

RESEARCH NOTES

**A Mapping and Geographical Analysis of Japanese Gardens in the Kyoto Basin**

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This study analyzes the location of 164 renowned Japanese gardens in the Kyoto basin, that is the Kamogawa alluvial fan and the Katsuragawa flood plain. The gardens were mapped using Geographic Information System (GIS) technology. The mapped data indicate that physiographic environments constrain the location of the gardens. Rock gardens (*karesansui* type gardens) are located across the whole area of the alluvial fan, while water gardens (*chisen* type gardens) are concentrated along the piedmont spring zones and the artificial canals of the irrigation system known as the Biwako sosui (constructed in 1890). In brief, hydrological conditions affect the location of Japanese gardens, which is primarily constrained by surface geomorphic units.

**Keywords:** JAPANESE GARDENS, KYOTO BASIN, *BIWAKO SOSUI*, GEOGRAPHIC INFORMATION SYSTEM

**1. Introduction**

The Kyoto basin has developed garden cultures since the Heian period (794–1192). Japanese gardens reflect not only various natural environments but shifting cultural backgrounds. Heretofore garden landscapes and their environmental conditions have mainly been discussed from the viewpoint of landscape architecture. In the Kyoto basin, Mori Osamu 森蘊 considered geological factors controlling the distribution of gardens in the *shinden* style (*shinden zukuri* 寝殿造), established during the Heian era.<sup>1</sup> Shinozawa Kenta 篠沢健太 has stressed the significance of landform on garden landscapes.<sup>2</sup> Kamiyama Fumiko 上山文子 and Iizuka Hideo 飯塚英雄 also analyzed the relationships between garden style and surrounding

landforms, focusing especially on the idea of “borrowed landscape” (*shakkei* 借景).<sup>3</sup>

Several other studies have focused on the influence of surface water on garden landscapes. Asano Jirō 浅野二郎 et al. have examined waterscapes affected by surrounding landforms.<sup>4</sup> Maeda Hideki 前田英紀 et al. have indicated that the forms and the areas of garden ponds periodically changed from the Heian to the Azuchi Momoyama eras.<sup>5</sup> In modern gardening, Amasaki Hiromasa 尼崎博正 has emphasized the significance of canal systems such as the Biwako lake irrigation system (Biwako sosui 琵琶湖疏水) established in 1890.<sup>6</sup> Hidaka Eiji 日高英二 et al. have used landform analyses to classify pond style gardens, known as *chisen shiki teien* (池泉式庭園), into plain and slope localities. The suggestion is that the former are located in water rich conditions, whereas the latter are situated in piedmont slopes.<sup>7</sup>

These earlier studies, however, have omitted from consideration the dry landscape rock gardens known as *karesansui* 枯山水. In addition, detailed geomorphic units have rarely been analyzed in landscape architecture. Garden landscapes consist of surface water, rocks, sands, vegetation and artificial structures. These landscape elements rely on various physiographic factors. Waterscapes are especially affected by their physiographic setting. Surface water often composes the landscape of Japanese pond style gardens, which must be related with the hydrological environment at the garden site. For instance, piedmont water rich conditions enhance water use in a hydrological recharge area, while fluvial terraces, alluvial fans and flood plains (by which is meant natural levees and back marshes) may prevent construction of Japanese pond gardens.

This study firstly extracted 164 gardens from existing topographic maps of the Kyoto

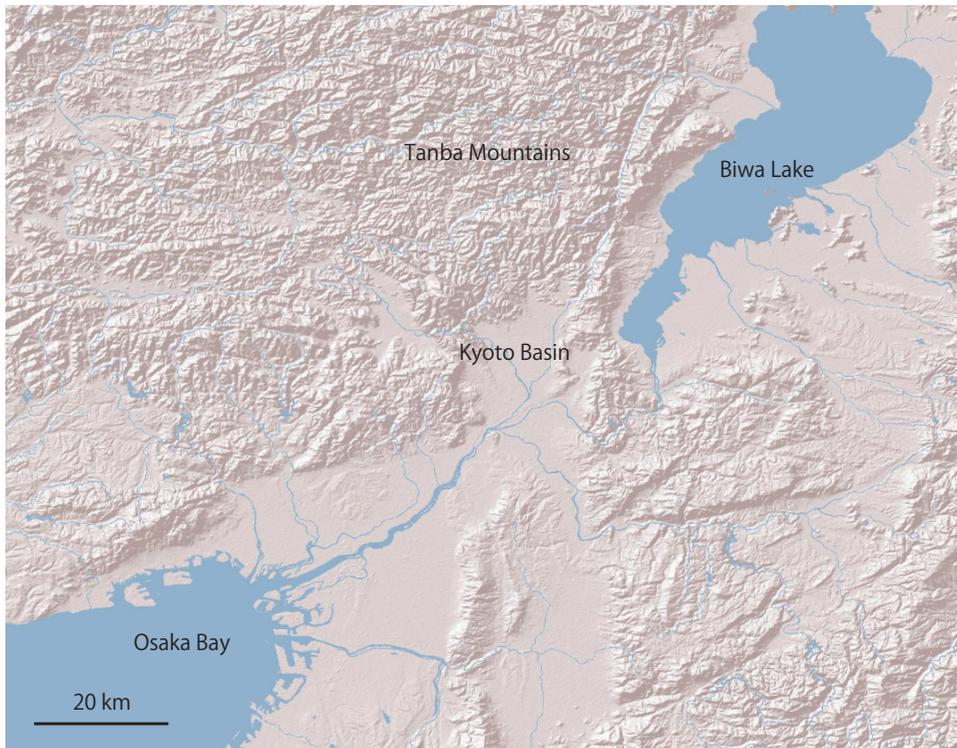


Figure 1: Location of the Kyoto basin.

basin. Secondly, the gardens were mapped with the Geographic Information System (GIS), and classified according to surface geomorphic units. The mapping and physiographic analyses allow a detailed discussion of the relation between gardens and natural environments in the Kyoto basin, the most representative garden area in Japan.

## 2. Study Area

The Kyoto basin is surrounded by low altitude mountains and hills, such as Mts. Hiei 比叡山 (848 m), Kurama 鞍馬山 (584 m) and Atago 愛宕山 (924 m), which offer scenic spots that are “borrowed” by the gardens located in the basin floor to create the *shakkei* effect. This basin presents various physiographic conditions, and is composed of four fluvial catchments, the Rivers Katsura 桂川, Kamo 賀茂川／鴨川, Uji 宇治川 and Kizu 木津川, located in the Kinki 近畿 district of western Japan (Figure 1 and 2). This study divides the basin into a northern and southern part (catchments of the Katsura and Kamo rivers and the Uji and Kizu rivers respectively). The northern part of this basin is accommodated mostly within the area of the present Kyoto city, and consists mainly of a coalescing alluvial fan (hereafter, the Kamogawa alluvial fan) and a flood plain (hereafter the Katsuragawa flood plain) (Figure 2). The Kamogawa alluvial fan lies on relatively large particles of sand and gravel, whereas the Katsuragawa flood plain consists of natural levees and back marshes formed by course deposits. The ancient state’s capital of Heian had mainly developed on the Kamogawa alluvial fan, which produced rich groundwater resources in Holocene fluvial deposits. The present study defines the basin floor as comprising the Kamogawa alluvial fan, the Katsuragawa flood plain and

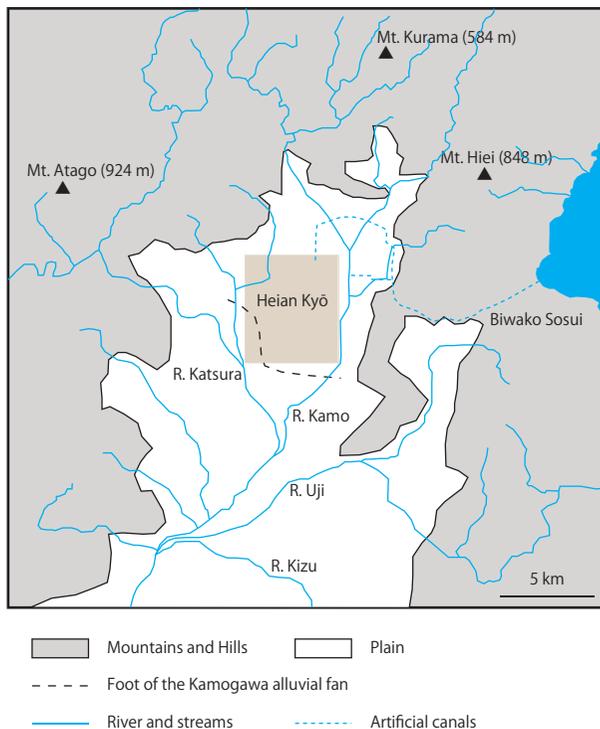


Figure 2: Landform and drainage pattern around the Kyoto basin.

surrounding fluvial terraces and valleys, divided by the feet of mountains and hills.

Modern Kyoto has its origins in the Heian period (794–1192), when many Japanese gardens were established in the several houses of the nobility in the Kyoto basin. In the following Kamakura era, Zen 禅 and Jōdo 浄土 sect temples developed Buddhist style gardens. During the Edo era, the advance of civil engineering boosted the construction of large scale gardens, and then the Meiji era saw Western culture exert an influence upon Japanese garden design. The modern Biwako irrigation system especially contributed to the construction of many gardens with surface water. Irrigation canals were excavated from Lake Biwa into the Kyoto basin, which brought rich water to the eastern part of the area under consideration here.

### 3. Methods

This study identified 164 Japanese gardens located in the northern part of the Kyoto basin, using for reference the following studies: *Kyōto no teien* 京都の庭園, *Nihon teien shi taikai* 日本庭園史大系, and *Nihon teien kanshō binran* 日本庭園鑑賞便覧.<sup>8</sup> *Kyōto no teien* was compiled by Kyoto City to advertise the gardens in the city, which described the location of ninety four gardens and introduced the landscape styles of fifty famous gardens. *Nihon teien shi taikai* was published as a multi volume study of Japanese garden history by Shigemori Mirei 重森三玲 (1896–1975), a well known landscape gardener. This series of books, which consists of thirty five volumes, also listed the location of 357 gardens in Japan. *Nihon teien kanshō binran* compiled by Kyōto Rinsen Kyōkai 京都林泉協会 added much new information to that of *Kyōto no teien* and *Nihon teien shi taikai*.

The locations of the gardens were determined on the 1:25,000 topographic maps “Kyōto tōhoku bu,” “Kyōto tōnan bu,” “Kyōto seihoku bu” and “Kyoto seinan bu,” as published by Kokudo Chiri in 国土地理院 (Geographical Survey Institute of Japan). In this study, the center of each garden was defined as a representative locality where the quantitative geographic information (altitude, latitude and longitude) was measured on the topographic maps. In addition, historical and cultural information on the time of establishment, the gardener and the garden type was extracted from *Kyōto no teien* and *Nihon teien kanshō binran*.

The gardens were classified into “water gardens” and “(dry landscape) rock gardens,” based on the presence or absence of surface water such as ponds, rivers and waterfalls. The two garden types accord with the *chisen* type and *karesansui* type gardens of traditional classification, respectively. The garden types were identified using the afore mentioned topographic maps as well as the *Rāji mappu: Kōseisai kūchū shashin WebGIS* ラージマップ：高精細空中写真 WebGIS published by the International Research Center for Japanese Studies.<sup>9</sup> These geographical, historical and cultural data were converted and mapped using the GIS application ESRI ArcGIS, ver. 9.2.

### 4. Historical aspects

Chart 1 tabulates the number of gardens established in each historical period: Heian, Kamakura, Muromachi, Momoyama, Edo (early, middle and late), Meiji, Taishō and Shōwa. (One garden established before the Heian era is omitted.) It shows two peaks in garden establishment: the first between Momoyama and Edo, and the second between the Meiji and Shōwa eras. The former seems to be a result of cultural developments promoted by Kobori Enshū 小堀遠州 (1579–1647) and Emperor Go Mizunoo 後水尾 (1596–1680). The latter is further classified into two “sub peaks.”

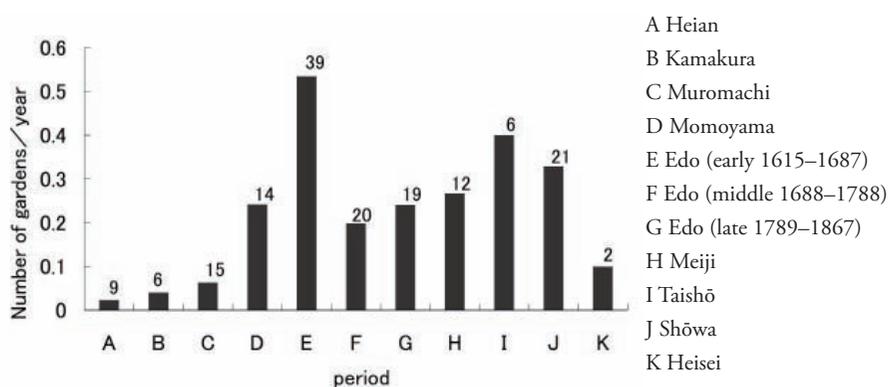


Chart 1: Number of established gardens per historical period.

The first sub peak occurred during the Meiji and Taishō eras with the establishment of the Biwa irrigation canal in 1890. This canal helped to produce many new gardens along its stream. Ogawa Jihei 小川治平衛 (1860–1933) was especially responsible for producing many water gardens in the vicinity of Keage 蹴上, located at the foot of the Higashiyama 東山 hills. His gardens are characterized by water rich landscapes that make use of the Biwa irrigation canal. The second sub peak occurred in the Shōwa era when many rock gardens were established in Zen temples. The afore mentioned Shigemori Mirei is especially noted for his establishment of nine rock gardens in this period.

## 5. Mapping

Figure 3 shows the distribution of water and rock gardens in four historical periods. The four maps suggest between them the influence that geographical and historical aspects have exerted on garden establishment in the Kyoto basin from ancient times to the present day. Forty five gardens have been mapped, of which twenty are water gardens and twenty five are rock gardens. Figure 3A maps the period from Heian through to the Momoyama era (8<sup>th</sup> to 16<sup>th</sup> centuries). In the Heian and Kamakura eras, thirteen water gardens were constructed in the *shinden* style, which favors water landscapes. In the Muromachi and Momoyama eras, twenty two rock gardens were constructed in Zen temples.

For the Edo era (1600–1867), seventy eight gardens have been mapped, of which thirty five are water gardens and forty three are rock gardens (Figure 3B). Their distribution clearly indicates physiographic controls. Figure 3B shows twenty three water gardens situated along the foot of the Higashiyama hills, located in the eastern edge of the Kyoto basin, where geological and hydrological conditions produce a water rich spring zone. This natural environment and its spring water assisted the establishment of many water gardens. The other water gardens are mainly established in the several houses of the nobility where surface water and shallow groundwater presented water rich landscapes. For instance, several water gardens in the Kyoto Imperial Palace are situated at a local spring zone in the alluvial fan surface. In contrast, many rock gardens were established in Zen temples, located in the center of the Kamogawa alluvial fan, which lacked both surface water and shallow groundwater. Such distribution indicates the striking significance of hydrological environments.

For the Meiji to Taishō eras (1867–1925), eighteen gardens have been mapped, of which

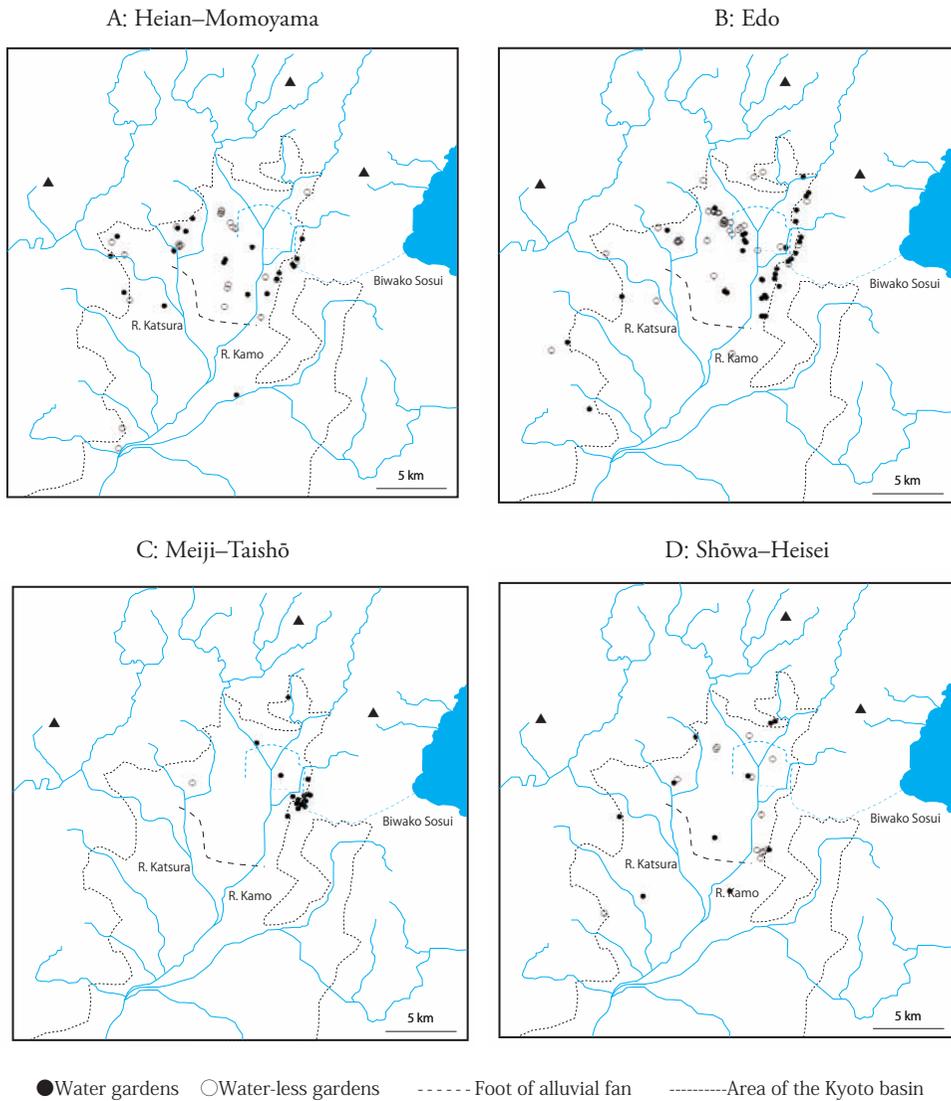


Figure 3: Locations of Kyoto gardens.

seventeen are water gardens and one is rock gardens. Figure 3C highlights the geographical concentration of water gardens along the Biwa irrigation canal. This canal, flowing to thirteen water gardens around Keage, contributed to the development of garden cultures with artificial ponds, flows and falls. The gardens established in this period were evidently determined by artificially hydrological environments. For the Shōwa era (1925–) (Figure 3D), twenty three gardens have been listed and mapped; they include ten water gardens and thirteen rock gardens. This period is characterized by a new boom in rock gardens, which were mainly established in Zen temples.

## 6. Physiographic Environments

**Table 1: Number of the two type gardens in each geomorphic unit.**

Landforms	Heian – Momoyama		Edo		Meiji – Taishō		Shōwa – Heisei	
	water	rock	water	rock	water	rock	water	rock
fluvial terrace	4	9	6	10	1	0	3	2
valley	1	2	0	3	0	0	0	1
alluvial fan	11	11	18	24	0	12	2	7
flood plain	2	1	2	2	0	4	4	0
piedmont line	2	1	9	4	0	1	1	3

Mapped data suggests the significance of hydrological factors in controlling garden distribution. Among the water gardens cited in Table 1, forty five gardens (55%) are located at the foot of the Higashiyama hills. Seven, twenty three, fourteen and one gardens respectively were established in the Heian to Momoyama, the Edo, the Meiji to Taishō and the Shōwa to Heisei eras. Thirty gardens established before Edo rely on natural springs, while thirteen gardens established after Meiji used the Biwako irrigation canal. In contrast, the rock gardens in Table 1 are located throughout the entire area of the Kyoto basin including the center of the Kamogawa alluvial fan where the water flows in relatively deep ground and the surface remains dry. Naturally those rock gardens established in Zen temples do not depend on hydrological conditions. Such conditions reflect surface geomorphic units, and Table 1 shows the distribution of gardens by geomorphic unit. 52% of water gardens and 51% of rock gardens are located on the alluvial fan surface.

In the Katsuragawa flood plain, the meandering river supplies course fluvial deposits, which form many marshes. Along the foot of the Higashiyama hills, the piedmont line forms rich spring zones derived from hydrological recharge processes. In the Kamogawa alluvial fan, its top and foot produce a water rich condition with springs and shallow groundwater, whereas its center tends to relatively dry conditions resulting from deep groundwater. Therefore, in the natural environments water gardens favor the top and the foot of the Kamogawa alluvial fan and the foot of the Higashiyama hills, while rock gardens are suitable for the whole range of surfaces excluding the Katsuragawa flood plain.

## 7. Conclusions

This study isolated eighty two water gardens and eighty two rock gardens, and mapped them using a GIS application. The mapped data demonstrates that many Japanese gardens are located across an extensive geographical area on the Kamogawa alluvial fan, where the ancient capital was developed based on rich groundwater resources. Garden types, however, are typically constrained by hydrological conditions deriving from surface micro reliefs and their physiographic settings. The results of this study constitute evidence that the location and type of Japanese gardens are primarily constrained by geomorphic environments.

**Acknowledgement:** This study was supported by the Grant-in-Aid for Scientific Research (2007–2010, Grant No. 19200019; leader: S. Yamada).

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#### 要旨

#### 京都盆地に分布する日本庭園の地図化と地理的条件

尾方隆幸、李 偉、山田奨治

京都盆地に現存する164の日本庭園のリストを作成し、GISを用いて地図化した。造園技術が発達した江戸時代には大規模な庭園が数多く築造されたが、この時代に築造された枯山水庭園が扇状地面に広く分布しているのに対し、池泉庭園は湧水の見られる東山丘陵の山麓に集中している。明治～大正時代に築造された庭園のほとんどは1890年に完成した琵琶湖疏水沿いに位置しており、池・流れ・滝などの水景が巧みに取り入れられている。京都盆地に分布する庭園は、自然的にも人為的にも水文条件の影響を強く受けているが、その水文条件を決定する要因としては地形単位が重要である。