

Wang, Yun-cai; Shen, Jia-ke; Xiang, Wei-ning; Wang, Jie-Qiong

## Article

# Identifying characteristics of resilient urban communities through a case study method

Journal of Urban Management

### Provided in Cooperation with:

Chinese Association of Urban Management (CAUM), Taipei

*Suggested Citation:* Wang, Yun-cai; Shen, Jia-ke; Xiang, Wei-ning; Wang, Jie-Qiong (2018) : Identifying characteristics of resilient urban communities through a case study method, Journal of Urban Management, ISSN 2226-5856, Elsevier, Amsterdam, Vol. 7, Iss. 3, pp. 141-151, <https://doi.org/10.1016/j.jum.2018.11.004>

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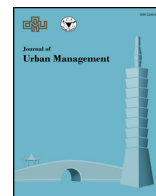


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Contents lists available at ScienceDirect

## Journal of Urban Management

journal homepage: [www.elsevier.com/locate/jum](http://www.elsevier.com/locate/jum)

# Identifying characteristics of resilient urban communities through a case study method

Yun-cai Wang<sup>a</sup>, Jia-ke Shen<sup>b,\*</sup>, Wei-ning Xiang<sup>c</sup>, Jie-Qiong Wang<sup>b</sup><sup>a</sup> Department of Landscape Architecture, Ecological Wisdom and Practice Research Center, College of Architecture and Urban Planning, Tongji University, No. 1239 Siping Rd., Shanghai 200092, China<sup>b</sup> Department of Landscape Architecture, College of Architecture and Urban Planning, Tongji University, No. 1239 Siping Rd., Shanghai 200092, China<sup>c</sup> Ecological Wisdom and Practice Research Center, College of Architecture and Urban Planning, Tongji University, No. 1239 Siping Rd., Shanghai 200092, China

## ARTICLE INFO

## Keywords:

Resilience

Characteristics of resilience

Case study

Resilient urban community

## ABSTRACT

With an increasing acknowledgement of climate variability, the important role of resilience in achieving healthy urban ecosystems has also been discussed by the academics recently. The literature however shows ambiguity about the characteristics of urban resilience, while substantive progress has been made in the practice of resilience building in urban communities. To bridge the gap between theory and practices, this paper dedicate to answer the question: What are the typical characteristics of resilient urban communities? Using the research method of case study, the paper screens and analyzes four exemplary cases of resilient urban communities from around the world, articulating the specific resilient strategies and their core resilient concept of each case. Finally, eight characteristics in four performance dimensions are distilled and explained. The identification of the characteristics provides a scenario of resilient urban community, and it also gives the direction for fostering the urban community resilience.

## 1. Introduction

The risks and changes induced by natural hazards and disasters are on rise globally. The impacts to the cities are severe and widespread in the areas of physical, economic, social development, loss of life, property, resources and overall destruction (Ainuddin & Routray, 2012). What's more, during the urbanization, a widely horizontal urban expansion and the increase of population density have resulted in the decline in urban carrying capacity and the increase of the vulnerability of individuals and communities in the city (Thomalla, Downing, Spanger-Siegfried, Han, & Rockström, 2006). Recently, influenced by climate variability and changed at both global and local level, resilience has been considered as a notion that seeks to capture and organize the capability of a city to react, respond and cope with different changes (Pike, Dawley, & Tomaney, 2010). With the emergence of resilience thinking (Berkes & Ross, 2013), the city's strategy of coping with disasters transforms from passive resistance and post disaster relief approach to active adaptation and risk assessment, preparedness and early warning systems (Ainuddin & Routray, 2012). Cities are integrated social-ecological systems in which social systems and ecosystems are recognized as coupled, interdependent, and coevolving (Berkes, Folke, & Colding, 1998; Folke, 2006). In the discourses of urban planning, construction and policy-making (Ainuddin & Routray, 2012; Meerow & Newell, 2015; Williams, 2012), urban resilience refers to a holistic capacity of urban social-ecological system that is

\* Corresponding author.

E-mail addresses: [wyc1967@tongji.edu.cn](mailto:wyc1967@tongji.edu.cn) (Y.-c. Wang), [jiakeshen1991@tongji.edu.cn](mailto:jiakeshen1991@tongji.edu.cn) (J.-k. Shen), [wnxiang@tongji.edu.cn](mailto:wnxiang@tongji.edu.cn) (W.-n. Xiang), [echo\\_wang@tongji.edu.cn](mailto:echo_wang@tongji.edu.cn) (J.-Q. Wang).<https://doi.org/10.1016/j.jum.2018.11.004>

Received 23 June 2017; Received in revised form 23 January 2018; Accepted 19 November 2018

Available online 13 December 2018

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contributed to by different coupled subsystems in a city.

Integrated by ecosystem and people together, urban communities are socio-ecological subsystems of the city with the characteristics of diversity, dynamic, and adaptation (Xiang, 2013; Cumming G et al., 2008). As the basic unit of urban risk governance and security defense (Steiner & Forman, 2002), urban community has a great responsibility in providing basis for urban planning and fostering resilience at various spatial scales of the city.

Actually, substantive progress has been made through instantiated experiments in the practice of resilience building in human-dominated ecosystems—urban communities, such as community resilience to the floods (Liao et al., 2012) and earthquake (Ainuddin & Routray, 2012; Huang, Fang, & Yan, 1997), community resilience enhancement (Magis, 2010; McFadden, 2010), and resilience restoration after disasters (Ainuddin & Routray, 2012). These urban communities are all regarded as successful practices “with resilient characteristics”, which are proved to be “useable” and “effective” coping with disasters and hazards. These cases show the corresponding resilience strategies for specific problems, and the different forms of deduction of resilience in different cases. However, the resilience in these cases are limited to present certain and varying characteristics of resilience because of their specific contexts (Allan & Bryant, 2011). What are the characteristics of the resilient urban community that make it adaptable to the risks and disasters in the city? How are these resilient characteristics expressed in the successful resilient urban community practices? How should we identify these characteristics? Answering these questions are important to the urban resilience foster on the community level, because the specific strategies and effective ways for the community to deal with risk disasters can be clearer, thus guiding the similar situations.

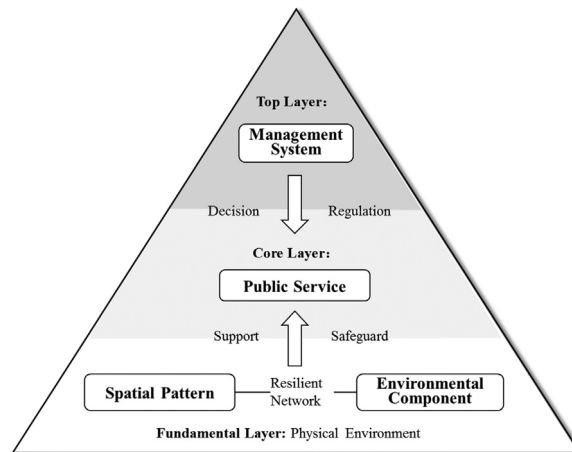
Although substantive progress has been made through instantiated experiments in the resilient urban community practices, the academics have not reached an agreement on what are the characteristics of resilience. Wildavsky (1990) proposed six characteristics of a resilient system, namely homeostasis, omnivory, high flux, flatness, buffering and redundancy. Based on this, Wardekker, Jong, Knoop, & Sluijs (2010) considered ‘foresight and preparedness/planning’, ‘compartmentalization’ and ‘flexible planning/design’ as practical principles for urban resilience. Ahern, Qin, & Liu (2011) argued for five urban planning and design strategies to achieve urban resilience, including multifunctionality, redundancy and modularization, (biological and social) diversity, multiscale networks and connectivity, and adaptive planning and design. They also considered resilient city to have eight major features, including diversity, allowing for variability, modularity, innovation, tight feedbacks, overlap in governance, social capital and ecosystem services (Ahern et al., 2011). In addition, other similar or relevant terms of describing urban resilience’ characteristics are often discussed in the literature, including ‘the ability to learn’ (Newman, 2009), ‘self-(re)organizing ability’ (Carpenter, Walker, Anderies, & Abel, 2001; Tompkins & Adger, 2004), action, ‘recovery’ (Meerow, Newell, & Stults, 2016), flexibility, ‘robustness’ (Wardekker et al., 2010), autonomy, ‘interdependence’ (Brody, Godschalk, & Burby, 2003), ‘reflexivity and connectivity’ (Davoudi & Strange, 2009). As discussed above, the literature generally shows ambiguous and uncertain understandings of the characteristics of resilience. This paper argues that there is a theoretical lacuna between the resilience theories and practices. It is the knowledge transformed from the experience of successful practices, which can be used again to guide the practice to be successful. This paper focuses on the resilience in urban communities because they play an essential role in contributing to healthy urban ecosystems (Steiner & Forman, 2002). A fundamental question remains pertaining to the building of resilient urban communities—How should the characteristics of resilient urban community be identified? What characteristics of resilient urban community will be identified?

It is not easy to answer this question. Because it is difficult to generalize and summarize the resilient characteristics from a theoretical high ground, since the background environment and the specific problems faced by the urban community are different on the practical low lands (Xiang, 2017). Drawing upon a recent work on ecophronesis (ecological practical wisdom), using a research method which is transforming practical experiences to scientific theories, this paper discusses four successful practices all over the world as case studies, from which eight characteristics of resilience are summarized, embodied in the aspects of spatial patterns, environment components, services and management of urban communities.

## 2. Methodology

### 2.1. A resilient community model

The abstract concept of community resilience needs to be understood and realized through concrete carrier. By building a resilient community model, therefore, the dimensions which express the characteristics of resilience are articulated (Fig. 1). It is helpful to clarify the concrete method and target object of community resilience construction. This is also the premise of the identification of community resilient characteristics, and the foundation of shaping the characteristics of community resilience. The physical environment is on the fundamental layer of the resilient community model, including two performance dimensions of the community resilient characteristics: the first is the spatial pattern of traffic roads, residential buildings, activity sites and landscaping in the community, and the second is the infrastructure for living and recreation, municipal public utilities, municipal network, information and communication. These two dimensions are the physical support of the whole resilient community and the hardware guarantee for dealing with all kinds of natural and man-made hazards. Public service is on the core layer of the community resilience mode, this dimension includes the public services in the resilient community that provide all residents with information distribution, education and training, culture, entertainment, medical care, psychological counseling and other services. It is the embodiment of the local culture and community spirit of the whole community, which is an important way to improve the community’s overall response to risk and to carry out the soft power of post-disaster recovery and promotion. The management system is on the top layer of the resilient community model, this dimension consists of the local government, property, residents’ committees, self-government organizations and community residents, which collaborate with each other and also each performs its own functions. As the planner of



**Fig. 1.** The resilient community model consists of four performance dimensions of resilience.  
**Source:** By Authors.

the pre-disaster prediction and preparation, the executor of the disaster response and answer, as well as the leader of the post-disaster recovery and learning, the dimension of management system is the behavior agent and decision-making mechanism of the resilient community to deal with the risks and disasters.

## 2.2. The cases selection

In order to identify the characteristics of the community resilience, the method of case study was used. This method is grounded in a recent work on *ecophronesis* (ecological practical wisdom) (Xiang, 2014, 2016). This paper considered successful urban community practices as ‘right things’ (Schwartz & Sharpe, 2010) and learn from the cases to reveal right ways to foster resilient urban communities. Specific resilient characteristics are embedded in substantive urban community practices, hence, the characteristics of specific resilience can be summarized, transformed and generalized into ecological knowledge to guide other resilient urban communities.

This paper focused on studies which had been published in recent 5 years in worldwide, to ensure that new information is selected in a large scope, and searched for studies using combinations of keywords of resilient community and the performance dimensions of their resilient strategies. Those for the four performance dimensions were green spaces/ spatial structure, environmental components/ infrastructure/ facilities, public services/ service system, management/ management departments. In this way, communities with a resilient characteristic or a resilient strategy in a specific dimension will be searched. The initial search results were screened according to the following criteria:

- Does the study deal with urban communities?
- Is the study aimed at common risks and disasters in the city?
- Has the community in the study been built up and been proved to be resilient?
- Are the resilient strategies and measures used in the study explicit and specific?
- Whether the study shows the characteristics of resilience in the corresponding dimension prominently ?

The study was in the selection range if all these questions could be answered with “yes”.

## 2.3. The sites of cases

Considering the adequacy and availability of case data and images, as well as the equilibrium of each case in the location distribution, the typicality of the problem and the representativeness of the resilient strategies, from the cases that meet the screening conditions above, this paper selected the following four communities as the samples to identify the characteristics of community resilience on four performance dimensions: the St. Kjeld Community which is the world’s first climate resilient community located in Copenhagen, Denmark; the Rosenthal Ave Carpark of Lane Cove Community located in Sydney, Australia, which was redeveloped into an active town center; the New Jiangwan Community which is a meteorological intelligent community located in Shanghai, China; the Northbridge Community located in Los Angeles, USA, which is an example of post-earthquake reconstruction. (Fig. 2)

## 2.4. The procedure of case analysis

The methodology delineates the following stages in the identification of the characteristics of urban community resilience: (a) analyzing the performance dimension of resilience in each case of resilient communities; (b) analyzing the targeted problems for each

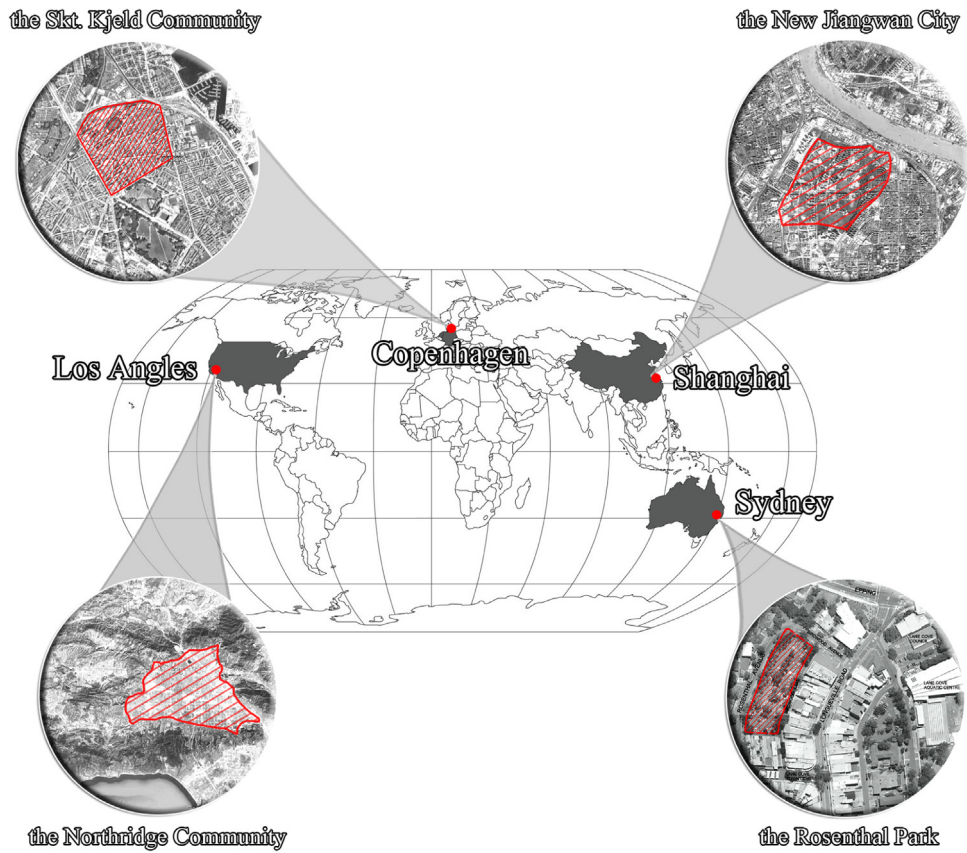


Fig. 2. The locations of four cases around the world.  
Source: From Google Earth, by Authors.

resilient community to solve; (c) analyzing and illustrating the resilient strategies based on the four expression dimensions above, and indicating how they solve the problems through the measures; (d) analyzing the core resilient concept embodied in the resilient strategies, which means to explore the essential and fundamental purpose of each measure and ask “What has been actually changed by doing this?” (e) inducing the characteristics of resilient community from the resilient concepts and explain each of them as the result of the identification (Fig. 3)

### 3. Case study research

#### 3.1. The performance dimensions of resilience in communities

- (1) **The spatial pattern of urban community** is the key to the resilience of community structure in the face of changeable environment, while indicators such as the distribution, formation, location and function of spaces have direct influences on the structural resilience. The first case selected in this paper is the Skt. Kjeld Community located in Copenhagen, Denmark as shown in Fig. 4, which gives us an example of fostering the community resilience toward flood infestation as a response to climate change, through rational planning of the community spatial patterns.
- (2) **The environmental components in urban community** are the core of a resilient community in responding to changing and diverse needs. Indicators that influence the resilience of the components include their types, quantities and functions. The second case chose in the paper is the Rosenthal Park in the Lane Cove community located in the Lower North Shore of Sydney, Australia as shown in Fig. 5. This park is a good example which demonstrates the resilience of a community when coping with the environmental and social problems, by providing environmental components with diversity in types and interactivity in functions.
- (3) As is resident-oriented in urban communities, **the service system** expresses the resilience of communities during functioning. A close relationship network is formed in the process of information exchange and transfer between the managers and residents in urban communities. This network of relationships enables communities to cope with risks and disasters and also respond to the immediate changes from the timely exchange of information. Indicators that have impacts on service resilience includes: the technologies and approaches used by the services, as well as the activities and targeted people in the services. The third case in this paper is the New Jiangwan City meteorological intelligent community located in the northeast of Shanghai, China which is



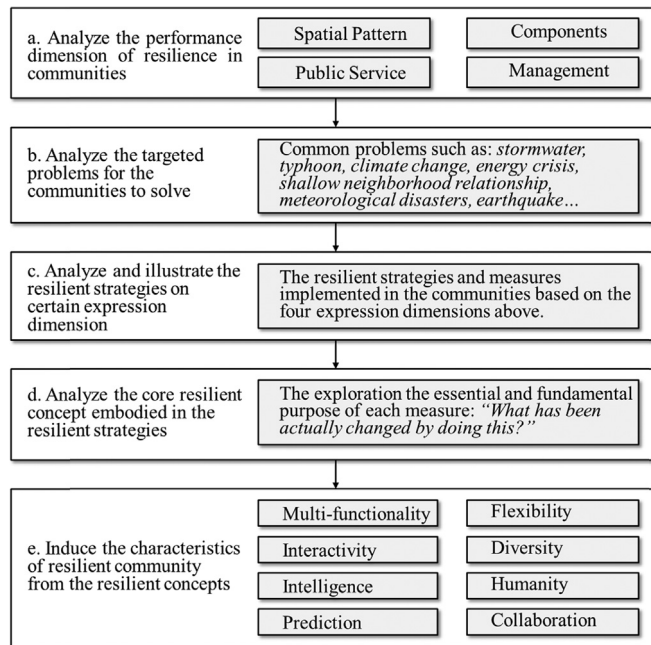


Fig. 3. A flowchart of case study research of resilient urban community. Source: By Authors.



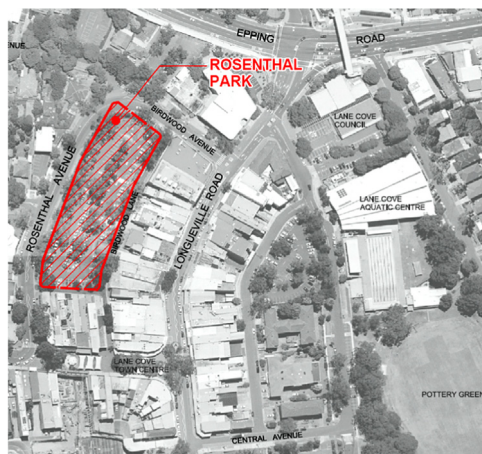
Fig. 4. The location of Skt. Kjeld Community in Copenhagen. Source: From Google Earth, by Authors.

marked in Fig. 6. This case shows us how an urban community gains the resilience toward typhoon with the help of intellectual and humanistic technology in the service system.

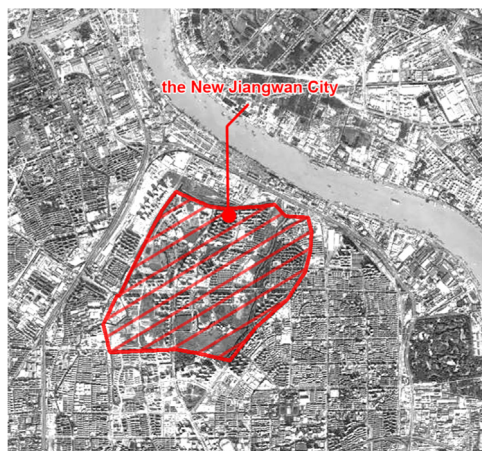
- (4) Organized by the managers in urban communities, **the management system** is the way to implement the community resilience on the operational level. A resilient management system allows for the rational mobilization and integration of community resources, maximizing the effects of community functions, and achieving greater resilience in the face of risks and disasters. Indicators contributing to the resilience of management system include: the approaches and mechanism of management, as well as the motivation and plans of the managers. The fourth case selected in this paper is the Northridge community located in the northwest suburb of Los Angeles in USA, which is tagged in Fig. 7. It demonstrates the superiority of a community with management resilience in the process of post disaster reconstruction and rehabilitation.

### 3.2. The targeted problems for the communities to solve

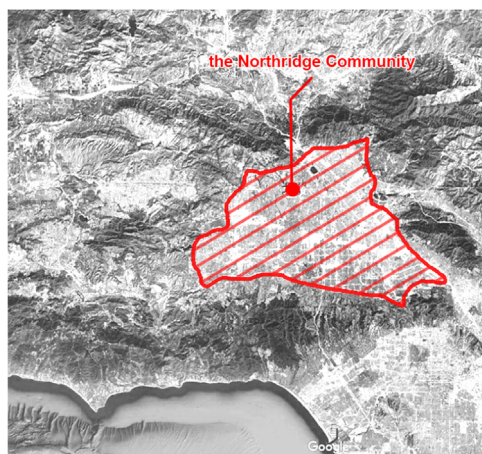
- (1) With the prediction of an increase in rainfall of up to 30% in the coming years, the prime objective of Skt. Kjeld Community is to make more room for stormwater.



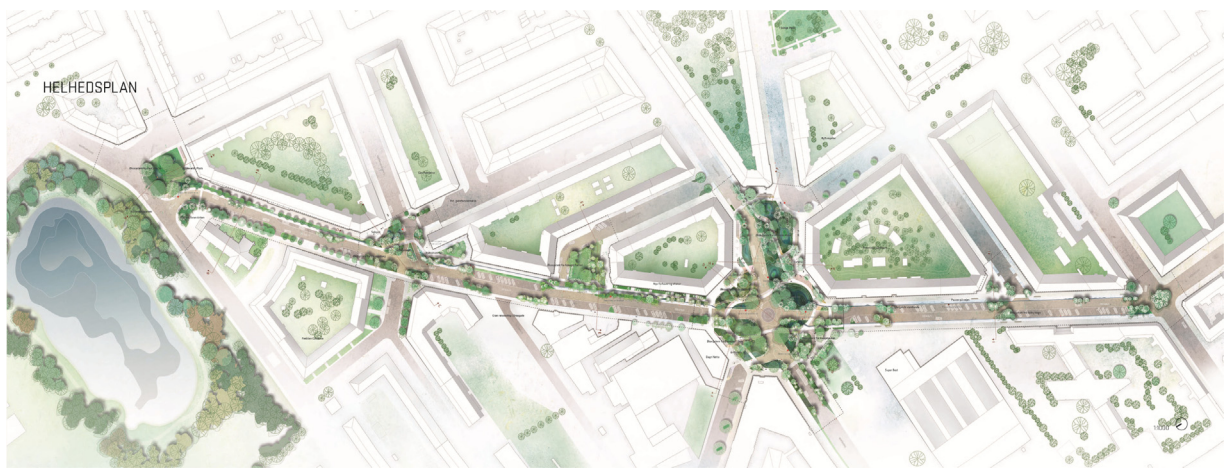
**Fig. 5.** The location of Rosenthal Park in Lane Cove Community.  
**Source:** From Google Earth, by Authors.



**Fig. 6.** The location of the New Jiangwan City in Shanghai.  
**Source:** From Google Earth, by Authors.



**Fig. 7.** The location of the Northridge Community in LA.  
**Source:** From Google Earth, by Authors.



**Fig. 8.** The green spaces in the Skt. Kjeld Community in Copenhagen.

**Source:** From Copenhagen X Gallery. (<http://www.dac.dk/en/dac-life/copenhagen-x-galleri/cases/the-st-kjeld-climate-district/>)

- (2) Under the pressure of climate change, energy crisis and shallow neighborhood relationship, the environmental and social problems are the Lane Cove Community aims to deal with.
- (3) Frequent and unavoidable meteorological disasters, such as typhoon or rainstorm weather, bring inconvenience to residents' lives and travel. How to reduce the inconvenience and improve the coping ability of the whole community in the face of meteorological disaster is the main target of the New Jiangwan City community.
- (4) Northridge is a community where a magnitude-6.7 earthquake happened in a morning in 1994 (Huang et al., 1997), consequently causing 62 people's lives and \$150 billion loss due to the damage of buildings, highways and other infrastructure. Faced with huge economic losses and casualties, the community needs to be rebuild and recover from the disaster as soon as possible.

### 3.3. The resilient strategy and the embodiment of its resilient concept

- (1) In order to make more room for stormwater in the limited space, the Skt. Kjeld Community maximizes the use of outdoor spaces by establishing a series of functionally dependent and structurally connected green spaces, including cloudburst boulevards, green island square, green courtyards and public areas as seen in Fig. 8, creating a resilient spatial network to provide more recreational opportunities, ecology and disaster prevention. Firstly, more permeable surfaces and more approaches are created to hold and reuse stormwater. For example, there is drainage along the newly built bicycle lane which can discharge the excessive stormwater into a nearby harbor when it rains heavily. Secondly, a huge roundabout is built to connect major roads in the community. The permeable pavement and intensive vegetation make the roundabout become a "green heart" to collect more surface runoff and pleasant microclimate. Thirdly, a community cultural center plaza is transformed from a bunker that was covered by weeds, providing green spaces, cafes and local culture center. The green spaces are enlarged by decreasing street width to create more spaces for communication and better environment for walking and cycling. Finally, the enclosed courtyards surrounded by buildings are also transformed to make more activity spaces with different themes, such as small-scaled rain gardens, public open spaces or ecological green spaces. *It can be concluded as the following two resilient concepts: 1) Using limited spaces to provide as many functions as possible, which means each site should be multi-functional to reduce the impact of stormwater on certain functions. 2) Providing more ways to eliminate the stormwater, so that the pathway of the stormwater runoff can be shift in time flexibly.*
- (2) By improving public spaces' incorporations and connections with the idea of resilience, the Rosenthal Park presents a landscape that responds to the social, economic, environmental and cultural needs of the community. It is not only a civic space but also a community backyard. The Rosenthal Park can be considered as consisting of two parts. The first part refers to open spaces providing chances of various events, such as a central gathering place for flexible gathering ("02" in Fig. 9), scattered play zones for kids of all ages ("06" in Fig. 9), and performance areas for diverse community activities ("01" "03" in Fig. 9). This part makes the park so flexible and diverse, engaging people in the interaction with the natural beauty as well as each other to enjoy a range of community events and recreations. The second part of the park consists of sustainable and interactive facilities. The sustainable facilities include roof gardens, rainwater disposal systems, solar energy collection structures, indigenous wildflower planting beds ("09" in Fig. 9) and other environmentally friendly facilities. The interactive facilities include a sustainable and functional community center ("04" in Fig. 9), stepped green walls ("05" in Fig. 9), food and beverage offering amenities ("08" in Fig. 9), interactive fountains ("10" in Fig. 9) and other services and recreational facilities. These facilities enhance the connection between people and nature in the park. They also support different elements to adapt to each other, and then decrease the impacts of disasters and hazards. They can help restore post-disaster social relations and social structures by encouraging and supporting





**KEY DESIN IDEAS LEGEND**

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>01 THE BOWTIE-PLAZA EXTENSION OF THE TOWN CENTRE</li> <li>02 ADAPTABLE SPACES FOR COMMUNITY FUNCTIONS+EVENTS</li> <li>03 IMPROVE AND PROMOTE THE LANEWAY NETWORK FOR COMMERCIAL SUCCESS</li> <li>04 COMMUNITY SUSTAINABILITY+FUNCTION CENTRE WITH COMMUNITY GARDEN</li> <li>05 DISSOLVING THE EDGE-WITH STEPPED WALLS+GREENING</li> </ul> | <ul style="list-style-type: none"> <li>06 URBAN FOREST OFFERS CHARACTER+HABITAT+SHADE BBQ ZONE</li> <li>07 ACCESSIBLE PEDESTRIAN SPINE+CONNECTIONS FOR EFFICIENT MOVEMENT</li> <li>08 PARK ACTIVATING FOOD+BEVERAGE OFFERINGS+AMENITIES</li> <li>09 WILDFLOWER MEADOW FEATURING INDIGENOUS PLANTING</li> <li>10 ADVENTURE+WATER PLAY WITH CONNECTIONS TO LOCAL ENVIRONS</li> </ul> |
|--|--|

Fig. 9. The layout and sections of the Rosenthal Park in the Lane Cove Community.  
 Source: From Lane Cove Council. (<http://www.lanecove.nsw.gov.au/CouncilConsultations/Pages/RosenthalDesignIdeas.aspx>)

people in the community to gather together, to do recreational activities, to learn and to meditate. *It can be concluded as the following two resilient concepts: 1) Creating media to promote interactions between ecological and social factors, so as to strengthen individual connections and form a close relationship network. 2) To form a one-to-many relationship between function and functional carriers, using various environmental components in terms of quantity, type and form to ensure the normal operation of certain function in disasters.*

(3) To deal with meteorological disasters, such as typhoon or rainstorm weather, the New Jiangwan City meteorological intelligent community has reached an agreement with Shanghai Meteorological Bureau to introduce weather forecast service system to the community. The service system is supported by several new technologies, including informationized management in a community, a disastrous weather assessment model, multi-dimensional geographic information and clouds computing. It can provide the community with weather disaster and hazard risk analysis, live weather monitoring information, and community refined risk warning (SSAM, 2016). In addition to flooding prevention, the community can provide other information services to its residents, such as timely weather information shown on a display screen and sent by a technology department of meteorology bureau. Once disastrous weather comes, community managers will announce warning information through a monitoring warning system and start the flooding prevention emergency plan of the community. For example, they need to check and clean drainage systems in the community, put sandbags at the entrance of underground parking, broadcast to remind residents to pay more attention to travel safety during storms, and provide disaster prevention guidance through information platform. *It can be concluded as the following two resilient concepts: 1) Ensuring that the services are optional in forms and types, in order to enlarge the service groups in the community. 2) Combining technology with the services provided by the community, leveraging the convenience and efficiency of technology to enable communities to advance or save more time in response to disasters.*

- (4) Although faced with huge economic losses, the Northridge community is able to recover as long as there was a full preparation in advance. Before the disaster, most of the citizens had participated in earthquake training courses in their communities. Meanwhile, some relevant departments had worked out a long-term plan called “City Restoration Plan” for post-disaster redevelopment in order to make the city recover as soon as possible to minimize the expenses of reconstruction, and to improve the living environment of the city. After the disaster, the federal, state and local governments and the community focused on the reconstruction of housing. They established a multi-party cooperation organization based on laws and regulations, and set up an organization framework of mutual cooperation in order to ensure that each department can perform its own functions to make overall arrangements, to implement details and to command operations while they jointly carried out the reconstruction work. The natural disaster prediction and evaluation system and the post-disaster reconstruction plan made by the Northridge community management department not only reduced the disaster risks and the reconstruction stresses, but also enhanced the awareness of disaster prevention and the mental preparation of the community residents to deal with all kinds of disasters. Moreover, the division of working in collaboration not only clarified the framework of cooperation for the reconstruction, but also made the victims understand the reconstruction process, and then actively participate in the long-term reconstruction of the community (Wan et al., 2011). *It can be concluded as the following two resilient concepts: 1) Instead of a static management framework and a fixed planning, using a dynamic management concept that the tasks, goals and plans are adjustable depending on the changing environment and situation. 2) Aiming at the same target, making diversified parties participate in the management and form a feedback mechanism with cooperative mode.*

#### 3.4. The characteristics of the resilient communities

- (1) With Skt. Kjelds Community setting the example, it is shown that the spaces and the spatial patterns presenting the characteristics of **multi-functionality and flexibility** have as much effect in controlling floods as the neighborhood-wide approach.
- (2) Taking the Rosenthal Park as an example, it can be concluded that the **interactive and diverse components** in communities including both spaces and facilities can contribute to building a people-engaging and environmental-friendly community which provides various possibilities in the changeable environment.
- (3) The case of the New Jiangwan City meteorological intelligent community points out a new way to build the community resilience on the operational level, which is to create an information exchange network in the community through the service system with the characteristics of **intelligence and humanity**.
- (4) The Northridge community is an excellent example, for it shows us how fast a community is able to get recovered from a disaster, thanks to its resilient management system which has the characteristics of **predication and collaboration**.

## 4. Results

As discussed above, each case presents different characteristics of specific resilience due to different circumstances. This section aims to clarify the essence of the community resilience through a discussion of each characteristics and a comparison of their similarities.

- (1) **The multi-functionality of space** is to satisfy different needs due to dynamic environment. Urban communities should allow more spaces to have multiple functions so that the possibility of switch between different functions can be achieved.
- (2) **The flexibility of spatial processes** is to prevent being interrupted by the changes of environment, and accordingly influencing system’s functions. Space is the supporter of spatial processes while the process is the channel of spatial functions. Each spatial process therefore needs various space supporters to ensure its ability to shift (especially the shifting of the occurrence location) when necessary.
- (3) **The interactivity of facilities** addresses that facilities can help community residents interact with environment. It refers to the responses to the changes of environmental conditions and the ability to meet users’ changing demands. The key point of the former one is to provide a variety of channels for natural ecological cycles (including water cycle, atmospheric cycle, energy cycle and material cycle), which enables each type of facilities absorb, accept or digest different natural resources. The latter one means each facility can switch between different functions, usages or to move between different locations.
- (4) **The diversity of components** means that one facility has different functions. Each facility has the ability to switch between multiple functions. Moreover, this characteristic also means that the same function can be achieved by several facilities, allowing the same type of facilities to be transformed spatially at different locations.
- (5) **The intelligence of public services** is required to deal with complicated demands and dynamic environment. The public services of urban communities need to use intelligent approaches to provide the feasibility for each type of services in different circumstance. There are variations in services technologies, vectors, modes and so on.
- (6) **The humanity of public services** emphasizes that the public services in resilient urban communities designed with humanity should fully consider and meet individual’s requirements that are changed at different degrees in a dynamic environment. In the other word, the services and their modes have alternatives.
- (7) **The prediction is based on management concepts**. A range of possible changes, consequences and responsive strategies are fully considered in advance, which enables management objectives, tasks, plans and solutions to adjust to changing circumstances and forms a dynamic management framework triggered by different environmental change factors.
- (8) **The collaboration of management institutions** means that the process of implementing management is a cooperative mode with

feedback mechanisms, rather than unilateral or unidirectional mode. The main parties engaged in implementation and the assignment of the tasks should be diversified when forming a cooperating unity towards consistent objectives.

Considering the similarity of all these characteristics of resilient urban communities, two groups can be summarized based on their system qualities. Firstly, multi-functionality and flexibility from spatial patterns, and interactivity and diversity from environmental components represent inherent qualities of urban communities, which ensure the system functions well during non-crisis periods (Cutter et al., 2008). In terms of this group, the key points rely on the changeability of the system itself, including the exchange between different functions, the shift of internal processes, the movement of locations, and the changes of distributions. Secondly, humanity and intelligence from services, and prediction and collaboration from management represent adaptive quality of urban communities, namely the organizations and controls of external interventions which enhances the system's flexibility in response during disasters (Cutter et al., 2008). The key points rely on the changeability that a system responds to external interventions, including alternative contents, various approaches, adjustable concepts and diversified institutions.

## 5. Discussion: What are the key attributes to make urban community resilient?

Using the method of case study, with a “bottom-up” approach, this paper firstly analyzed the target problems and the specific strategies to solve the problem of successful resilient urban communities. Secondly this paper identified the essence of the resilient strategies as well as the resilient characteristics reflected in the strategy concepts. Finally, the paper summarized eight typical characteristics of resilient urban community. When solving a certain problem of a city in the specific situation, the resilient characteristics above set up clear targets to foster urban community resilience, and also make we know the features of resilient urban community should show when it facing of risks and disasters. However, for the study of the resilient urban community, the next research question is: how to make the urban community have the above-mentioned resilience characteristics? Namely: what are the key attributes to make it resilient in the process of building a resilient urban community? The answer to this question is helpful to find the focus of the resilient urban community construction and form a guiding practical framework. This part of the study needs to take a top-down perspective, by summarizing the common points expressed by the characteristics of resilient urban communities, sums up the core attribute of resilient of urban communities, as the guiding principle of the resilient urban community construction. Extracting and summarizing the eight representative resilient characteristics, the result is that: as the changing of environmental conditions, elements in the system make corresponding changes and adaptations in different ways, which makes the system obtain the resilience of a particular situation— that is, the resilience is the result of “change” and “adaptation”, and the eight characteristics of specific resilience in urban communities are deemed variants of adaptability which are conveyed by various vectors in different conditions. Therefore, “adaptability” is the key attribute of urban community resilience. In order to further clarify the scope and principle of the adaptability of overall community, as well as the forms and ways of the elements' adaptations in the community, considering the nature of urban community which is a social-ecological system, this paper interprets and delineates the adaptability of resilience urban community from the following three aspects: (a) context dependence—celebrating the unique traits of an urban community; (b) space variability—satisfying changing needs or preferences of spaces in the urban community; (c) human centricity—respecting people's rights and opinions. Based on the key attribute and three principles of resilience, the guiding framework for building a resilient urban community can be established.

Under the guidance of ecrophonesis (ecological practical wisdom), this paper has identified and extracted the representative resilient characteristics of successful resilient urban communities by case study method. Starting from the ecological practices that proven to be feasible and effective, the method of case study used in this paper transforms the experience, strategy and technology that come from the successful ecological practices, into useful ecological knowledge. The conclusion of generality from the targeted cases can help to bridge the gap between the practical low lands and theoretical high grounds. However, limited to the numbers of analyzed cases, comprehensive and complete conclusions are not guaranteed, only by expanding the sample size of the case study, which means more successful resilient urban community cases should be observed and analyzed, so as to continually perfect the analysis results, the characteristics of the resilient urban communities will be more clearly described. At the same time, in the process of case selection, the selection criteria will also influence the results of the final analysis. This paper only provides a general and primary screening method, and uses the four performance dimensions of the resilient characteristics as the screening criteria. In the subsequent research, the selection criteria should be adjusted and refined according to the specific research objectives to improve the representativeness of the selected cases and the authenticity of the analysis results.

## 6. Conclusion

In the context of climate change, as a complex socio-ecological system with different spatial scales and local characteristics, a city's development is always accompanied by a variety of disasters and risks to resist. In this case, the resilience is deemed to a necessary condition of the urban communities as socio-ecological subsystems of urban ecosystem. Although the important role of studying urban community resilience has already been acknowledged by the academics and there are many successful practices in achieving resilience in reality, there is still a theoretical lacuna between the resilience as a characteristic and an approach and the resilient urban community as the object and outcome. The characteristics of the resilient urban communities need to be clearly identified from the successful practices before they are transformed into useful guidance in the shape of specific strategies and measures on theoretical level. Therefore, the question that “What are the typical characteristics of resilient urban communities?” and “How to identify these characteristics from the practices proved to be resilient?” need to be answered. In order to bridge the gap and



answer the question, using the research method of “from practice to theory then back to practice” inspired by the ecophronesis, this paper aims to explore the implied ecological practical wisdom in ecological practices which are based on ecological knowledge with the help of the ecological wisdom theory and consequently apply these ecological practical wisdom in new ecological practices. To identify the characteristics of resilience, this paper defines the performance dimensions of the resilience in urban communities as the first step. By building up a resilient community model, the four performance dimensions which are spatial pattern, environmental components, public services and management system are clarified, and also work as the key words in the search of resilient urban community cases. After being screened, four international cases of urban communities targeted to solve common urban problems are selected and analyzed in this paper, where specific strategies and measures of resilience are embedded in the four dimensions above. Eight characteristics of specific resilience are drawn from these four performance dimensions, including the multi-functionality and flexibility of the community's spatial patterns, the interactivity and diversity of the community's environment components, the intelligence and humanity of the community's public services, as well as the predication and collaboration of the community's management systems. These typical and specific resilient characteristics represent the essence of the resilient strategies on the practical level, and also make the abstract concept more concrete on the theoretical level, so as to bridge the gap between the theoretical high lands and the practical low grounds. Urban community is responsible for providing a basis for urban planning and fostering resilience at different scales of a city. Thus, it can become a starting point and a key link of building resilient city in the future. This is why making the characteristics of resilience clear in urban community context is crucial and necessary, for they are the foundation for building resilience in urban communities. Furthermore, the resilience in different aspects or scales of a city can be increased, dealing with urban risks together (Shi, 2016) and achieving the general resilience of overall urban ecosystems.

## Acknowledgements

The research and writing activities pertaining to this paper were supported by China National R & D Program “building strong ecological security patterns through elevating green infrastructure's level of ecosystem services” (No. 2017YFC0505705), which is one of six items of research project “the coupling and its regulation mechanism between urbanization and regional ecology” (No. 2017YFC0505700).

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