Enhancing Urban Resilience After the 1995 Kobe Earthquake

Parks and Open Spaces as a Multi-Functional Resource

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Changing ecological and socio-economic circumstances ranging from global warming, economic decline or shifts in social compositions can pose risks to the viability and livability of the built environment. Urban Resilience describes the ability of a city's social and physical elements to withstand and recover from such disturbances (Meerow et al. 2016: 39). It is critically important in the face of the diverse risks posed by natural disasters. In cases like the Kobe earthquake of 1995, resilience in the sense of a return to normalcy, was only possible after an extended period of extreme social-spatial dislocation. In order to better understand this process of recovery and rebuilding, this chapter argues that space is one important, but little studied, resource for the creation of urban resilience. This study elaborates on the work of Carlow (2016), which treats space as a valuable resource for sustainable development. Carlow argues that space, like other natural resources, needs to be consciously planned for in urban development and needs to be shared equally between current and future generations (Carlow 2016: 153-157). The present study suggests that space plays a similarly crucial role as a resource in urban resilience. Space is, by its very nature, decentralized, and multifunctional. It is a latent resource that can be activated for different purposes. Space, in this analysis, is understood in its morphological sense as a three-dimensional entity which is bound to land and includes characteristic physical qualities such as topography, vegetation, and built structures. In this perspective, space should be viewed as a resource that is similar to building material, financing, and labor. In order to explore the significance of space as a resource, this study examines the case of Kobe's recovery from the Great Hanshin Earthquake in 1995, where the disaster impact was exceptionally high and available space was strictly limited by the surrounding topography.

This chapter specifically focuses on the way that parks and open spaces can contribute to urban resilience in the wake of natural disaster. It suggests that these spaces ought to be protected not just for their high value for urban life in normal times, but also because their intrinsic qualities can significantly enhance urban re-

silience in post-catastrophic scenarios. Parks and open spaces can mitigate disaster impacts and contribute to a wide spectrum of recovery tasks through their multifunctionality, their dispersal across cities, and their high integration into urban daily life. To be clear, space does not in itself create urban resilience. Rather, it is one of the resources that can be activated to mitigate the challenges – and enhance the efficiency of – emergency relief, recovery, and rebuilding.

Methodology

This case study uses a broad range of material such as reports, census data, and research conducted to a large part by the city of Kobe and Hyogo Prefecture. The current analysis builds on the theory of resourcing for recovery developed by Chang et al. (2010) and focuses on early and intermediate tasks in disaster recovery – tasks which correspond to the emergency and restoration recovery cycle phases described by Kates and Pijawka (1977: 1-2). According to Chang et al. (2010: 65-83), "resourcing" refers to the acquisition and activation of resources in order to fulfill key tasks in disaster recovery including sheltering, establishing support bases, and reconstructing the built environment. The problems in disaster recovery are often caused by resource shortages or bottlenecks in the resourcing process - shortages that are determined, in large part, by the scale of the disaster impact and attendant demand for relief and recovery services (Chang et al. 2010: 67). Chang et al. conclude that pre-disaster resourcing strategies and resource availability are decisive for recovery. They further argue that cooperation between stakeholders to make better use of existing resources – or to identify alternatives – are essential elements of disaster recovery (Chang et al. 2010: 77-78). Building on Chang et al.'s findings (2010: 73-76), the present study analyzes space as a resource in four distinct ways:

- Identifying the characteristics of different types of spaces and determining their suitability for discrete recovery tasks.
- Determining the accessibility of space, which is crucial for victims and supporting actors who are involved in tasks like sheltering, debris removal, and essential construction work.
- Understanding the legal frameworks that regulate the acquisition and use of space through legislation and policy.
- Analyzing the exchange of user rights and properties, which might impact recovery timelines.

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Kobe's Recovery from the Great Hanshin-Awaji Earthquake 1995

The city of Kobe, as part of Hyogo Prefecture, is located southwest of Osaka on Honshu, Japan's main island. Kobe is flanked to the south by Osaka Bay and to the north by the Rokko Mountains. This topography naturally limits the expansion of the city and contains the central urban area in a band between the sea and mountains that is roughly 2 to 4 km wide and 30 km long (Umesao et al. 1999: 78).

The earthquake struck Kobe on January 17, 1995 at 5:46 in the morning with a magnitude of 7.3 (City of Kobe 2014a: 1), originating from the epicenter near Awaji Island 30 km southwest of central Kobe. The most severe damage was caused on a small strip of land measuring roughly 5 by 20 km in the central city (EQE 1995: 1). The damage inflicted by the disaster was exceptional and constituted the most severe catastrophe in Japan since the 1923 Great Kanto Earthquake in Tokyo (City of Kobe 2000: 10). Damage to the inner city was caused both by the impact of the earthquake and by fires. To this day, unprotected gas storage tanks and heaters in urban areas that are densely built with wooden buildings pose a major fire risk in many Japanese cities (EQE 1995: 73). In total, 15 per cent of Kobe's houses were destroyed (City of Kobe 2010: 34) and traffic infrastructure, public facilities, and economic functionality were badly damaged (City of Kobe 2000: 10). The earthquake and the fires resulted in 4571 fatalities (City of Kobe 2014a: 4) and 230.000 people were forced to find accommodation in shelters (City of Kobe 1995: 212).

After the disaster, a diverse set of recovery tasks had to be accomplished. They included repairing the heavily damaged traffic and lifeline infrastructure, caring for the victims' mental health, providing emergency relief and shelter, and reconstructing housing (Yamori 1997: 119). However, a lack of funding hampered reconstruction, welfare provision, and the remediation of existing vulnerabilities in some parts of the damaged areas. Instead, recovery efforts were concentrated on prioritized public reconstruction areas (cf. City of Kobe 2011; City of Kobe 2014b). As a result, some of the most impacted areas lacked the resources necessary for adequate and timely reconstruction.

The Intrinsic Qualities of Open Space for Resilience: The Case of Evacuation Shelters

Parks and open spaces possess intrinsic qualities that can greatly mitigate disaster impacts, and that can be used to support a broad variety of recovery tasks. Planners and other stakeholders clearly recognize the value of green space as an urban amenity. However, the following case of emergency sheltering for disaster victims shows that open spaces need also to be recognized for their value as a flexible and spatially accessible resource for urban disaster resilience. They should be seen as

multifunctional resources that fulfill disaster recovery needs that dedicated shelters – purpose-built, spatially fixed, and limited in supply – are sometimes unable to do.

Immediately after the earthquake, many of Kobe's citizens escaped their destroyed or collapsing homes in order to seek refuge. On January 26, the number of evacuees had grown to about 230.000 citizens (City of Kobe 1995: 212) sheltering in 599 evacuation sites throughout the city (City of Kobe 2000: 10). Formally, the disaster prevention plan of Kobe indicated 364 evacuation sites comprised of public facilities and city owned schools. However, some of the designated evacuation sites were themselves damaged or destroyed. Most of the intact sites quickly became overcrowded, and others were inaccessible due to road blockages. The limited capacity of designated spaces for sheltering forced evacuees to use alternative spaces. This included public facilities like schools and assembly halls, as well as parks and open spaces (City of Kobe 1995: 212).

Designated shelters were designed as temporary facilities and did not have the sanitary facilities, electricity, or privacy to function as a long-term shelter for such a great number of users. Until 1995, evacuation sites in Japan were designed primarily to meet immediate survival needs, as can be seen from the fact that emergency shelters were provisioned with food and blankets adequate just for one or two days (Yamori 1997: 119-120). However, in the case of the 1995 earthquake, many evacuees were forced to live in shelters until water, electricity and infrastructure lifelines had been restored, transitional housing built, and homes restored or rebuilt (Horikiri/Odani 2000: 842-825). This resulted in an average accommodation time in shelters of 8.5 months (ibid: 25), making long-term recovery support necessary (Yamori 1997: 119-120).

The adequacy of shelters is, to some extent, a subjective matter that depends on the needs of users – in particular, their individual vulnerabilities and the duration of their displacement. Elderly people proved to be particularly vulnerable to the impact of the disaster, since they were typically less mobile and less equipped to rebuild their homes. Consequently, elderly people made up a large part of the long-term shelter inhabitants (Horikiri/Odani 2000: 821). They were also more impacted by the deficient sanitary facilities and insufficient heating of designated shelters. For the elderly and other vulnerable populations, upgrading of emergency facilities was vital in making their long-term use bearable. Ongoing spatial improvements of designated shelters included measures against the cold (e.g., the provision of stoves and insulated mats); the improvement of electric capacity of schools to meet the requirements of a high number of washing machines and fridges; and upgrading of inadequate sanitary facilities in schools through the installation of additional capacity. The lack of privacy in the crowded shelters was another major concern for many residents. Due to a lack of resources, this hardship could only be addressed at a very basic level, for example, by distributing cardboard room dividers to shel-

ters in schools (City of Kobe 1995: 213-214). Neither the capacity nor the design of designated evacuation sites was appropriate for use as mid to long-term shelter.

Designated shelters in the vicinity of residential areas could not accommodate all nearby evacuees and often proved difficult to access due to blocked roads and disrupted traffic infrastructure (City of Kobe 1995: 212). Faced with the spatial and material design failures of designated facilities, evacuees used a variety of alternative spaces. The 364 designated shelters were thus complemented by another 235 sites, many of them improvised by evacuees in parks and other open spaces. (City of Kobe 1995: 224). Because Kobe's parks and open spaces are spread throughout the city, they were easily accessible to residents of impacted areas, typically within ten minutes walking distance of victim's residences (Horikiri/Odani 2000: 823). Compared to designated shelters, these spaces offered a wider spread of locations in closer proximity to residential areas. Because of their distribution across cities, parks and open spaces are particularly well suited for evacuation sites and shelters.[1] The high number of evacuees in parks can also be linked to their proximity to public institutions such as schools, temples, churches, or ward offices (Ikeguchi 1995: 107). All of these sites are well-known to local residents, and typically offer basic sanitary and infrastructural capacity like bathrooms and running water. This again highlights a beneficial quality of parks and open spaces for emergency: their visibility in normal urban life is another feature which recommends their deployment during and after emergencies. Because local residents can easily plot their course to nearby parks and other well-known open spaces, they do not need emergency managers to direct them to evacuation or emergency sheltering sites.

The right to use these spaces for the purposes of emergency sheltering and support services was already well regulated through the disaster prevention plan mentioned earlier. The establishment of shelters also did not require any trade of user rights or land ownership, as most of these spaces were already publicly owned. All of this suggests why parks are such a rich latent resource. In times of crisis, these spaces are spatially available to be used as shelter, and because they are public lands, there are no legal barriers to their usage for evacuation and emergency relief.

There are however smaller physical barriers – for example fences and bushes – which impede easy access to parks (ibid: 110). While these elements of landscape architecture are important in peaceful times, they pose obstacles in the early and intermediate phases of a crisis. If parks are to be efficiently used as evacuation sites or spaces for temporary shelter, then physical barriers to access need to be limited and easily removable (ibid: 113-114).

1 The spatial distribution of parks throughout cities is, of course, fairly typical, even in urban environments where access to green space mirrors larger urban inequalities. One might argue that it is in the spatialized nature of urban parks to be decentralized.

In general, three types of shelter organizations can be identified in Kobe's parks: 1) an orderly, dense camping formation of cars and tents regulated by the municipality and supported by the Self Defense Forces; 2) unstructured and sparse formations of cars and tents with less public regulation and support and 3) an agglomeration of tents or cars without any organization in formation. Evacuees based their selection of parks on a variety of factors, including individual preferences for supporting facilities, differences in density and resulting degree of privacy, and proximity to family or place of former residence (ibid: 113-114). This diversity of parks offered choices between different spatial qualities such as location, size, and degree of organization. This was a range of choices that was missing in designated shelters. Parks offer a way to address the individual needs of victims during the demanding post-disaster period.

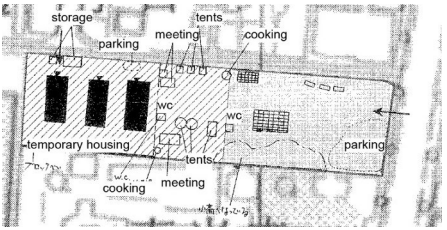
Although parks provided sufficient capacity for sheltering, other characteristics (e.g., exposure to the weather and access to electricity and sanitary facilities) limited their usefulness for the purposes of long-term shelter. To mitigate these shortcomings, preexisting park features were adapted to meet essential needs for sheltering: fences, pergolas, and playgrounds, for example, were used as storage space for household goods and property (City of Kobe 1995: 107). Other structures like soccer goals, huts, and playground slides were used to build shelter-alternatives to tents (JILA 1995: 251), while sandboxes could serve as fire-pits. Evacuees mitigated the effects of rainfall and cold by constructing tents on top of wooden boards (Ikeguchi 1995: 113-114) and insulated and waterproof sheets (City of Kobe 1995: 214). Existing sanitary installations provided drinking water (Ikeguchi 1995: 107) until more extensive and efficient temporary sanitary facilities were constructed (Hyogo Prefecture 1997: 2). The essential qualities of parks, namely their decentralization, openness, and their integration into people's daily life proved to be a valuable resource for the task of sheltering in the days, weeks, and months after the earthquake. As easily accessible, multi-functional spaces that offered evacuees choices about their temporary homes, these spaces enhanced urban resilience by easing the transition between disaster and recovery. The substitution of undesignated parks and open spaces for designated shelters fulfilled an essential function during the initial phase of post-disaster recovery.

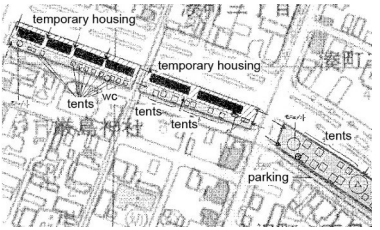
Open Space as a Flexible Resource for Diverse Recovery Tasks

Not only did parks provide valuable resources for emergency sheltering, but many of their intrinsic qualities proved to be useful for a broad range of recovery tasks. Just two weeks after the earthquake, the use of parks was expanded by the administration, volunteer groups, and the Self Defense Forces. Parks were used: 1) as sites of shelter; 2) staging grounds for recovery organizations providing medical goods,

water supply, bathing facilities or registration for temporary housing; 3) construction sites for temporary houses; 4) spaces for the storage of either rubble or relief goods (JILA 1995: 251). Moreover, the openness of parks provided a multi-functionality that could accommodate multiple recovery tasks simultaneously, as can be seen in figures 1 and 2.

Figure 1: Parallel uses of Susano-Park (0,4ha) clearly zoned into temporary housing > sheltering/ support > parking (Adapted from Nakase et al. 1996: 108). Figure 2: Parallel uses of Minato-Chou-Park (0,7ha) with merging functional zones (Adapted from Nakase et al. 1996: 108).





The use of parks and open spaces as sites for the disposal and treatment of huge amounts of disaster debris was important in the early disaster response and throughout the city's intermediate restoration. Since open spaces and parks provided storage space in close proximity to damaged areas, debris could be (more) efficiently moved from blocked roads to be prepared for further treatment. This was important to restore traffic infrastructure and prepare plots for reconstruction (Yamanaka/Nishimura 1999: 508). Parks and open spaces were a key site for the transition from immediate disaster response to the longer-term restoration of the built environment and everyday urban life. A whole range of park sizes accommodated the various uses, ranging from small parks under 1000 m² to bigger neighborhood and district parks (Ishikawa 2002: 837). Throughout the duration of emergency response and the following phase of restoration these different park sizes supplied space for sheltering, supporting activities, and temporary housing. The fact that parks simultaneously supported these different tasks (Nakase et al. 1996: 108) highlights their multifunctional value for disaster resilience.

Parks and other green or open spaces also played an important role in mitigating earthquake and fire damage. Various examples in Kobe show how tree lines in parks, along roads, or in front of buildings prevented fire from spreading (JILA 1995: 259). An example of this effective fire containment is the Sugaharadouri-Park in the heavily impacted ward of Nagata (Yamamoto et al. 1997: 18). The fire approa-

ching the Sugaharadouri-Park was stopped by fire-resistant plants which slowed the spread of fire, and further retarded by the open space in the middle of the park which functioned as a buffer zone. These green and open spaces effectively reduced the impact of post-earthquake fires and protected dense residential areas on the other side of the park (Yamamoto et al. 1997: 19). Green spaces in general, and trees in particular, also helped to stabilize collapsing buildings. Along major streets, roadside trees prevented collapsing buildings from falling on to street and thus helped to ensure the integrity of essential infrastructure (JILA 1995: 251). These examples show that green and open spaces functioned as barrier and buffer against fire and a shield against collapsing buildings. Because green spaces and trees are already existing features of the urban ecology, they proved to be ready and effective resources in increasing the city's resilience to the impact of the disaster.

Open Space as a Resource during the Restoration Phase: Temporary Housing

Given the inadequacy of shelters as a long-term living environment, the provision of long-term temporary housing for disaster victims became a main priority for the Kobe government (City of Kobe 1995: 300). In part because of their distribution throughout the inner city, parks were widely used for this important task. The availability of parks and other open spaces facilitated the rapid construction of temporary housing in extremely challenging circumstances (Baumann 1998: 15): just two months after the earthquake more than 20.000 units had been delivered, which were supplemented by an additional 8.800 units by the end of May. Various locations throughout the city were eventually used, comprising a total of 230 hectares and nearly 30.000units of different types and sizes (City of Kobe 1996: 20).

Despite the rapid installation of temporary housing, difficulties in reconstruction, and especially the timely provision of public housing forced victims to endure life in temporary facilities for as many as four years. By 1998, three years after the earthquake, approximately half of the evacuees were still living in temporary housing (Baumann 1998: 15-16). The last facilities were closed on December 20, 1999, five years after the earthquake (City of Kobe 2010: 74).

Japan's "Disaster Countermeasures Basic Act" formed the legal framework for the use of land by the city administration. The Basic Act stipulated that any plot, building or other structure could be used on a temporary basis to implement emergency measures, independent of ownership (National Land Agency 1997: 37). In theory, this created broad powers for the municipality to acquire land deemed necessary for rapid recovery. In practice, though, the acquisition of private property could be both costly and time-consuming: while the city could take land, they had to compensate property owners, and address potentially lengthy legal challenges.

The situation with parks and open spaces was different. While the involved public administrations had to pay for privately held property, publicly owned parks and open spaces were readily available and did not require additional funding (Hyogo Prefecture 2000: 17). The rapid construction of temporary housing and other essential construction was made possible in part by access to parks and open space that presented low legal or financial barriers.

By the time this construction phase concluded, the open spaces of parks and school grounds contained more than 30 per cent of Kobe's temporary housing units distributed across the city (City of Kobe 2000: 141). Four different types of temporary housing units were constructed in Kobe: 1) A two-room standard unit (JPA 1995: 33); 2) A smaller variation with one room (ibid: 37); 3) A special shared housing type for elderly residents or those with disabilities (ibid: 45-46) as well as 4) Another shared housing type for all residents (City of Kobe 1995: 275–276). The varying sizes and locations of temporary housing compounds offered a diverse range of spatial qualities, enhancing the capacity to match user-preferences for either smaller or larger temporary housing complexes.

Initially, the Hyogo Prefecture administration constructed one-story standard units of 26 m^2 in Kobe. As the limitations on available land became clear, the 26 m^2 design was soon replaced by 20 m^2 single-story constructions. In order to quickly supply housing for the most vulnerable evacuees, and to meet the needs of elderly and disabled residents, larger two-story units were constructed in 21 parks in the inner-city, allowing residents to stay in their old neighborhoods (ibid: 275–276). Later, and again in response to the limited availability of space and the large number of evacuees, the city deployed another two-story shared type construction (City of Kobe 1996: 21). In the "Comprehensive Strategy for Recovery, 2010", the City of Kobe advised a more extensive use of shared-use type units for future recovery actions, noting that they could be rapidly deployed at low cost in relatively small spaces. As an added benefit, the Comprehensive Strategy noted that this type of housing promotes daily interactions between the residents, creating the conditions for the development of new communities (City of Kobe 2010: 72). While the standardized 26 m^2 units can be viewed as an effective way to quickly provide temporary housing space, the smaller 20 m^2 units and the two-story type were a more resource-conscious reaction to the depletion of suitable urban space in Kobe. The variety of unit types represents different approaches to the acquisition and improvement of space – approaches that focused either on quick supply or space saving construction.

The variations in unit types, compound sizes, and locations might have given evacuees greater choice between different kinds of communities and/or proximity to former neighborhoods, and this could have enhanced a feeling of normalcy and continuity for victims. However, the city missed the chance to take advantage of the spatial diversity of parks and open spaces when it launched a rehousing scheme that allotted residents to sites and units via a lottery (City of Kobe 1995: 298).

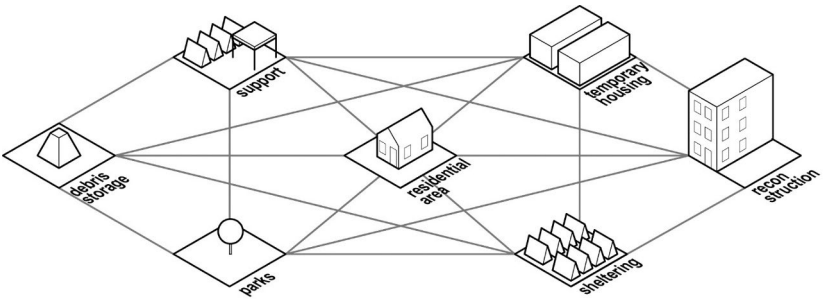
This reduced the potential for building solidarity which might result from choosing homes near places of former residency.

To summarize, Kobe's intense and diverse use of parks and open spaces is a sign of their value as a versatile resource for urban disaster resilience. These spaces are already socially and spatially well integrated into the urban system and their use is legally sanctioned. Parks and open spaces also have inherent qualities that allow for multi-functional usages; and a spatial flexibility that makes them well-suited to meet the individual needs of victims during disaster recovery.

Conclusion: Parks and Open Spaces as Effective and Multifunctional Resource

Open spaces in general, and parks in particular, proved to be a very useful resource for immediate and intermediate recovery tasks in Kobe. The fact that parks are valuable for urban resilience is already recognized in Japan and has been documented in technical manuals such as "Technical Notes and Guideline Proposal on Planning and Implementation of Disaster Prevention Parks" (Ministry of Construction 1999). This case study, however, uncovers the reasons for their usefulness by viewing space as a resource. It concludes that the resource-conscious use of open space can lead to a higher disaster resilience and an improved recovery process.

Figure 3: Use of open spaces around residential areas for different recovery tasks. (Author's Rendering).



Parks and open spaces are important resources for urban disaster resilience, particularly for temporary uses during the phases of emergency and restoration. Because their acquisition and use by public actors and victims alike is legally uncontested, and because these spaces are familiar, well integrated elements of the urban

form, they are easily accessible from endangered residential areas. Their openness makes them well-suited to new construction or the adaptation of temporary structures to aid different tasks. In combination with the high number and variety of parks in Kobe, their multi-functional quality helped to mitigate limited space and changing circumstances through a highly flexible network of recovery actions, as depicted in figure 3. This included different forms of sheltering, supporting bases, temporary housing, and debris storage.

The findings of this study show that planners and policy makers should realize the value of parks and open spaces as a resource for urban disaster resilience. In conclusion, planners and municipal authorities should develop resilience strategies that include parks and open spaces before disasters such as the Hanshin Earthquake occur. This includes the maintenance of extensive and varied open spaces dispersed throughout the city. These spaces can potentially serve different functions during the disaster relief and recovery phases, and can create flexibility in responding to unanticipated problems. In the absence of disasters like the 1995 Hanshin Earthquake, these spaces serve as an important urban and ecological amenity that has been proven to improve quality of life for city residents.

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