LANDSCAPE PERFORMANCE SERIES
presented by the Landscape Architecture Foundation

Yanxiu Waterfront Park, Liaoyang City, China

Methodology for Landscape Performance Benefits

Case Study Investigation 2017

Prepared by:

Research Fellow: Hong Wu, Ph.D., Associate ASLA, Assistant Professor, Department of Landscape Architecture, The Pennsylvania State University

Research Assistants: Jie Yang, Yan Yu, MLA candidates, Department of Landscape Architecture, The Pennsylvania State University; Clarissa Ferreira Albrecht da Silveira, Ph.D. Candidate in Architecture, The Pennsylvania State University; Assistant Professor, Federal University of Viçosa, Brazil.

Firm Liaisons: Jie Hu, Vice President; Lihong Cai, Furong Pan, Nan Sun, Landscape Architects, Research Center for Landscape Architecture Planning, Beijing Tsinghua Tongheng Urban Planning and Design Institute, Beijing, China

This Methods Document accompanies a *Landscape Performance Series* Case Study Brief. It was produced through the Landscape Architecture Foundation's *Case Study Investigation* (CSI) 2017 program, a unique research collaboration that matches LAF-funded faculty-student research teams with leading practitioners to document the benefits of exemplary high-performing landscape projects.

The full case study can be found at:
https://landscapeperformance.org/case-study-briefs/yanxiu-park

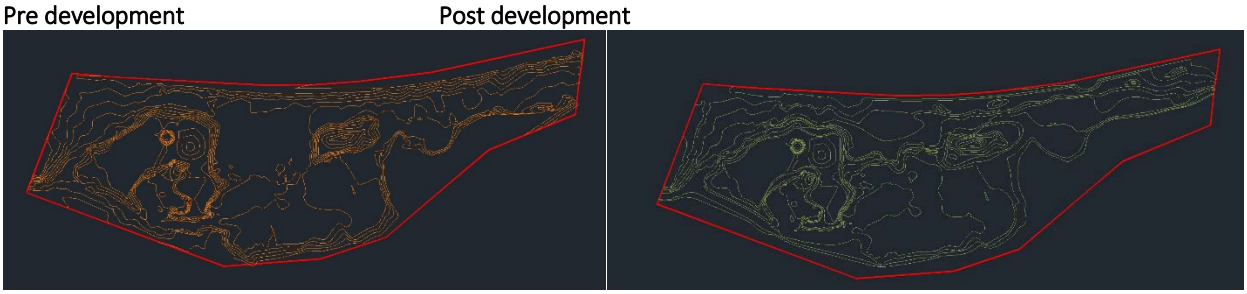
Environmental Benefits

- *Increases flood storage capacity by approximately 29,500 cu yds, equivalent to 9 Olympic-sized swimming pools.*

To create a safe environment during the flood season, a 768-foot long terraced meandering creek – the Zhuoqing Creek - was created to connect two existing gravel mining pits, forming a side channel-pond system that safely and effectively moves flood through and out of the park. Creation of the new creek and reshaping of existing ponds also increased flood storage capacity. The exact volume increase was calculated by the research team[E1] based on pre-development topographical survey maps and construction documents.

A 3D model was created in Civil3D software by inputting pre- and post-development contours and spot elevations that define the reference and control surfaces, respectively (Figure 1). The software then provided statistics for the consolidation coefficient factor, excavated volume, fill volume, and net volume value. The channel-pond system yielded a 22,522 m^3 (29,459 cubic yard or 18.26 acre-feet) increase in flood storage volume. This volume is equivalent to 9 Olympic-sized swimming pools (1 Olympic-sized pool = 50m (L) x 25m (W) x 2m (D) = 2500m^3).

Figure 1: Pre- and Post-development contour input for Civil3D.



Limitations:

The major limitation of this method is that the contour drawings used did not reflect potential grading changes made during construction. Thus, the accuracy of this calculation remains to be verified by the contractors who we were not able to reach within the timeframe of this research.

Sources:

[E1] *Calculations performed by Yan Yu, Research Assistant, MLA candidate, Department of Landscape Architecture, the Pennsylvania State University, June 2017*

- *Reused 5,354 trunks and branches from nursery trees thinned on the site to create timber embankments, saving $16,500 in material costs.*

New embankments for the two ponds were created by reusing timber poles harvested on-site (Figure 2). As mentioned in the Case Study, the pre-existing overly dense nursery was thinned in order to maintain adequate space for healthy tree growth. The selectively removed trees were transplanted to adjacent construction sites of the River-east new district. During this process, the remnants that resulted from pruning the transplanted trees as well as those unhealthy ones that would not have survived were repurposed as timber embankments. We calculated the amount and value of the recycled trunk materials as shown in Table 1 below. The total cost savings by repurposing plant materials for erosion control was around $16,500.

Figure 2: Recycling of plant materials as embankments.

Table 1: Cost savings by repurposing plant materials.

Calculations:	D = Avg. diameter of pole[E2] = 13 cm
	L = Avg. length of each pole[E2] = 1.8m
	LE = Length of the new embankment[E2] = 683m
	N = Number of poles used = LE/D = 5254
	V = Volume of Timber = $\pi \times (D/2)^2 \times L \times N = \pi \times (0.13/2)^2 \times 1.8 \times 5284 = 70.14\ m^3$
	P = Unit Price of Timber[E3] = $235*
Savings =	**V x P = 70.14 x $235 = $16,482.90**

Limitations:

Whereas the calculation of this portion of construction materials savings was fairly accurate, quantifications of other savings were not successful due to lack of data. For instance, a substantial amount of river pebbles harvested onsite from the creation of the Zhuoqing Creek and dredging of existing gravel pits were reused as foundation materials for the parking lot; significant amount of soil excavated from adjacent construction sites were reused as fill for constructing the plazas and regrading the steep banks, greatly reducing material and hauling expenses. However, due to incomplete construction records, quantification of these benefits remained infeasible within the timeframe of this research.

* All calculations in this document based on currency exchange rate of 1 dollar = 6.8 RMB.

Sources:
[E2] *Based on design and construction drawings from THUPDI.*
[E3] *This estimate is based on a web search on www.1688.com, an online wholesale shopping hub in China with wood products. The final estimate of $235/m^3 was also validated by Chief Engineer of the Landscape Research Center of THUPDI.*

- *Contributes to supporting at least 60 wildlife species including 36 bird species, 10 dragonfly species, 13 butterfly species and 1 frog species, as a critical part of a larger riverfront ecosystem. Two of these species are nationally protected.*

A plant and wildlife survey team was contracted by the Landscape Research Center of THUPDI to contribute to the CSI investigation with the slightly different objective of understanding the ecological functions of a larger riverfront open space system that includes but is not limited to the scope of Yanxiu Park. The boundary of the plant and wildlife assessment area (7.26 km^2) is depicted in Figure 3 below. The two-day survey was conducted only once on both 5/19 and 5/20, 2017, along a 26.1-km (16.2-mile) route as shown in Figure 4, with an average walking speed of 1.5 km/hour. The survey focused on recording 4 categories of species including birds, dragonflies, butterflies, and native plants not planted by humans (see list of species in Appendix I), although 1 species of frog was also included in the report because of its nationally protected status.

Figure 3: Plant and Wildlife Survey Assessment Area (Park marked by asterisk).

Figure 4: Plant and Wildlife Survey Routes.

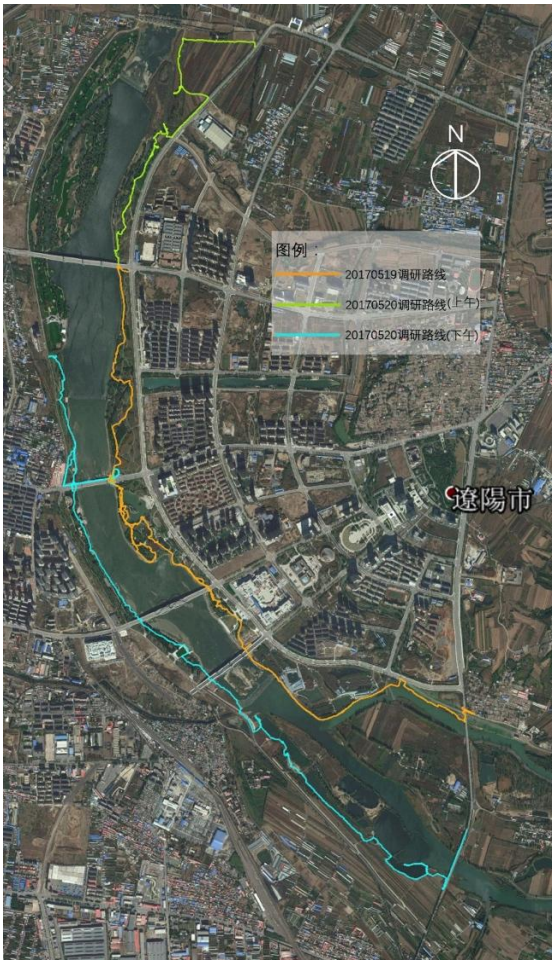


Table 2, 3, 4 and 5 below provide inventories of the 36 bird species, 10 dragonfly species, 13 butterfly species, as well as 1 frog species, respectively.

Table 2: Bird spp. observed in assessment area.

#	Scientific Name	Quantity	Functional Group	Protection Level
1	*Falco tinnunculus* 	1	Bird of Prey	*National Level 2*
2	*Passer montanus*	49		
3	*Hirundo rustica*	46		
4	*Sinosuthora webbiana*	24		
5	*Acrocephalus orientalis*	12		
6	*Tachybaptus ruficollis*	12	Swimming	
7	*Pica pica*	11		
8	*Delichon urbicum*	10		

9	*Cecropis daurica*	8	
10	*Phasianus colchicus*	7	Land
11	*Charadrius dubius*	7	Shoreline
12	*Oriolus chinensis*	7	
13	*Lanius cristatus*	7	
14	*Actitis hypoleucos*	6	Shoreline
15	*Motacilla alba*	6	
16	*Streptopelia orientalis*	6	
17	*Cuculus micropterus*	6	
18	*Butorides striata*	5	Shoreline
19	*Alcedo atthis*	5	
20	*Cuculus canorus*	5	
21	*Spodiopsar cineraceus*	4	
22	*Anas zonorhyncha*	4	Swimming
23	*Remiz consobrinus*	4	
24	*Apus apus*	3	
25	*Nycticorax nycticorax*	3	Shoreline
26	*Ardea cinerea*	2	Shoreline
27	*Pycnonotus sinensis*	2	
28	*Anas platyrhynchos*	2	Swimming
29	*Upupa epops*	2	
30	*Motacilla cinerea*	1	
31	*Streptopelia decaocto*	1	
32	*Dendrocopos major*	1	
33	*Ficedula zanthopygia*	1	
34	*Muscicapa sibirica*	1	
35	*Phoenicurus auroreus*	1	
36	*Chloris sinica*	1	

Table 3: Dragonfly spp. observed in assessment area.

#	Scientific Name	Quantity
1	*Ischnura elegans*	26
2	*Paracercion hieroglyphicum*	26
3	*Paracercion v-nigrum*	20
4	*Orthetrum albistylum*	14
5	*Anax parthenope*	7
6	*Ischnura asiatica*	6
7	*Paracercion calamorum*	4
8	*Crocothemis servilia*	1
9	*Trigomphus citimus*	1
10	*Copera tokyoensis*	1

Table 4: Butterfly spp. observed in assessment area

#	Scientific Name	Quantity
1	*Pieris rapae*	14
2	*Everes argiades*	10
3	*Pieris napi*	6
4	*Lycaeides argyrognomon*	5
5	*Polygonia c-aureum*	3
6	*Polygonia c-album*	1
7	*Papilio bianor*	1
8	*Colias poliographus*	1
9	*Polyommatus eros*	1
10	*Papilio xuthus*	1
11	*Pontia daplidice*	1
12	*Papilio protenor (? Cannot ID due to lack of clear photos)*	1
13	*Inachis io*	Larvae abundant

Table 5: Frog spp. observed in assessment area.

#	Scientific Name	Quantity	Protection Level
1	*Pelophylax nigromaculatus* 	1	***National Level 2***

Limitations:

First, the survey would ideally have been conducted for multiple times, instead of just once with a limited two-day duration, so that the timing could have been better coordinated with seasonality of certain wildlife use. Second, due to severe time and budget constraints, the surveyors did not specifically record the locations, number, and quantities of species found in the Yanxiu Park itself, making it very difficult to clearly characterize the habitat contribution of the Park. Third, because the Park offers unique water features such as creeks, ponds and wetlands, aquatic wildlife species should have been included as one important survey category.

We end this section of environmental benefits with responses from the environment-related questions in our social survey, even though the time and budget constraints prevented us from collecting other environmental data.

- 96% of the residents agree that the Park improves Liaoyang's urban ecological environment;
- 72% of the residents reported a *perceived* increase of wildlife species and quantity in the Park as compared to predevelopment conditions;
- 73% of the residents reported a *perceived* improvement of water quality in the Park

as compared to predevelopment conditions;

- ➢ 91% of the residents reported a *perceived* improvement of air quality in the Park as compared to predevelopment conditions;
- ➢ 82% of all respondents agree that the landscape design of the Park presented a natural and ecological healthy environment.

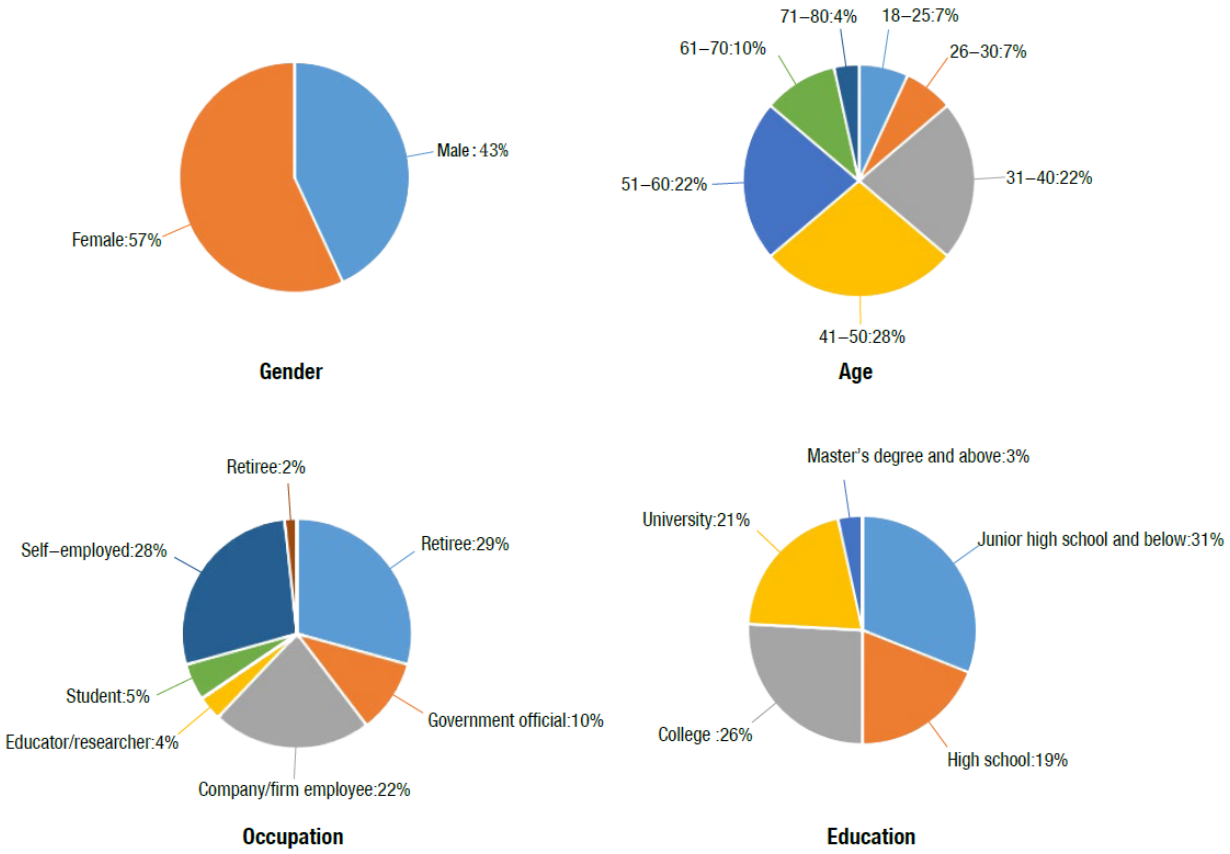
Social Benefits

For investigations of social benefits, we used a combination of methods including site investigations (6/1-6/2 and 6/30-7/1, 2017), literature search, social survey (June & July, 2017), as well as phone and in-person interviews.

To provide more details on the social survey, our research team completed the design of the survey instrument in May and obtained IRB approval on May 24, 2017. The survey mainly targeted residents of the Liaoyang City, with a small number of questions specifically for visitors. Main topics explored included: frequency, timing, duration of park use, means/cost of transportation, primary activities, understanding of the environmental features, perception of potential environmental, social, and economic benefits, satisfaction with the overall design, and so on (see Appendix II for the survey instrument).

The survey was implemented in Mandarin through two channels. First, the online version was distributed via the WeChat Mobile App with the survey itself hosted on www.sojump.com, in consideration of the overwhelming preference of mobile phone vs. computer use. Second, an intercept survey was implemented in the park on Friday 6/30 and Saturday 7/1, 2017. Up until Jul. 17, 2017, the survey received a total of 58 responses (online 18, intercept 40) from 50 residents and 8 visitors (see Figure 5 for an overview of the demographic information). Due to people's concerns on mobile identity theft, the online survey received fewer responses than expected.

Figure 5: Survey respondent details.



- *Attracts over 1,530 visitors on a typical weekday evening. Of 50 residents surveyed, 54% use the park more than 3 times per week. The park is accessible to an estimated 82,440 nearby residents within a half-mile walking distance.*

Without official estimates of park visitation, the research team did a rapid assessment on the number of people present in the Park during the time of 7:00-7:30pm on June 30, 2017 (Friday) when the daily peak hour began and a large number of people started their after-dinner exercises in the Park. The estimate was made by three researchers riding a multi-rider bicycle circling once around the Park, with each researcher responsible for counting people in one direction (left, right, and front). The bicycle trip covered all major outdoor spaces with a speed faster than people's walking speed to avoid counting the same visitors for multiple times. The final estimate was that 1,533 people were present at the Park during that half hour, including 317 people from 8 speed-walking groups (Figure 6).

A subsequent interview with the multi-rider bicycle rental indicates that this visitation number is representative of a typical workday night condition, with higher numbers on weekends and holidays. Interviews with daytime users also suggested heavy park use during early mornings before 8:30am due to needs for morning exercises. Since the rapid head-count was only for visitation during that half hour on 6/30/17, we believe the total number of people visiting the park per day well exceeds this estimate of 1533.

Figure 6: Primary park uses observed during site visits.

In addition, we looked at the total number of residents living nearby to better understand their access to the Park. We applied a standard of no more than a half mile as a reasonable distance to walk to a park, as suggested by *The Center for City Park Excellence* of *The Trust for Public Land*[S1] and identified from Google Maps a total of 7 residences (Table 6) within this 0.5-mile radius. We then web-searched the total number of households within each residence[S2] and applied a national average of 3.0 people per household[S3] to estimate the total number of people living within a half mile of the Park. Our final estimate of population with easy access to the Park is about 82,344. With that being said, our social survey indicated that 76% of the 50 resident respondents live <5km (3.1 mile) from the Park, with 24% from a distance larger than 3.1 miles, providing strong evidence that the Park serves many more citizens than those living close by.

Table 6: The seven residences within a half mile distance to the Park.

#	Residence	# of households	Estimated Population[S3]
1	Fan Mei Hua Ting	1900	5700
2	Jin Yu Ming Zhu	5000	15000
3	Wan Jia Guo Ji	456	1368
4	Jing Du Cheng	7200	21600
5	Dong Yue Shi Ji Cheng	1102	3306
6	Heng Da Lv Zhou	6324	18972
7	Lan Wan Guo Ji	5466	16398
	Total	**27,448**	**82,344**

The impressive visitation number suggests that the Park has truly become a very important daily destination for the residents. According to our social survey, 76% of the resident respondents use the Park at least weekly, 54% use the Park >3 times/week, and 30% use the Park every day (Figure 7A). 92% of the residents spent more than an hour at the Park each time they come (Figure 7B). In addition, 31% of the residents arrive at the Park without any cost, with 74% spending no more than 5 RMB ($0.7) in transportation fees (Figure 7C), indicating that access to Yanxiu Park has been highly affordable.

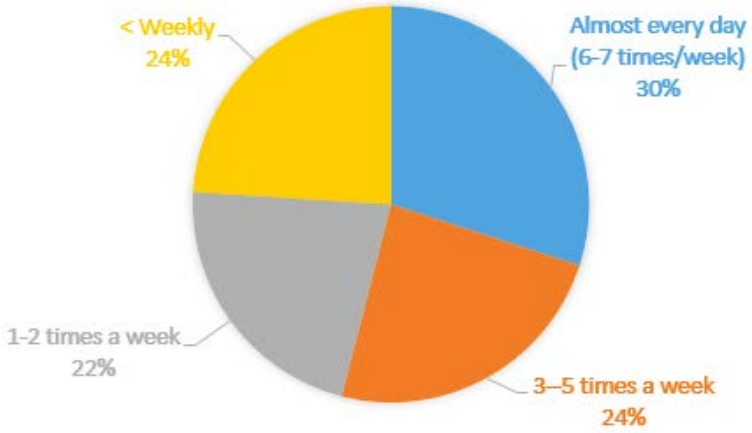
Sources:

[S1] *http://parkscore.tpl.org/Methodology/TPL_10MinWalk.pdf*

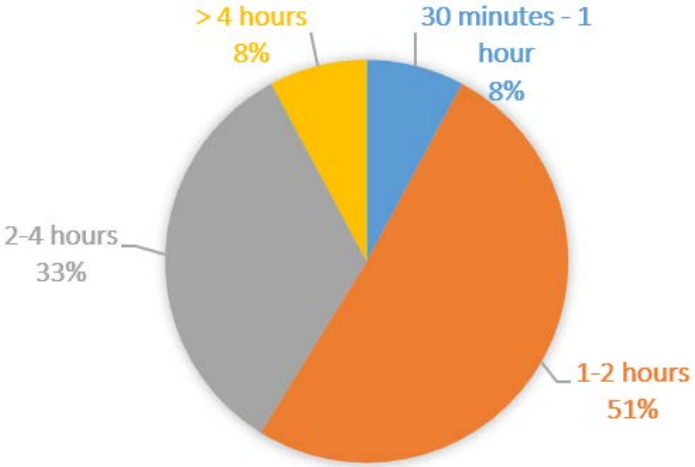
[S2] *http://www.fang.com/*

[S3] *Based on research by Michael Bauer Research (2016), https://www.arcgis.com/home/item.html?id=1d88d064071b438ab7143fa4c6dbac1e*

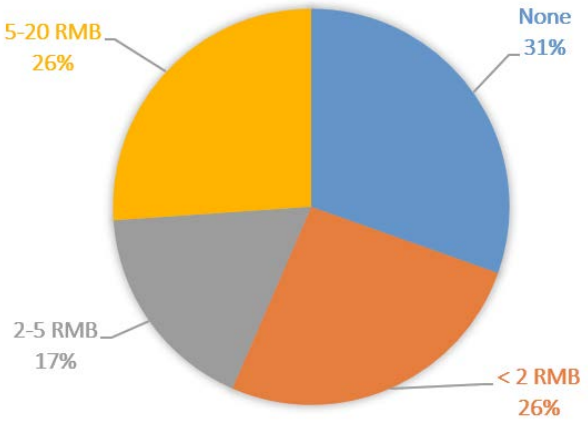
Figure 7:
A) Frequency of park use by the residents;



B) Duration of park use per visit;



C) One-way transportation cost to get to the Park.



- *Improves perceived physical health according to 86% of 50 surveyed residents and diversifies opportunities for recreational activity according to 92% of residents. The park is used for at least 33 types of outdoor activities, especially those promoting health, family bonding, and social interactions.*

The social survey and site investigations indicated that residents mainly come to the Park for exercising (72% residents reported as one primary activity), relaxing/hanging out with family (46%), and socializing with friends (32%), indicating the positive impacts of the Park in promoting health, family bonding, and social interactions.

To provide a full picture of how people use the Park, we recorded a total of 33 types of outdoor activities residents primarily undertake at the Park from the survey, among which the top 5 ranked are strolling, leisure activities with family, speed walking, gathering with friends, and photography. Table 7 below listed the 12 types of activities that at least 10% of the resident respondents reported as their primary activities. The other 21 types include hanging out in/around a tent, activities on ice (winter), walking dog(s), observing plants/wildlife, cycling, riding multi-rider bicycles, practicing musical instruments, fishing, people-watching, swimming, Taiji, singing/practicing traditional opera, picking wild vegetables, taking wedding photos, reading, plaza dancing, flying kites, dating, playing diabolo, spinning a top, and social/commercial events. The wide range of activities observed also aligns with the social survey where 92% of 50 residents agree that the Park diversifies their recreation activities.

Another interesting finding is that the resident respondents chose the Park for 25 types of activities because no other better alternative open space is available to accommodate these activities (termed “exclusive activities” hereafter). The top 5 ranked exclusive activities include speed walking, strolling, leisure activities with family, picnicking, and gathering with friends (Table 8), again emphasizing the indispensable role of the Park for accommodating physical and social activities. Other types of exclusive activities include: enjoying riverfront scenery, tennis/basketball, bringing kid(s) to playground, jogging/running, hanging out in/around tent, cycling, practicing musical instruments, fishing, photographing, relaxing/hanging out, using outdoor gym equipment, activities on ice (winter), observing plants/wildlife, riding multi-rider bicycles, people-watching, Taiji, picking wild vegetables, walking dog(s), swimming, and reading.

Table 7: Residents' primary outdoor activities at the Park.

#	Type of activities	% of pp. reported as primary activities
1	Strolling	72%
2	Leisure activities with family	46%
3	Speed walking	42%
4	Gathering with friends	32%
5	Photographing	22%
6	Enjoying riverfront sceneries	18%
7	Relaxing/Hanging out	16%
8	Picnicking	16%
9	Using outdoor gym equipment	14%
10	Taking kid(s) to playground	14%
11	Tennis/Basketball	12%
12	Jogging/running	10%

Table 8: Residents' top five exclusive outdoor activities at the Park.

#	Type of activities	% of pp. reported as exclusive activities
1	Speed walking	30%
2	Strolling	22%
3	Leisure activities with family	13%
4	Picnicking	13%
5	Gathering with friends	9%

86% of the 50 resident respondents agreed that the Park improved their own health. Besides the survey results mentioned above where strolling and speed walking were reported as the most important primary and exclusive activities, our site encounter with the eight speed walking clubs (Figure 6) also strongly supported the health benefits of the Park. The social survey was able to recruit 10 members from 4 clubs, among which 50% reported that their clubs, with ~300 members in total, come to the Park every day for 1-2 hours of exercising.

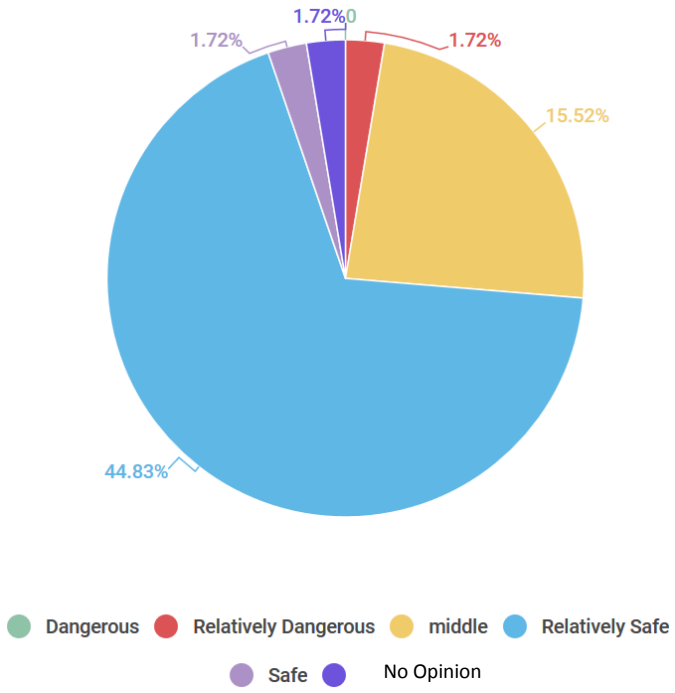
Besides improving health and diversifying activities, the Park influenced people's quality of life in a number of other ways according to our social survey:

- 80% of the residents agreed that the Park improved their social interactions. This fits well with the primary activities reported above where "gathering with friends" ranked as the 4th primary activity;
- 74% of the residents characterized the Park as an important summer destination for escaping the heat, among which 38% emphasized the Park as being extremely important in this regard;
- 62.5% of 8 visitors agreed that the Park enriched their tourist experience.

- *Is perceived as safe for use during flood season by 86% of the 50 surveyed residents.*

As mentioned in the Case Study Brief, one of the major challenges for obtaining permission to establish the Yanxiu Park at this location was safety concerns during the flood seasons. However, our social survey recorded that 86% of the resident respondents *perceived* the Park to be safe to use during the annual floods, and 38% reported a perception of "extremely safe" (Figure 8).

Figure 8: Safety perception during flooding season.



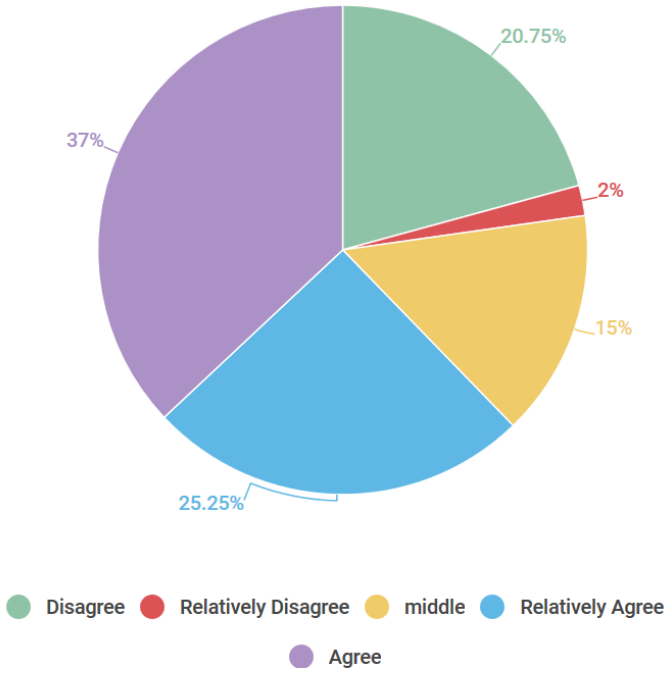
- *Improves understanding of ecological conservation for 62% of the respondents.*

The social survey reported that 62% of all 58 respondents agree that the Park improves their own understanding of ecological conservation.

Limitations:

Although the intercept survey was efficient in collecting people's responses, the fact that we only had one research assistant for a two-day survey was the key constraint in achieving a larger sample size. The main responses were collected between 9am to 9pm, missing the early morning park users. A better way to implement the online survey should be further explored, which would not only more efficiently increase the sample size, but also potentially reveal different perspectives of those who do not use the Park as frequently. Moreover, if there were a better way to distribute the survey to residents living within a half-mile radius, the results would have been more robust in demonstrating how the Park has influenced the lifestyle of those ~82,300 people within walkable distance.

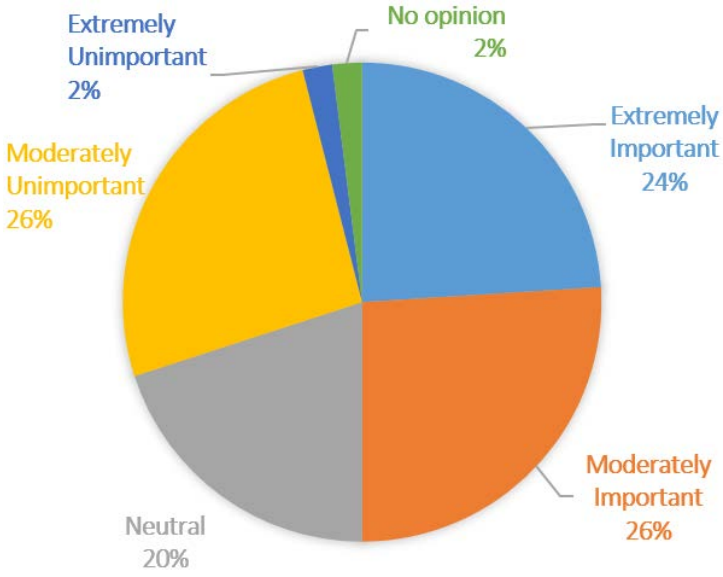
Figure 9: Level of agreement whether the Park improves understanding of ecological conservation.



- *Influenced housing choice for 50% of 50 surveyed residents.*

50% of the residents reported that "adjacency to the Park" has been/will be an important factor to consider in their decision of locating their residence, among which 24% emphasized it as being an "extremely important" factor (Figure 10).

Figure 10: Importance of "adjacency to the Park" in housing choice.



Limitations:
Ideally, this benefit would have been better quantified through a more thorough investigation into the level of *actual* influence of the Park in people's housing choice. The survey would have better targeted the residences of the River-east new district to find out the role of the Park when people made their decision to locate their new residences here.

We end this section of economic benefits with one last survey result:

- ➢ 96% of all respondents agree that creation of the Yanxiu Park more efficiently utilized vacant land resources within the city.

Economic Benefits

- *Created 19 jobs in park management, including facility maintenance, security, and cleaning services. Landscape maintenance work creates additional jobs.*

According to interview with the River-east new district development commission [ECON1], 19 positions were created to manage the park, including facility maintenance (2), security (2), and cleaning services (8 for land, 7 for lake/riverfront). In addition, commissioning landscape maintenance work to an independent firm indirectly created substantial job opportunities for the citizens.

Sources:
[ECON1] *Interview with Mr. Song, Director, Landscape Department, River-east new district development commission, Liaoyang City.*

Cost Comparison Methods

- *If the park were not built at its current location, but rather on another high-value parcel of the same size in the River-east new district, the city would have lost $41 to $45 million in land transaction revenue for new residential, commercial or office development.*

As mentioned in the main Case Study Brief, Yanxiu Park was built on a 28-ha construction-restricted area within the 100-year floodplain of Taizi River, rather than a valuable developable land within the River-east new district. This approach preserved a significant amount of land transaction revenue for the local government by keeping developable land for residential, commercial, and office development within the new district.

To investigate this benefit, we estimated the total Land Transaction Fees (LTFs) generated from the same amount of land (28ha) in the River-east new district during 2011-2012 when the Park was under design and construction. To provide a little more background about the Land Transaction Fee and land use rights in China, as all the land of the country are owned by the State or its agricultural collectives, real estate developers must pay the State a granting fee, i.e., the LTF, in order to obtain land use rights for a specific term and duration.

We obtained records of all land transactions in 2011 and 2012 (Table 9) within the River-east new district from the Liaoyang Land and Resources Bureau. A total of 23 parcels of land were available for residential, commercial, or office development during those 2 years. The area of planned residential development totaled 59 ha, whereas that of planned commercial/office development totaled 76 ha. The total LTFs generated by the residential development summed up to $97 million, with an average revenue of $1.6 million per ha. The total LTFs generated by the commercial/office development summed up to $114 million, with an average revenue of $1.5 million per ha. Therefore, in an alternative scenario where the Yanxiu Park were built on these developable parcels, the City would have lost $41 to $45 million ($41,975,871 to $45,891,720) in LTF revenue from residential or commercial/office developments.

Table 9: Land Transaction Revenue from Developable Parcels during 2011-2012.

#	Parcel #	Land Use	Time Available for Development	Land Area (m^2)	Gross Floor Area (GFA) (m^2)	Land Transaction Fees (LTF) ($)
R1	**2011AX008**	R	6/14/11	24828	81932	3,833,824
R2	**2011AX010**	R	6/14/11	174689	244565	23,120,588
R3	**2011AX013**	R	8/25/11	63121	189362	9,747,059
R4	**2011AX014**	R	8/25/11	38583	115748	5,957,353
R5	**2011AX016**	R	8/25/11	51342	154025	7,927,941
R6	**2011AX017**	R	8/25/11	42012	126035	6,486,765
R7	**2011AX021**	R	12/28/11	184778	461946	35,352,941
R8	**2012AX003**	R	7/10/2012	10843	27108	4,305,882
			Total	**590,195**		**$96,732,353**
			Average/ha.			**$1,638,990**
					LTF generated by 28 ha. =$1,638,990 x 28 = $45,891,720	

#	Parcel #	Land Use	Time Available for Development	Land Area (m^2)	Gross Floor Area (GFA) (m^2)	Land Transaction Fees (LTF) ($)
C1	**2011AX001**	C	4/21/11	71546	178865	9,470,588
C2	**2011AX005**	C	5/19/11	137673	261578	27,333,824
C3	**2011AX006**	C/S	6/2/11	14432	57728	2,411,765
C4	**2011AX007**	C	6/2/11	4826	7721	639,706
C5	**2011AX011**	C	6/14/11	275209	688022	31,770,588
C6	**2011AX015**	C/S	8/25/11	35673	142692	5,508,824
C7	**2011AX018**	C	9/22/11	19674	29511	3,038,235
C8	**2011AX022**	C/S	12/28/11	120209	384667	18,561,765
C9	**2011AX023**	C/S	12/28/11	27172	81515	4,195,588
C10	**2011AX024**	RW	12/28/11	3000	1500	364,706
C11	**2011AX025**	RW	12/28/11	2996	1498	397,059
C12	**2011AX026**	RW	12/28/11	2988	1494	395,588
C13	**2012AX001**	C	7/10/12	14761	22142	3,264,706
C14	**2012AX002**	C	7/10/12	18895	37790	4,176,471
C15	**2012AX004**	C	7/10/12	10600	21200	2,352,941
			Total	**759,652**		**$113,882,353**
			Average/ha.			**$1,499,138**
					LTF generated by 28 ha. =$1,499,138 x 28 = $41,975,871	

(C = Commercial/Office; C/S = Commercial/Service; R = Residential; RW = Retail/Wholesale)

Sources:

Liaoyang Land and Resources Bureau land transaction records.

Appendix I: List of Native Plant Species Observed during the Survey

#	Scientific Name	#	Scientific Name
1	*Potamogeton crispus*	26	*Chelidonium majus*
2	*Trapa bispinosa*	27	*Chenopodium album*
3	*Potamogeton malaianus*	28	*Capsella bursa-pastoris*
4	*Vallisneria natans*	29	*Trifolium repens*
5	*Polygonum lapathifolium*	30	*Metaplexis japonica*
6	*Rumex patientia*	31	*Leonurus artemisia*
7	*Ixeridium chinense*	32	*Geranium sibiricum*
8	*Hemistepta lyrata*	33	*Cirsium setosum*
9	*Conyza canadensis*	34	*Vicia bungei*
10	*Artemisia selengensis*	35	*Plantago asiatica*
11	*Cirsium japonicum*	36	*Scorzonera albicaulis*
12	*Calystegia hederacea*	37	*Carduus nutans*
13	*Rorippa indica*	38	*Menispermum dauricum*
14	*Mazus japonicus*	39	*Viola collina*
15	*Trigonotis peduncularis*	40	*Androsace umbellata*
16	*Humulus scandens*	41	*Ixeridium sonchifolium*
17	*Isatis tinctoria*	42	*Medicago lupulina*
18	*Potentilla supina*	43	*Ranunculus sceleratus*
19	*Myosoton aquaticum*	44	*Rumex trisetifer*
20	*Lycopus lucidus*	45	*Beckmannia syzigachne*
21	*Cannabis sativa*	46	*Plantago major*
22	*Polygonum orientale*	47	*Sonchus oleraceus*
23	*Hyoscyamus niger*	48	*Equisetum arvense*
24	*Galium aparine*	49	*Vicia amoena*
25	*Bothriospermum chinense*		

Appendix II – Survey Instrument: Use and Perception of the Yanxiu Park Landscape[†]

1. What is your purpose at the Park?
   - o I live in Liaoyang.
   - o I am visiting here for business.
   - o I am here traveling for leisure/visiting family or friends.
   - o Other (please specify): _____

[Residents Only]

2. On average, how often do you visit the Park?
   - o Almost everyday (6-7 times/week)
   - o 3-5 times a week
   - o 1-2 times a week
   - o About once every two weeks
   - o About once every month
   - o About once every quarter
   - o This is my first visit
   - o Other (please specify): _____

3. Typically, which days do you come to the Park?
   - o Weekdays
   - o Weekends
   - o Holidays
   - o Depends on my schedule

4. What time of the day do you typically arrive at the Park?
   - o Before 6:00
   - o 6:00-9:00
   - o 9:00-12:00
   - o 12:00-15:00
   - o 15:00-18:00
   - o After 18:00
   - o Multiple times a day
   - o Not always the same, depending on my schedule

5. How far away do you live from the Park?
   - o < 1 km
   - o 1-3 km
   - o 3-5 km
   - o 5-10 km
   - o > 10 km

[†] The actual survey was implemented in Mandarin.

6. How do you usually arrive at the Park?
   - o On foot
   - o By bike
   - o By scooter
   - o By private car
   - o Public transportation
   - o Multi-mode (please specify): _____

7. What is your traveling time to get to the Park (one way)?
   - o < 0.5 hour
   - o 0.5-1 hour
   - o 1-2 hours
   - o > 2 hours

8. How much is the overall daily transportation cost to get to the Park?
   - o None
   - o < 2 RMB
   - o 2-5 RMB
   - o 5-20 RMB
   - o > 20 RMB
   - o Please enter the specific amount here if you will: _____

9. Please select 3 spaces in the Park that you utilize the most according to the MAP.

10. On average, how much time per day do you spend at the Park?
    - o Within 0.5 hour
    - o 0.5-1 hour
    - o 1-2 hours
    - o 2-4 hours
    - o More than 4 hours

11. What are the primary activities that you participate while at the Park? (check all that apply).

    Leisure
    - ❑ Relaxing/hanging out
    - ❑ Strolling
    - ❑ Walking dog(s)
    - ❑ Reading
    - ❑ Observing plants/wildlife
    - ❑ Enjoying coastal scenes
    - ❑ People-watching

    Physical activities
    - ❑ Jogging/Running
    - ❑ Speed walking
    - ❑ Cycling
    - ❑ Plaza dancing
    - ❑ Using outdoor gym equipment
    - ❑ Tennis/Basketball
    - ❑ Swimming

Family recreation and socialization

- ❑ Riding multi-rider bicycles
- ❑ Leisure activities with family
- ❑ Hanging out in/around tent
- ❑ Taking children to the playground
- ❑ Flying Kites
- ❑ Picnicking
- ❑ Gathering with friends
- ❑ Dating
- ❑ Activities on ice (winter)

Talent cultivation

- ❑ Photographing
- ❑ Qigong
- ❑ Taiji
- ❑ Playing instruments
- ❑ Playing diabolo
- ❑ Spinning a Top
- ❑ Singing/practicing traditional opera
- ❑ Fishing

Other:

- ❑ Social/Commercial events
- ❑ Taking wedding photos
- ❑ Picking wild vegetables
- ❑ Working (maintenance, cleaning, etc.)
- ❑ Other (please specify):

12. From the list above, select the activities you choose to participate at the Park because no other open spaces are easily available to you to accommodate them.

13. Are you a member of some walking/hiking club?
    - o Yes
    - o No

14. On average, how often does your club come to the Trail for group activities?
    - o Almost every day (6/7 times per week)
    - o 3-5 times a week
    - o 1-2 times a week
    - o About once every two weeks
    - o About once every month
    - o About once every quarter

15. If you are willing to, please specify the following information:
    - o The name of the club: _____
    - o Total # of members in the club: _____
    - o Club's contact Info: _____

16. If you regularly participate in any other club/group activities at the Park, please specify the activities and their frequency, and the club/group name (if applicable).

17. Based on your observation, how has the wildlife diversity and amount changed after the establishment of the Park in comparison to before?
    - o Substantially increased
    - o Moderately increased
    - o No change
    - o Moderately decreased
    - o Substantially decreased
    - o I did not notice
    - o I am not familiar with the conditions before
    - o Other (please specify): _____

18. Based on your observation, how has the water quality in the Park changed after the establishment of the Park in comparison to before?
    - o Substantially improved
    - o Moderately improved
    - o No change
    - o Moderately degraded
    - o Substantially degraded
    - o I did not notice
    - o I am not familiar with the conditions before
    - o Other (please specify): _____

19. Based on your observation, how has the Air quality in the Park changed after the establishment of the Park in comparison to before?
    - o Substantially improved
    - o Moderately improved
    - o No change
    - o Moderately degraded
    - o Substantially degraded
    - o I did not notice
    - o I am not familiar with the conditions before
    - o Other (please specify): _____

20. In summers, is the Park an important destination for you to stay out of the heat?
    - o Yes, extremely important
    - o Yes, moderately important
    - o Neutral
    - o Moderately unimportant
    - o Extremely unimportant

21. If you have already purchased a residence / plan to purchase a residence in the future, was/would “proximity to the Park” be one of the factors for selecting the location of your residence?
    - o Yes, an extremely important factor
    - o Yes, a moderately important factor
    - o Neutral
    - o Not very important
    - o Not important at all
    - o No opinion

[Visitors Only]

1. Which city/town/village do you currently live in?

2. How many times have you been to this Park?

3. How far away are you staying from the Park?
   - o < 1 km
   - o 1-3 km
   - o 3-5 km
   - o 5-10 km
   - o > 10 km

4. How did you arrive at the Park?
   - o On foot
   - o By bike
   - o By private car
   - o Public transportation
   - o Multi-mode (please specify): _____

5. How much time in total have you spent at the Park during this trip?
   - o Within 0.5 hour
   - o 0.5-1 hour
   - o 1-2 hours
   - o 2-4 hours
   - o More than 4 hours

6. What are the primary activities that you participate while at the Park? (check all that apply). [Same as the Resident question]

[Both Residents and Visitors]

22. How would you rate the ambient noise (e.g., transportation noises) level when you are in the park?
    - o Extremely high
    - o Moderately high
    - o Neutral
    - o Moderately low
    - o Extremely low (barely noticeable)

23. How would you rate the safety of the Park during flood seasons when the water level of Taizi River is high?
    - o Extremely safe
    - o Moderately safe
    - o Neutral
    - o Moderately unsafe
    - o Extremely unsafe

24. Please indicate how much you agree with the following statement: The landscape design of the Park presented a natural and ecologically healthy environment.
    - o Strongly disagree
    - o Moderately disagree
    - o Neutral
    - o Moderately agree
    - o Strongly agree

25. Please indicate how much you agree with the following potential environmental, social, or economic benefits provided by the Park [Scale: Strongly Disagree, Moderately Disagree, Neutral, Moderately Agree, Strongly Agree]:

[for Residents]	[For visitors]
Improves urban ecological environment	Improves urban ecological environment
Improves my physical health	Provides wildlife habitat
Diversifies my recreation activities	Diversifies my travel experience
Increase my social activities	Improves my understanding about ecological conservation
Improves my quality of life	Improves citizens' physical health
Improves my understanding about ecological conservation	Diversifies citizens' recreation activities
Increases land use efficiency	Increase citizens' social activities
Other (please specify):	Improves citizens' quality of life
	Improves image of the city
	Increases land use efficiency
	Other (please specify):

26. Please rate your overall satisfaction toward the design of the Park (1=extremely unsatisfied, 5=extremely satisfied)

27. If you consider that the design of the Park needs improvement, which deficiencies should the designers address? (Check all that apply)
    - ❑ Transportation is inconvenient to get to the Park.
    - ❑ Parking space is limited.
    - ❑ Deficiency in dining, retail, restrooms and other facilities.
    - ❑ Deficiency in trash cans.
    - ❑ Deficiency in seating.
    - ❑ Deficiency in fitness facilities.
    - ❑ Deficiency in play equipment.
    - ❑ Park gets too crowded at certain locations.
    - ❑ Safety hazard exists at certain locations.
    - ❑ Scenery in the Park is not stunning enough.
    - ❑ Park is poorly maintained.
    - ❑ Other (please specify): _____

28. Please share any other comments you may have about potential improvements that could be made to the Park to enhance your experience here.

29. Please indicate your gender
    - o Female
    - o Male

30. What year were you born?

31. Please indicate your occupation:
    - o Retiree
    - o Government official
    - o Company/firm employee
    - o Educator/researcher
    - o Military
    - o Student
    - o Self-employed
    - o Laid-off workers
    - o Other (please specify): _____

32. What is your highest level of formal education?
    - o Junior high school and below
    - o High school
    - o University or college bachelor's degree
    - o Master's degree and above