic Monthly* 8(1998): 73-81.

317 and modernist practicality.

318 The turf grasses offered a perfect ground for certain sports, originated from European
319 countries as well. For example, Hongkou Park (now Luxun Park), constructed in 1909 was a
320 main sport venue in Shanghai and even China at that time. A wide range of sports fields were
321 set to facilitate sports for foreign residents. Among them, fields for football, baseball and
322 hockey, tennis court, golf courses and bowling greens were all made from turf grasses. Those
323 sports fields were also built in several other public parks, e.g. Huishan Park, Gujiazhai Park
324 and Fanerdeng Park. Important sports meetings were held in Hongkou Park in the period of
325 the Republic of China (1912-1949), which promoted those imported sports and the turf
326 culture for the sports field. Until 1941, there were 33 tennis clubs, 20 football clubs, 4 field
327 hockey clubs and 12 baseball clubs in Shanghai. In 1933, 8256 people had taken part in the
328 sport games⁶⁹. Besides, the horse race was also a popular sport for foreign residents in
329 Shanghai. Three racecourses had been built at that time and were only open to foreign
330 residents at the beginning (Figure 8). The racecourses were made from turf grasses and there
331 was a big lawn in the central part equipped with fields for playing cricket, football, tennis,
332 golf, baseball and polo etc.⁷⁰. The popularity of sports played on grassy fields in early
333 modern Shanghai had a fundamental influence on the popularity of those western sports in
334 China and the construction of sport fields and rise of lawn industry after the Second World
335 War.

336 The lawn had become a symbol of westernisation and modernity in early modern Shanghai
337 (1840-1949)⁷¹. The parks built in foreign concessions tended to reflect the national style of

⁶⁹ Ma Youyu. Wosuo Zhidao De Hongkou Tiyuchang [The Houkou Stadium I know]. *Sports Culture Guide 2* (2003):63-64.

⁷⁰ Xiong Yuezhi. Cong Paomating dao Renmin Gongyuan Renmin Guangchang: Lishi Bianqian yu Xiangzheng Yiyi [From Racecourse to People Park and People square: Historical Change and Symbolic Significance]. *Social Science* 3(2008): 001.

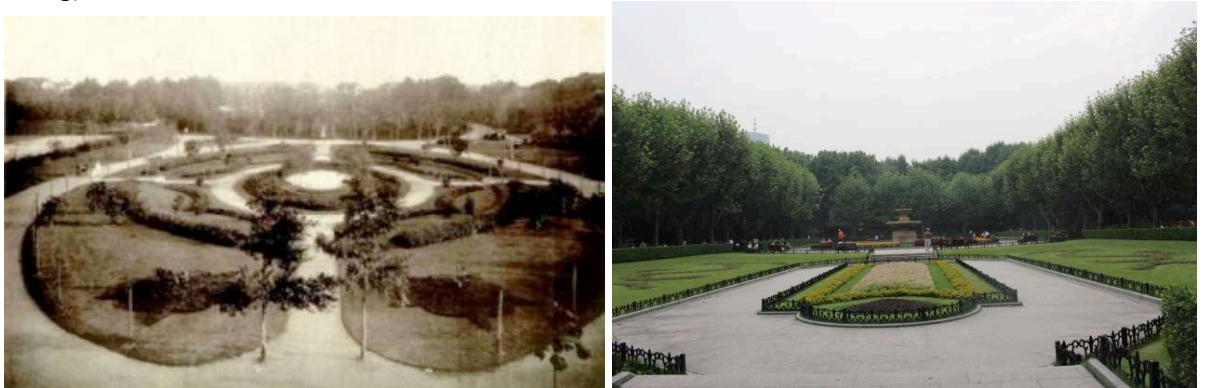
⁷¹ Zhou and Chen. Shanghai gardens in Transition from the concessions to the Present, p. 123-139.

338 the home countries of foreign residents. The establishment and exclusive use of lawns was an
339 expression of civilizational superiority of the western countries. Those parks were opened to
340 the public after the establishment of People's Republic of China (1949). The European
341 Renaissance-baroque-picturesque-gardenesque and modernist style landscapes created and
342 their crucial elements such as parterres, lawns, topiaries and flowerbeds used in those first
343 parks became models of some public parks built after 1949⁷².



344

345 Figure 6. a) The lawn in the public park in Shanghai, constructed in 1930s (Yuezhi. 'The
346 Parks and Daily Life in Modern Shanghai'. *Social Science* 5(2013): 129-139), and b) the lawn
347 in Gujiazhai Park, established in the 1930s, which is still well-kept today (photo by Fengping
348 Yang).



349

350 Figure 7 a) Gujiazhai Park, Shanghai, built in 1909⁷³ and b) parterres in Gujiazhai Park using
351 short grasses as a basis (photo by Fengping Yang).
352

⁷² Yang Le, Zhu Jianning and Xiong Rong. Qianxi Zhongguo Jindai Zujie Huayuan [An analysis of the Concession Gardens in Modern China—Taking Tianjin and Shanghai as Examples]. *Journal of Beijing Forestry University (Social Sciences)* 2.1 (2003): 17-21.

⁷³ Retrieved from tuku.history.China.com.



353

354 Figure 8 Race courses in Shanghai⁷⁴

355 Lawns, as an element of western architectural landscape due to the modernistic movement,
356 were introduced to the treaty port cities in modern China (1840-1949). For example, from
357 1872 onwards, in the foreign concessions of Shanghai, garden villas were built for the upper
358 class Chinese and foreign residents. Most of these villas were designed in a European style
359 and each had a large garden consisting of a lawn, a fountain or marble statue in the centre, a
360 glasshouse with exotic plants, rockeries and a pavilion. These gardens were usually fenced
361 around with high walls or hedges to keep the space private (Figure 8). By 1949, around 5000
362 garden villas had been built in Shanghai and covered an area of 300 hectares⁷⁵.



363

364 Figure 9 Garden villas in Shanghai (photo by Fengping Yang).

365

⁷⁴ Retrieved from tuku.history.China.com.

⁷⁵ Xue Shunsheng, and Lou Chenghao. *Laoshanghai Huayuan Yangfang* [Old Garden Villas in Shanghai] (Shanghai: Tongjing University Press, 2002).

366 Parterres and lawns together with western buildings were used in the gardens of returnee
367 Chinese in Guangzhou and Xiamen (two of the five treaty ports) and their neighbour cities as
368 well. Those regions were also an area with a large number of migrants because of their special
369 geographical location. The Chinese returnee who had both western and Chinese background
370 started to build garden villas in their hometowns in the mid-nineteenth century. Such villa's
371 garden had a hybrid character and kept the irregular structure and artistic concept of Chinese
372 Classical Gardening but also adopted some elements of western landscape architecture. The
373 lawn as one of the crucial elements in western landscape architecture was commonly used in
374 the gardens of Chinese returnee for outdoor leisure activities. For example, a big lawn with
375 parterres and a maze was built in the Huangyizhu Sea-view villa garden in Xiamen⁷⁶.

376 ***2.4 Lawn use in contemporary China (1949 to present)***

377 *2.4.1 Lawn development from 1949 to 2000*

378 After the People's Republic of China was established in 1949, some remains of colonial lawns
379 were transformed into public lawns for local inhabitants. In the "General Greening" campaign
380 in the 1950s, lawns became an issue of greening. This was a result of "Learning from the
381 Soviet Union", because in several handbooks translated from Russian, lawn was regarded as
382 an integral feature of urban green spaces. However, it was announced in the Fifth Urban
383 Construction Conference held by the Architectural Engineering Ministry in June 1965 that no
384 parks and green spaces would be created or extended. Mao Zedong also emphasised the need
385 to further expand farming and fishery in the parks and change pleasure features to utilitarian
386 functions. For example, in Zhongshan Park, many fruit trees and medicinal plants were
387 planted with tall fences to enclose them. In the absence of ornamental plantings, the public

⁷⁶ Chen Zhihong and Wang Jianping. Cong Huaqiao Yuanlin dao Chengshi Gongyuan—Minnan Jindai Yuanlin Yanjiu [From overseas Chinese Gardens to City Parks—Research of Modern Landscape Architecture in Southern Fujian]. *Chinese Landscape Architecture* 22.5(2006): 53-59.

388 were forced to enjoy the aesthetic beauty of the fruit and flowers of those plants. Some parks
389 were even turned into pig farms⁷⁷. During that period, green space together with lawn
390 development was negatively affected. Since the Chinese Economic Reform (1978), the use of
391 lawns in landscape design has grown at great speed. Government officials travelling abroad
392 were impressed by the European Renaissance-baroque-picturesque-gardenesque and
393 modernist landscapes, which were all based on lawns. They immediately regarded manicured
394 lawns as an essential element of contemporary landscape architecture⁷⁸.

395 In the early 1980s, an area of 46,000 m² of buffalo grass (*Buchloe dactyloides*) was planted in
396 the Dalian People's Square and the city greening projects in Dalian (located in north-east
397 China with a temperate climate), such as Xiangzhou Road and Baiyunyanshui Park, used
398 buffalo grass and Zoysiagrass (*Z. japonica*). Although no intensive management practices
399 were needed, the green period of the two grass species was short and the landscape was seen
400 as unattractive. In 1991, the grass species in the People's Square was changed in favour of
401 Kentucky bluegrass (*Poa pratensis*) introduced from Europe, which has a green period of up
402 to 300 days. From then on, it was commonly used in Dalian city. In the years 1994-1997, an
403 area of 700,000, 1 million, 2 million and 2.8 million m² of lawns, respectively, was recorded
404 in Dalian. The Dalian People's Square and Friendship Square were also the first two parks in
405 the northern cities of China to use turf colorant to keep lawn grasses green all year round. In
406 addition, grass seed was imported from Canada. A variety of grasses species are currently
407 used in Dalian's lawns, but the majority are non-indigenous and imported from abroad
408 (mainly North America). Among them, Kentucky bluegrass is the most commonly used
409 species, followed by creeping bentgrass (*Agrostis stolonifera*), buffalo grass, perennial
410 ryegrass (*Lolium perenne*), Zoysiagrass (*Z. japonica*) and red fescue (*Festuca rubra*). Since

77 Zhao. 'Thirty years of Landscape Design in China (1949-1979)', p. 107-111.

78 Chen. 'Planning Urban Nature', p. 92.

411 the 1990s, the landscape of Dalian city has become a model for many other Chinese cities⁷⁹.
412
413 In 1986, the “National Pilot Program of Residential District Construction” was launched, with
414 the emphasis on landscape design and greening of residential districts. The European styles of
415 landscape design were quite influential and started to be applied in these construction
416 programmes. Elements such as ornamental lawns, annual flowerbeds, fountains, Roman
417 colonnades and sculptures appeared in the residential districts. A huge quantity of new
418 housing area (from less than 200 km² in 1998 to nearly 1000 km² in 2009) was completed to
419 meet the high demand from consumers after the housing reform in 1998⁸⁰. The focus of
420 residential area planning was gradually switched towards the quality of living environment
421 and green space planning⁸¹. The lawn was widely applied in the landscape design of
422 residential areas, not only because of the simple and mature planting technology and fast turf
423 characteristics of lawns favoured by the real estate developers (according to an interview with
424 a landscape architect in a real state company in Xi’an), but also because of the preferences of
425 local residents, who regarded the lawn as a symbol of western lifestyle as depicted by a local
426 resident of Xi’an city “the perfect lawn for me is like the European lawn which is very open
427 scattered with trees and shrubs. I can sit and sleep on the lawn while my kid is romping
428 around”. The lawn became part of people’s daily life as an extension of the indoor living
429 space and “a second living room without walls”⁸².
430 Globalisation also speeded up the popularity of sports such as football and golf, while the

⁷⁹ Wang Haiyan, and Song Shufan. Dalian Chengshi Caoping Jingguan Goujian Jichu ji Youguan Wenti Tantaoh [Discussion on the City Lawnscape Construction and Problems in Dalian]. *Chinese Landscape Architecture*, 16.6(2000):11-13.

⁸⁰ Yang, Zan, and Jie Chen. ‘Housing Reform and the Housing Market in Urban China.’ *Housing Affordability and Housing Policy in Urban China* (Springer Berlin Heidelberg, 2014), 15-43.

⁸¹ Liu Wei. Woguo Chengshi Zhuzhai Xioaqu Jingguan de Fazhan Tedian Ji Qushi [Development Characteristic and Trend of Urban Residence Community in China]. *Anhui Agricultural Science Bulletin* 17.16(2011): 100-102.

⁸² Steinberg, Theodore. *American green: The obsessive quest for the perfect lawn* (New York: W. W. Norton & Company, 2006).

431 successful hosting of the Asian Games in 1990 offered a good opportunity for the rise of the
432 Chinese lawn industry⁸³.

433

434 “National Garden City” program launched in 1992 has its emphasis on urban greening⁸⁴⁸⁵. In
435 order to achieve the standard of a “National Garden City”, each city endeavoured to build
436 green spaces. The turf is regarded as the fastest way to build green spaces. For example, the
437 city gardener in Xi’an explained that the quick ground covering merit of turf grasses made
438 them popular to city greening projects aiming to increase green spaces and plant coverage. In
439 other words, the short growth period of turf grasses suited the fast development of Chinese
440 society in last several decades. Till 2016, around half of the cities (310) in China have been
441 honoured as “National Garden city”⁸⁶.

442 Due to several programs launched by Chinese government, the lawn was widely used in
443 residential areas and public green spaces in China. At this stage, the lawn became a
444 monoculture and had relatively close-cut surfaces, partly because people’s attitudes changed
445 so that nature was not considered beautiful until the signs of human order were explicitly
446 visible⁸⁷.

447 *2.4.2 Development of Chinese lawns in the twenty-first century*

448 Traditional grass lawn still dominates urban and suburban landscapes in Europe, Canada and
449 the USA and it remains integral to the British garden, where up to 60 per cent of private

⁸³ Sun Jixiong. *Caoping Xue* [Turf Science]. (Beijing: China Agriculture Press, 2003)

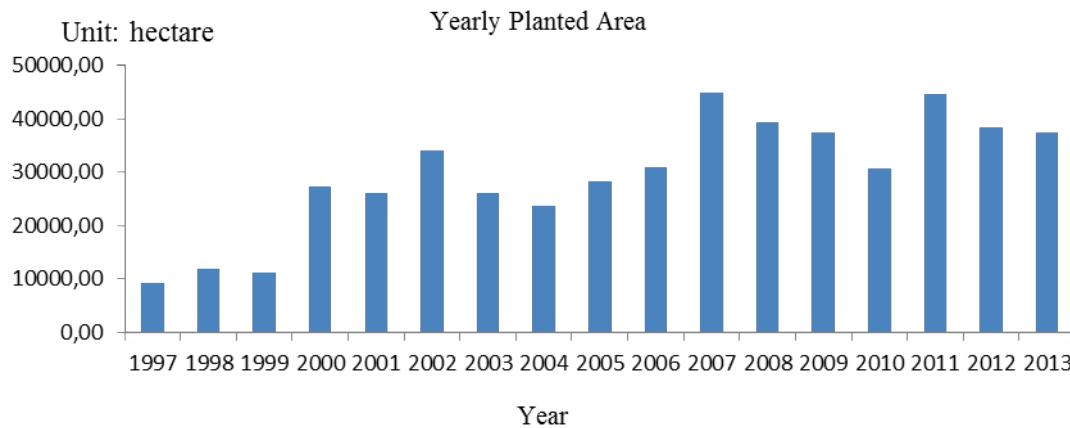
⁸⁴ Zhao, Jingzhu. ‘Exploration and practices of China’s urban development models.’ *Towards Sustainable Cities in China*. Springer New York, 2011. 15-36.

⁸⁵ Standard for “National Garden City”. Retrieved from <http://www.mohurd.gov.cn>

⁸⁶ Gov.cn. Name list of “National Garden city” in 2015. [2016-01-29]. http://www.gov.cn/xinwen/2016-01/29/content_5037350.htm

⁸⁷ Chip and Boult. *Illustrated History of Landscape Design*, p. 107-202.

450 gardens contain a lawn.⁸⁸



451 Figure
 452 10. Area of new lawn planted annually in China from 1997 to 2013 (Ministry of Agriculture of
 453 PRC. ‘China Agricultural Statistical Information-Planting Industry’ (Zhongguo Nongye
 454 Tongji Ziliao--Zhongzhiye). Retrieved May 14th, 2015, from <http://tongji.cnki.net/> (2014)).
 455

456 In China, the planted area of lawn increased dramatically in the period 1997-2013 from
 457 9210.53 hectares to around 40 000 hectares, although it fluctuated over the years (Figure 9).

458 The urban globalised landscape can be observed throughout China now, despite the varying
 459 climatic conditions since 2000. Well-mown lawns together with huge plazas, peaceful lakes,
 460 scattered broad-leaved trees and regular beds of annual flowers have become a symbol of the
 461 globalised landscape, in spite of their high maintenance costs and low environmental value⁸⁹.

462 The peak in 2007 can be explained by the construction of Olympic parks and sporting fields
 463 for Beijing Olympic Games.

464

465 Table 1 Classification of lawns in national standards in China⁹⁰

Standards	Department of Implementation	Classification	Time of implementation
-----------	------------------------------	----------------	------------------------

⁸⁸ Smith and Fellowes. ‘The grass-free lawn, p. 433-442.

⁸⁹ Chen. ‘*Planning Urban Nature*’, p. 93.

⁹⁰ The greening lawns referred to are lawns used for covering the ground, recreation or improving the ecological environment and are found in residential areas, university campuses, factories and government institutions; ornamental lawns refer to lawns created for aesthetic value; closed access lawns refer to lawns used for aesthetic value only and with visitors not allowed to use and step on the lawns, while open access lawns refer to lawns which are open to visitors and used for recreational purposes.

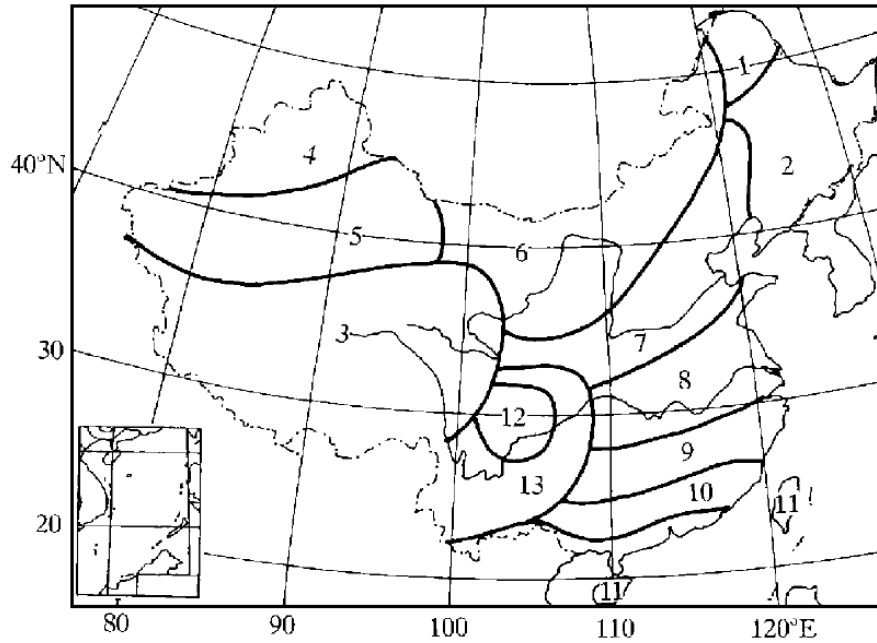
Product grade for major ornamental plants (GB/T 18247.7-2000)	State Forestry Administration of the People's Republic of China	1. Closed access lawns; 2. Open access lawns; 3. Roadside lawns; 4. Water & soil conservation lawns; 5. Airport runway lawns; 6. Football field turf.	2001-04-01
Grade of quality for turf (NY/T 634-2002)	Ministry of Agriculture	1. Greening lawns; 2. Water & soil conservation lawns; 3. Ornamental lawns; 4. Play lawns.	2003-03-01
Technical guidelines for urban lawn maintenance (GB/T 19535.2-2004)	General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ)	Urban lawns: 1. Closed access lawns; 2. Open access lawns	2004-09-15

466

467 Lawns in China are classified according to their usage (Table 1). For different types of lawns,
 468 different management intensities are applied according to the requirements and classified
 469 grading system. The increase in “play lawns” is probably due to the increase in golf courses in
 470 China. In 2009, the number of golf courses was 348, which was threefold more than in
 471 2000⁹¹.
 472 The grass species used in China also vary with climatic conditions. Yan et al. (1998)⁹²
 473 classified China into 13 climatic zones and suggested different grass species grown in
 474 different climatic zones (Figure 11, Table 2).

⁹¹ Shan Huajia, et al. Jin Shinian Zhongguo Caopingye Fazhan Xianzhuang [Recent Development of Turf Grass Industry in China]. *ACTA AGRESTIA SINICA* 21.2(2013): 222-229.

⁹² Yan Jiang et al, Zhongguo Caoping Qihou Quhua Tantaol [A study on lawn climatic regionalization in China]. *Journal of Nanjing Institute of Meteorology*. 21.3 (1998): 370-376.



475

476

Figure 11 Climatic regionalization for lawn in China (中国草坪气候区划探讨)

477

Table 2 Grasses species for lawns grown in classified climatic zones

Region	Climatic condition	Grass species grown
1 North of Northeast Region	The coldest region in China. Long winter, mild and short summer. Annual average temperature: -4.9-0.5℃, Annual precipitation 403-489 mm, Average lowest temperature in January: -37.3—31.6℃	Cold tolerant cold-season grasses: Kentucky bluegrass (<i>Poa pratensis</i>), rough bluegrass(<i>P. trivialis</i>), Canada bluegrass (<i>P. compressa</i> Linn), tall fescue (<i>Festuca elata</i>), red fescue(<i>F. rubra</i>)
2 Northeast Region	Cold winter, mild summer with high precipitation. Annual average temperature: 2.9-5.9℃, Annual precipitation: 411-889 mm, Average lowest temperature in January: -30.7- -12.6℃, Average highest temperature in July: 25.2-33.2℃	Cold-season grasses: Kentucky bluegrass (<i>P. pratensis</i>), rough bluegrass(<i>P. trivialis</i>), Canada bluegrass (<i>P. compressa</i> Linn), tall fescue (<i>F. elata</i>), red fescue(<i>F. rubra</i>), perennial ryegrass (<i>Lolium perenne</i>), creeping bentgrass(<i>Agrostis stolonifera</i>)
3 Tibet Plateau	Annual average temperature: 0.1-8.6℃, Annual precipitation: 76-761 mm, Average lowest temperature in January: -20.6- -7.9℃, Average highest temperature in July: 21.1-24.8℃.	Cold tolerant, drought resistant cold season grasses: Kentucky bluegrass (<i>P. pratensis</i>), tall fescue (<i>F. elata</i>), red fescue(<i>F. rubra</i>), perennial ryegrass (<i>L. perenne</i>)
4 Northern Sinkiang	Annual average temperature: 4.9-9.1℃; Annual precipitation: 181-492 mm, Average lowest temperature in January: -30.6- -12.6℃, Average highest temperature in July: 28.2-31.8℃	Drought tolerant grasses: Kentucky bluegrass (<i>P. pratensis</i>), red fescue(<i>F. rubra</i>), smooth bromegrass (<i>Bromus inermis</i>), tall fescue (<i>F. elata</i>), common couch (<i>Elytrigia repens</i>), perennial ryegrass (<i>L. perenne</i>)
5 Southern Sinkiang	Dry climate with barren soil. Annual average temperature: 8.2-13.9℃, Average highest temperature in July: 31.9-39.9℃, Annual precipitation: 16-62 mm	too dry, no lawns
6 Inner Mongolia	Mid-temperate climate with cold winter and warm summer. Annual average temperature: -0.6-9.5℃, Average lowest temperature in January: -30.5- -12.6℃, Average highest	Drought tolerant grasses: Canada bluegrass (<i>P. compressa</i> Linn), annual bluegrass(<i>P. annua</i>), red fescue(<i>F. rubra</i>), tall fescue (<i>F. elata</i>), crested

7 North China	temperature in July: 19.2-29.9□, Annual precipitation: 85-419 mm. Arid Spring and humid Summer, Annual average temperature: 9.0-14.2□, Average lowest temperature in January: -13.9- -4.7□, Average highest temperature in July: 28.6-32.4□, Annual precipitation: 550-685 mm.	wheatgrass(<i>Agropyron cristatum</i>) Both warm-season and cold-season grasses, mainly cold-season grasses: Kentucky bluegrass (<i>P. pratensis</i>), Canada bluegrass (<i>P. compressa</i> Linn), red fescue(<i>F. rubra</i>), creeping bentgrass(<i>A. stolonifera</i>), Japanese zoyiagrasses (<i>Zoysia japonica</i>), Chinese zoyiagrasses(<i>Z. sinica</i>)
8 Jianghuai Region (the area between Yangtze River and Huai River)	Annual average temperature:12.2-18.1□, Average lowest temperature in January: -4.7-4.0□, Average highest temperature in July: 26.9-34.1□, Annual precipitation: 773-1204 mm	Mainly warm-season grasses and some cold-season grasses: dog's tooth grass (<i>Cynodon dactylon</i>), centipede grass (<i>Eremochloa ophiuroides</i>), petting grass (<i>Z. Tenuifolia</i>), zoyiagrasses (<i>Z.sinica</i>), Kentucky bluegrass (<i>P. pratensis</i>), creeping bentgrass(<i>A. stolonifera</i>), water paspalum (<i>Paspalum thunbergii</i>)
9 Jiangnan Region	Annual average temperature: 16.2-19.3□, Average lowest temperature in January: 0.7-5.4□, Average highest temperature in July: 31.9-34.9□, Annual precipitation: 1300-1695 mm	Mainly warm-season grasses and some cold-season grasses: dog's tooth grass (<i>Cynodon dactylon</i>), centipede grass (<i>Eremochloa ophiuroides</i>), petting grass (<i>Z. Tenuifolia</i>), broadleaf carpetgrass(<i>Axonopus compressus</i>), lesser spear grass(<i>Chrysopogon aciculatus</i>), Kentucky bluegrass (<i>P. pratensis</i>), creeping bentgrass(<i>A. stolonifera</i>)
10 South China	Annual average temperature: 18.8-21.6□, Average lowest temperature in January: 4.9-9.6□, Average highest temperature in July: 33.0-35.5□.	Warm-season grasses: dog's tooth grass (<i>C. dactylon</i>), centipede grass (<i>Eremochloa ophiuroides</i>), petting grass (<i>Z. Tenuifolia</i>), broadleaf carpetgrass(<i>Axonopus compressus</i>), water paspalum (<i>P. thunbergii</i>), zoyiagrasses (<i>Z. sinica</i>), Manila grass(<i>Z.matrella</i>)
11 South China Coastal region	Annual average temperature: 21.3-24.7□, Annual precipitation: 1554-2044 mm, Average highest temperature in July: 31.6-33.9□	Warm-season grasses: dog's tooth grass (<i>C. dactylon</i>), Ramput dada lipan (<i>Stenotaphrum helferi</i>), zoyiagrass (<i>Z. japonica</i>), centipede grass (<i>E. ophiuroides</i>), broadleaf carpetgrass(<i>A. compressus</i>), kidney weed(<i>Dichondra repens</i>)
12 Sichuan Basin	High precipitation in summer and autumn. Annual average temperature: 16.2-17.6□, Average lowest temperature in January: 2.4-4.2□, Average highest temperature in July: 30.0-32.3□.	Warm-season grasses: dog's tooth grass (<i>C. dactylon</i>), centipede grass (<i>Eremochloa ophiuroides</i>), zoyiagrasses (<i>Z. sinica</i>); cold-season grasses: Kentucky bluegrass (<i>P. pratensis</i>), creeping bentgrass (<i>A. stolonifera</i>)
13 Yunnan-Guizhou Plateau	Mild winter and summer with high precipitation. Annual average temperature: 11.6-17.0□, Average lowest temperature in January: -2.3-3.6□, Average highest temperature in July: 24.0-30.3□, Annual precipitation: 738-1175 mm.	Both warm-season and cold-season grasses: dog's tooth grass (<i>C. dactylon</i>), Manila grass(<i>Z. matrella</i>), petting grass (<i>Z. Tenuifolia</i>), Centipede grass (<i>Eremochloa ophiuroides</i>), broadleaf carpetgrass(<i>A. compressus</i>), Kentucky bluegrass (<i>P. pratensis</i>), annual bluegrass(<i>P. annua</i>), colonial bent grass (<i>A. tenuis</i>)

479 In order to achieve “perfect” lawns, intensive management with advanced chemicals, tools
480 and techniques is applied in China, which is very costly and resource-consuming. Turf grass
481 seeds and lawnmowers, as well as irrigation facilities, are all imported from European
482 countries and North America. However, the climate conditions are not suitable for the growth
483 of these imported grass species. Moreover, mowing and irrigation equipment is very
484 expensive to import, which has made lawn even more expensive to maintain in China than in
485 European countries. For example, in Dalian city 5-10 million tons of water is needed to
486 irrigate the lawn every year. The brown loam soil in Dalian is not suitable for the growth of
487 turf grasses as it is very sticky and the soil fertility is poor, with low humus content. During
488 the growing season, peat soil has to be brought from Jilin and Heilongjiang Provinces (in
489 north-east China), which costs RMB¥100 (€13.33 EUR) per m³, to keep the grass height at 5-
490 6 cm. In addition, the lawn has to be mown every 5-6 days and the mowing costs overall are
491 RMB¥ 5000-6000 (€666.5-800). Because of the monoculture and unfavourable climate, turf
492 grasses are vulnerable to diseases and it takes much time and efforts to care for them. In total,
493 therefore, the cost of establishing a lawn is RMB¥ 8-20 (€1.1-2.7) per m² and the maintenance
494 costs are RMB¥ 6-8 (€0.8-1.1) per m².⁹³ Apart from these high costs, the intensive
495 management of lawns in China may cause serious environmental problems through pollution
496 from the chemicals used, greenhouse gas emissions during mowing and heavy water use for
497 irrigation. Besides, nearly half of these lawns are fenced and people are not allowed to step on
498 them. There are two reasons for this: (1) traditionally, green spaces or gardens in China were
499 fenced and used for ornamental purposes and for more than 2000 years only privileged groups
500 of people could use them. Thus visitors and lawn managers do not recognise the utility
501 function of lawns; (2) lawn managers are afraid that fully opening lawns to visitors would
502 cause extensive tramping, because of the large number of park visitors in China, which would

⁹³ Wang and Song. Dalian Chengshi Caoping Jingguan Goujian Jichu ji Youguan Wenti Tanta [Discussion on the City Lawnscape Construction and Problems in Dalian], p.11-13.

503 damage the lawn and influence its quality. According to an interview with a lawn manager of
504 Qujiang Heritage Park in Xi'an city, there can be up to 70,000-80,000 visitors to that park per
505 day. Some managers also claim that the imported seeds of grass species (95% of them are
506 imported) such as Kentucky bluegrass, perennial ryegrass and tall fescue are not suitable for
507 the local climate. Furthermore, these species are invasive and the seed mix may contain
508 pathogens from abroad. Seed breeding from native species in China needs to be improved^{94,95}.
509 In the absence of suitable domestic grasses, imports of seed increased from 200 tons in 1993
510 to 5000 tons in 2000 and are still increasing by 50 per cent every year⁹⁶.

511 At present, China is facing serious environmental problems. About 70 per cent of the surface
512 water and more than half the groundwater in urban area have been contaminated. Around 10
513 million hectares of farmland have been contaminated by heavy metals and farm chemicals and
514 hundreds of plant and animal species are under threat⁹⁷. It is not known how much of this has
515 been caused by the overuse of water and chemicals on lawns. In terms of the increasing area
516 of planted lawn in China, its negative effect on the urban environment cannot be neglected
517 and actions should be taken to solve problems relating to lawn use.

518 **3 New perspectives and attitudes regarding lawns**

519 With experts having recognised the drawbacks of manicured and monoculture lawns, some
520 new perspectives and attitudes on lawns have emerged in recent years.

521 In Europe, a monoculture of low-growing native herbaceous plants has been recommended as

⁹⁴ Zhang Jing, and Zhang Juming. Diyanghu Caoping Caozhong Yanjiu Jinzhan [Research Progress on low-Maintenance Turfgrass]. *Pratacultural Science* 27.7(2010): 35-40.

⁹⁵ Liu Jiawen. Dali Fazhan Zhongguo Caozhongye [Rapid Development of the Grass Seeds Career in China]. *Acta Agrestia Sinica*. 24.3(2016): 483-484.

⁹⁶ Gao Feixiang, et al. Woguo Dangdi Yesheng Caoping Dibei Zhiwu de Yanjiu Jinzhan [Research Progress on Native Wild Gound Cover Plants in China]. *Pratacultural Science*. 24.11(2007): 77-81.

⁹⁷ Saunders, William S., ed. *Designed Ecologies: the Landscape Architecture of KongJian Yu* (Berlin: Walter de Gruyter, 2013).

522 an alternative to grass lawns since the 1980s⁹⁸. Suitable herbaceous plants for this purpose are
523 yarrow (*Achillea millefolium*), self-heal (*Prunella vulgaris*) and clover (*Trifolium repens*).
524 Studies in Iran and US have indicated that the use of regionally adapted native grass species
525 as monocultures and polycultures is characterised by lower resource input and better visual
526 quality compared with non-native species^{99,100}.

527 Inspired by the concept of the medieval lawn, “enamelled mead” has been proposed¹⁰¹. The
528 idea of naturalistic herbaceous plantings (mixture of exotic and native) is a very popular
529 approach popularised by the Sheffield landscape architecture school. This English approach
530 was widely used at the London Olympic Park. The main goal of this new lawn alternative is
531 to provide visual colour satisfaction to visitors and to manage stormwater¹⁰².

532 Ecological management practices have been applied to the lawn in a public park named
533 Bulltoftaparken in the outskirts of Malmö, Sweden. Grazing animals have been used as a
534 replacement for lawnmowers since 2008. Such practices provide a wide range of ecosystem
535 services. For example, animal trampling and impacts on trees and shrubs create a large
536 variation in the pasture’s habitats compared with mechanical pruning. The animal manure also
537 works as a habitat and food for certain insects and provides educational benefits for people of
538 all ages and social groups to experience and learn more about natural processes. Such
539 “conservation grazing” can also be found in at least 10 cities in England (on peri-urban green
540 spaces) and provides many different values such as production, recreation and nature

⁹⁸ Smith and Fellowes. ‘Towards a lawn without grass’, p. 157-169.

⁹⁹ Simmons, M., Bertelsen, M., Windhager, S., & Zafian, H. (2011). The Performance of Native and Non-native Turfgrass Monocultures and Native Turfgrass Polycultures: An Ecological Approach to Sustainable Lawns. *Ecological Engineering*, 37(8), 1095-1103

¹⁰⁰ Pooya, Elham Saeedi, et al. ‘The use of native turf mixtures to approach sustainable lawn in urban landscapes’. *Urban forestry & urban greening* 12.4 (2013): 532-536.

¹⁰¹ Woudstra and James. ‘The Enamelled Mead’. p. 29-47.

¹⁰² Hitchmough J., Liu B., Hang Y. Applying an Ecological Approach to Extensive, Designed Herbaceous Vegetation in Urban Green Infrastructure. *Chinese Landscape Architecture* 3 (2013): 16-21.

541 conservation¹⁰³. However, the difficulty in managing grazing animals in densified urban areas
542 limits this practice to suburban or rural areas.

543 Grass-free lawns have been experimented on at Reading University in the UK, with the use of
544 85 types and forms of native and non-native species which created a “dynamic and
545 aesthetically diverse multi-species sward”¹⁰⁴. Plants included violets (*Viola* spp.), clovers
546 (*Trifolium* spp.), chamomile (a species in Asteraceae family), thyme (*Thymus* spp.), yarrow
547 (*Achillea millefolium*), self-heal (*Prunella vulgaris*) etc. The first grass-free lawn was
548 installed in Avondale Park in London in May 2013¹⁰⁵.

549 Ignatieva and Ahrné¹⁰⁶ advocate the use of biodiverse and less cut lawn with use of native
550 species as an alternative landscape design solution in Sweden. Meadows with short growing
551 native plants have been suggested by the companies VegTech and Pratensis for their
552 recreation merits, minimal maintenance needs and provision of wildlife habitats. These
553 companies create alternative meadows in different Swedish cities with high-quality Swedish
554 seed materials which are well adapted to Swedish conditions^{107,108}.

555 Recent changes in Chinese environmental policy have led to a significant growth in capital
556 investments in “building green”. For example, former President Hu Jintao coined the new
557 term “Ecological civilisation” in 2007. He argued that China “must pursue comprehensive,
558 balanced and sustainable development...and build a resource-conserving and environment-
559 friendly society...so that our people will live and work under sound ecological and
560 environmental conditions and our economy and society will develop in a sustainable way. He

¹⁰³ Sarlöv-Herlin, Ingrid, Johanna Deak and Anders Herlin. Betesdjur i Bulltoftaparken-så tycker besökare och närboende [Grazing animals in Bulltoftaparken-so think this is what visitors and local residents think about it]. *LTJ-fakultetens faktablad*, 24(2010):1-4.

¹⁰⁴ Smith and Fellowes. ‘Towards a lawn without grass’, p. 157-169.

¹⁰⁵ Smith and Fellowes. ‘The grass-free lawn’, p. 433-442.

¹⁰⁶ Ignatieva and Ahrné. ‘Biodiverse green infrastructure for the 21st century’, p. 1-9.

¹⁰⁷ www.vegtech.se/in-english/

¹⁰⁸ www.pratensis.se/

561 explained ecological civilisation was a choice for human society after agricultural civilization
562 and industrial civilization¹⁰⁹. In 2014, ecological civilisation is set alongside the political
563 slogan “China Dream” which is emerging as the signature of Xi Jinping’s leadership. It
564 invites its readers to “recognise the great value of lucid waters and green mountains” and to
565 “speed up the creation of a new environment for modernisation featuring harmonious
566 development between man and nature”¹¹⁰. In the context, several strategies have been
567 implemented to achieve the goals of ecological civilization. For example, the “Sponge City”
568 program was launched by Ministry of Housing and Urban and Rural Development and
569 Ministry of Finance at the end of 2014. In such city urban underground water system operates
570 like a sponge to absorb, store, leak and purify rainwater, and then release it for reuse when
571 necessary. This system will increase water resource flow efficiency in the city. Thirty pilot
572 cities were selected all over China. Guangzhao Li¹¹¹, as the manager of the sponge city
573 program in Tianjin, suggested using spontaneous herbaceous plants as urban sponges to
574 replace lawns. He emphasizes environment-friendly merits of their extensive management
575 practices and stresses their tolerance characteristics.

576 China has a rich resource of plants and a long tradition of using different low-growing native
577 plant species as ground cover. They vary from woody plants to herbaceous plants (perennial
578 and annual plants) and from deciduous to evergreen. Native ground cover species as lawn
579 substitutes are suggested by researchers because they need less management and can create
580 much more diverse landscapes¹¹². In different regions of China, ground cover species that are
581 suitable for the local conditions are selected and suggested by researchers. For example, under

¹⁰⁹ Sze, Julie. *Fantasy islands: Chinese dreams and ecological fears in an age of climate crisis* (Oakland: Univ of California Press, 2015).

¹¹⁰ Retrieved from <https://www.chinadialogue.net/article/show/single/en/8018-Interpreting-ecological-civilisation-part-one->

¹¹¹ Li Guangzhao. Jianshe Haimianchengshi Pojie Kanhai Zhikun [Constructing “Sponge city” and solve the problem of urban water logging]. *Binhai Daily*. 2016-01-05 (008)

¹¹² Gao et al. Woguo Dangdi Yesheng Caoping Dibe Zhiwu de Yanjiu Jinzhan [Research Progress on Native Wild Gound Cover Plants in China], p. 77-81.

582 the tree canopy in Xiuqiu Park in Nanjing City (East of China), shade-tolerant species such as
583 a species from the mint family (*Glechoma longituba*) and mock strawberry (*Duchesnea indica*)
584 are suggested as ground cover¹¹³. In Langfang city (northern China), a mixture of Chinese
585 violet cress (*Orychophragmus violaceus*) and daisy (*Dendranthema lavandulifolium*) has been
586 suggested as a substitute for turf grasses¹¹⁴. During the past five years, city gardeners in
587 Beijing have cultivated, selected and planted 16 native groundcover species including
588 Japanese false bindweed (*Calystegia hederacea*), Short-stem Sedge (*Carex breviculmis*) etc.
589 as substitutes for cold-season turf grasses used in Beijing. According to the city gardener's
590 plan, lawns in public parks will gradually be replaced with native ground cover and
591 embellished with flowering plants except for very important places where flat, clear surfaces
592 are needed. The planted area of native ground cover currently occupies 80 per cent of the
593 green area in 11 public parks in Beijing¹¹⁵.

594 Yu¹¹⁶ introduced a new environmental ethic within his “big foot” concept and encouraged
595 people to appreciate the beauty of wild herbaceous plants instead of lawns. He uses
596 agricultural crops and native species and covers most green spaces with wild herbaceous
597 plants. For example, in Qijiang Park, aquatic, wetland and xericherbaceous plants such as
598 cogon grass (*Imperata cylindrical*), Napier grass (*Pennisetum purpureum*) and sedges were
599 applied according to the site conditions, while in Houtan Park, a crop rotation of rice,
600 sunflower and rape was used as ground cover. Another of Yu's design “signatures” is the use
601 of combined rice fields and native vegetation to frame spaces for outdoor vegetation, e.g. at

¹¹³ Ru, Leiming. Nanjing Gongyuan Lyudi Dibeizhiwu Qunluo Diaocha yu Youhua Peizhi Yanjiu [Study on Plant Community and Optimal Disposition of Groundcover in Nanjing Park Green Space] (Master diss., Nanjing Agricultural University, 2008).

¹¹⁴ Liu Chunyan. Langfangshi Dibeizhiwu Yingyong Xianzhuang ji Fazhan Duice [Application Status and Developmental Countermeasures of Groundcover in Langfang city]. *Journal of Fujian Forestry Sci and Tech.* 36.1(2009): 243-246.

¹¹⁵ Bin, W. Benshi tui 16 Zhong Yecao tidai Rengong Caoping [Sixteen Species of Wild Herbs are Recommended to Replace the Conventional Lawn in Beijing]. *Beijing Youth Daily* (2015), Retrieved from www.ynet.com

¹¹⁶ Yu, Kongjian. The big feet aesthetic and the art of survival. *Architectural Design* 82.6 (2012): 72-77.

602 Shenyang Architectural University Campus¹¹⁷.

603 **4. Discussion and Conclusions**

604 The vision of lawns in the twentieth and early twenty-first century was a monoculture of low
605 and frequently cut grassed areas. However, in both China and Europe lawns have not always
606 been made using grasses. The word “草坪”, which is used today for describing lawns, was not
607 used in the Chinese language until the 1960s.

608 In classical Chinese gardens there were never monocultures and large-scale grassy surfaces.
609 The modern lawns in China, together with their technology for establishment and
610 management, were directly adopted from European countries through the colonial culture and
611 in the more recent trend for globalisation. In ancient times, flowering meadows were
612 established in certain royal gardens in China by transplanting wild flowering herbs from the
613 nearest meadows. The management of these transplanted meadows required great effort
614 because of time-consuming tasks (cutting and watering) and lack of practical knowledge of
615 keeping new plants in good shape. The plant composition of these ancient meadows was quite
616 dependent on existing surrounding natural landscapes. Steppe vegetation and pasture-like
617 landscape were only appreciated by certain emperors because of their personal interests and
618 relationships with natural pastures from their special experiences and background (nomadic
619 tribes).

620 In both China and Europe, lawns have changed from being an interesting and relatively small-
621 scale area, which from the beginning was very rich in biodiversity, into a large-scale
622 monoculture that requires intensive management. The economic and political stability of
623 recent times has promoted the popularity of sports such as outdoor bowling and golf and their

¹¹⁷ Sullivan and Boult. *Illustrated History of Landscape Design*, p. 237.

624 special requirements on playing surfaces, which has pushed the development of monocultures
625 and short-cut grassy surfaces. Besides, the change in the appearance of lawns is corresponding
626 to the change in the relationship between human and environment. Specifically, the
627 relationship has changed from the essential harmony between humans and environment in
628 agricultural or pre-modern civilisation to the conquest of modernism over the environment¹¹⁸.
629 People's control or conquest idea over their environment is reflected by intensive
630 management practices they imposed on lawns to keep them tidy and in order.

631 When searching for alternatives to turf lawns in China, it is crucial to trace back to the
632 concepts and means of arrangement of ground cover species in classical Chinese gardens.
633 Ground cover species were used there according to their ecological characteristics and their
634 suitability for the site conditions, which ensured the diversity of ground cover layers; in the
635 classic Chinese garden every species has its symbolic meaning and function according to
636 careful philosophical concepts, which makes the visits more interesting and culturally
637 acceptable. Moreover, the native species are used due to the limitation of communication and
638 transportation. This is respected because their maintenance is resource-saving and
639 environmentally friendly; their natural beauty is appreciated, which owes to the philosophy of
640 respect for nature in Daoism.

641 Although some alternative lawns have been proposed, a large proportion of green space is still
642 covered by "perfect" lawns. One of the reasons is probably the gap between the researchers
643 and practitioners and misunderstanding or superficial understanding of "green spaces" of the
644 decision makers. The decision makers' unaware of exiting proposals or a lack of concrete and
645 practical solutions adjusting to the local climate and culture limits the application of those
646 proposals. Besides, by simply bedding out green lawns, the city gardeners can quickly and

¹¹⁸ Bao. *Environmental history in China*, p. 475-499.

647 efficiently fulfil the requirement of building “green” goals in the city green system planning.
648 Further study is needed to investigate the stakeholders’ perception on lawns and bridge the
649 knowledge gap between the researchers and practitioners. Another reason is the public
650 demand and preferences (both decision makers and green spaces visitors). The challenge is to
651 shift people’s preferences from idealised lawn aesthetics to ecological aesthetics, so that urban
652 landscapes can be revolutionised¹¹⁹. The public has not recognized the adverse effects of the
653 manicured turf lawns brought to the local environment and their daily life. In China, some
654 influential projects such as Kongjian Yu’s projects may gradually change the public
655 perceptions on lawn aesthetics by letting them experience another type of landscape.
656 Educational programmes might be helpful by infusing ecological science into public policies,
657 the public’s aesthetic sensibilities and the development of new technologies for the lawn care
658 industry. By highlighting the need for a paradigm shift and suggesting new ways of designing
659 and managing lawns, people’s paradigm will be gradually shifted by them seeing,
660 experiencing and interpreting the new type of landscapes. Another challenge is to select
661 appropriate native plant species for establishment of alternative lawns due to the millennia-
662 long history of the transformation of landscapes in China and the consequent extinction of
663 certain native plant species and invasion of exotic species.

664

665 The Chinese environmental policy “Ecological Civilisation” is a new civilisation towards
666 ecocentrism. In the progress to sustainable development, the relationship between human and
667 environment in China will gradually change from placing the humans at its centre to
668 emphasizing a variety of creatures and their harmony with environment. In this context, the
669 timing is currently right to develop sustainable lawns in China. In Europe, from the 1990s
670 there have been some pilot projects proposing alternative lawns and China has been following

¹¹⁹ Byrne. ‘Of looks, Laws and Lawns’, p. 42-46.

671 the trend since the 2000s. However, whether these European examples can be applied in a
672 Chinese context is still uncertain. For example, in some public parks of Xi'an city, clover
673 lawns and man-made meadows were initially applied as a substitute for turf lawns but later
674 abandoned, because the white clover (*Trifolium repens*) and some species in the Compositae
675 such as oxeye daisy (*Leucanthemum vulgare*) and Lance-leaved coreopsis (*Coreopsis*
676 *lanceolata*) have been listed as serious invasive plants in China¹²⁰. Before proposing and
677 implementing practical solutions to turf lawns in China, it is necessary to thoroughly
678 investigate the phenomenon of lawns in China by tracing their history and understanding
679 people's perceptions of the current type of lawn and how it fits into the local environment in
680 specific case study cities. The in-depth analysis of Chinese history and development of lawns
681 in the present paper improved our understanding of lawns as a new phenomenon in China and
682 the driving force of its fast development. It also shed light on the search for sustainable lawns
683 which are culturally acceptable for both decision makers and green space visitors in China,
684 drawing on the advantages of ground cover use in classic Chinese gardens and modern
685 European and Chinese examples.
686

¹²⁰ Wang Ning et al. Zhongguo Ruqin Kelong Zhiwu Ruqinxing, Kelongfangshi ji Diliqiyuan [Invasiveness, Clonal form and Geographical Origin of Invasive Clonal Plant Species in China]. *Biodiversity Science*. 24.1(2016): 12-19.