Potential Assessment, Pattern Recognition and Phase Segmentation of Summer Residential Tourism for China's CTDZs Justified by a Compound Summer Residence Index (SRI)

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Abstract Summer residential tourism is the future trend in China because of tourists' living quality improvement, heat crisis, rising market demand, and optimization of the destinations' residential environment, transport and accessibility. Compared with summer tourism and vacation tourism, summer residential tourism had got less attention and lacks in prospective and preventive research. Hence, this study focused on potential assessment, pattern recognition and phase segmentation of 32 residential tourism destinations in China selected from 4 lists. An index system of 16 indicators from 5 dimensions was established as Summer Residence Index (SRI), and Range method, Entropy weight method and Composite index method were chosen as the core methods. Three main conclusions were as follows. (1) Only 2 typical districts' SRI value were near to 0.6, and 4 destinations were below 0.1, about 26 destinations were at medium-level, which indicated that China's summer residential tourism was not so popular and only few destinations have stepped into a higher level. (2) Seven patterns could be recognized based on the contribution of the 5 dimensions to SRI value, including 3 single-factor driven patterns and 4 compound factors driven patterns. (3) Like tourist area life cycle (TALC), Unconscious stage, Initial stage, Developmental stage and Maturity stage could be segmented for summer residential destinations with the value of below 0.1, 0.1−0.3, 0.3−0.5, and above 0.5. Four destinations were under Unconscious stage. Twenty-two destinations were at initiate stage. Only 4 destinations have stepped into development stage and 2 at maturity stage. China' summer residential tourism has just started and has a better prospect. This study is just an attempt and needs further consideration, for example, a tracking study of SRI calculation for each year will be carried to justify the effectiveness of SRI and to check the rationality of the empirical results. As time goes on, policies in housing, residential estate and other aspects should be included as a factor in the SRI index. Data availability should be optimized because of better data sources and new technologies. Some other districts or cities in 2 batches of national Comprehensive Tourism Demonstration Zones (CTDZs) pilots and provincial CTDZs will be further selections of summer residential tourism destinations.

Keywords Summer residential tourism, Summer residence index, Comprehensive tourism demonstration zone (CTDZs), China

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Climate change is a globally popular topic and the relationship between climate change and tourism development is another one. Rising temperature and extreme weather event heatwave have become globally notorious even in originally cooler countries such as UK, France and Germany[1]. Heatwave has caused hazard impact, health problems even death[2-3]. According to Lancet Countdown, China has experienced an increase of 7.85 heatwave days in 2021 compared with the period of 1986—2005[4]. Southern and central China would meet with higher frequency and strength of heatwaves[5]. Heatwave event would last 14 to 30 days in the middle and lower reaches of Yangtze River[6]. As the news media reported in 2022, China has gone through the strongest high-temperature process since 1961, many typical cities had experience high-temperature days over 40, and many residents had to go out for summer sojourn. All the related studies indicated the exposure risk of high-temperature or heatwaves. The residents have enormous cooling demand, and the most effective avenue is summer residential tourism.

1 Research reviews and background

Throughout the world, residents always try to adapt to higher temperature or heatwave during the hottest season. Most of them use the air-conditioning, and some of them go on vacation in areas of moderate temperature. But in summer, air-conditioning loads would account for more than half of the peak electricity load and would bring risks or environmental problems. Hence, summer tourism is booming. Residential tourism or second-home tourism has gradually prevailed in Europe as summer tourism grows[7-8]. The residential tourism started late in China and winter-typed residential tourism was more popular than summer-typed. But summer residential tourism has been fostered by the visitors from typical furnace cities such as Wuhan, Chongqing and other cities. According to *National Summer Tourism Development Report* issued in 2023, about 94.6% of the residents liked travelling in summer and 89.1% of the total residents liked staying longer. About 300 million aged people, students and teachers, and residents from higher-temperature cities had higher intention to travel. They preferred long and medium-distance destinations, and climate, tourism resources and brand were the core attractive items. Summer tourism destination has experienced the transition from scenic spots to cities, from short time-stay to long-stay, hence they need more convenient services and infrastructures just like residents do. Summer residential tourism is the developing trend and it's not the same as summer tourism. From Yu's study, summer tourism has transited to the phase of heat-escape city[9]. Summer residential tourism

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in cities is the future trend compared with that in countryside because of more and more younger visitors' preference and choices in residential amenities and conditions.

This research topic can be included within the fields of residential tourism, summer tourism and tourism development potential assessment. Many international scholars have done efforts in residential tourism (or second-home tourism)[7-8,10-11]. Several scholars have done review studies on residential tourism[8,10,12-13]. Visser and Hoogendoorn proposed that residential tourism was increasing in developing countries but few scholars were interested in doing research on it[12]. Residential tourism has increased in China and summer-typed residential tourism is booming because of summer heat-escape requirements. China's residential tourism studies are comparatively far behind the residential tourism practices. The evidence can be found from Hall's review. He proposed that international scholars from China was only 5 and ranking only 21st and more scholars are needed to join in second-home tourism research[7]. Winter residential tourism studies have got attention by some local scholars[14-18], but few studies focused on summer residential tourism. Previous residential tourism studies had focused on few destinations, Sanya in Hainan Province was frequently included. Besides, most of theses studies focused on migration or mobility[15,19], not the development potential. Among existing research cases, many studies were based on meteorological indicators or tourism climate index[20-21], with no more care about other factors.

Multiple studies have focused on tourism development potential for rural tourism, nature-based tourism, forest tourism, ecological tourism, cruise tourism and wellness tourism. But few studies focused on summer residential tourism. Present studies on summer tourism potential mainly focused on climate comfort degree, tourism resources, traffic and location opportunities[22-23]. Few studies focused on leisure, visitors' satisfaction and security[24]. Recently, rural senior residential tourism is a hot topic because of the aging trend[25]. Wang Wenhua and Wang Rongcheng had established a compound index system for Summer Residence Cities[26], the research mainly engaged in summer environmental quality, residence service requirements, tourism resources and market potential. It provided inspirations for this study, but the authors pay more attention to the selection of study areas, indicators and data innovation. Among these study fields, there are research gaps left for further studies. Summer residential tourism potential evaluation can be a breakthrough in index innovation and new data collection, recognition of exploratory destination pattern and segmentation of development phases has both theoretical and practical implication.

China's modern tourism industry has developed since 1978 and has witnessed many development phases. It has gone by sightseeing, diversification of tourism supply and demand, daily routine, revolution of tourism supply side[16]. Many typical events or policies emerged, such as comprehensive tourism proposed in 2015. Comprehensive tourism demonstration zone (CTDZ) pilot started in 2015 and those districts or cities that have been recognized as CTDZs would be more appealing because of strict requirements in the criteria of tourism supply, public infrastructure and services. Revolution of tourism supply side was proposed in 2013, tourism products and public infrastructure and services have been improved nationally. The country had practiced New-typed urbanization, rural revitalization policies to guarantee high-quality development in many aspects as well as tourism industry. What's more, the double cycle of international and domestic economy development policy was proposed to stimulate domestic demand after Covid-19 in 2020 by President Xi Jinping. Tourism consumption is a reasonable part of domestic demand. Strategies to release the potential of tourism consumption and promote the high-quality development of tourism were accordingly formulated in September 2023. All these events and policies can promote tourism industry development. Even after the Covid-19, China's tourism has recovered fast, and performance of the last National Day golden week (29th September–6th, October) was the evidence, with 826 million domestic tourists (92% of the 2019 data). Besides, vacation tourism has become a leading market because of tourist transition in interior preference, value cognition, relaxation requirements and exterior constraints like congestion and long-haul physical exhaustion caused by mass tourism. This trend has been near to international tourism. Hence, summer residential tourism is the future trend of China's summer tourism. But there's discordance when compared with research shortages and demands for summer residential tourism, and it's of great necessity to do basic studies. And some typical research questions need to be focused. The research questions need to be clarified are following.

How to justify the summer-typed residential tourism potential?

Which cities are possible summer-typed residential tourism destinations in China?

What are their patterns? How about the development phase of the candidate destinations?

How to maintain the sustainable development of the chosen destinations according to their pattern or development phase?

2 Constructing the Summer Re–sidence Index (SRI)

Based on related indicators from Chinese summer residence cities, Chinese summer resort, summer tourism valuation, urban quality, tourism destination competitiveness, tourism destination sustainability and comprehensive tourism development evaluation[23,26-29], summer-typed residential tourism destinations' characteristics or requirements were combined, such as moderate temperature, attractive environmental and resources, more convenient transport and public services, lower living cost. Meanwhile, the demand-side items should be considered, the market potential, high temperature or heatwave crisis push[30-31]. Also, the residential tourists' potential preferences and requirements should be included from previous local survey and interviews which can be referred from Wang' study[32], namely better and comfortable living environment, convenient transport, better supply in recreation, wellness, food and services. Besides, the scholars' viewpoints were referred. Five dimensions were finally determined. When choosing indicators, 5 principles like the data availability, quantization, representation, contemporaneity and innovation were paid more attention, which means data of indicators should be the most presented and available from either survey or documented data, and should be quantified. Data should keep pace with the times and different from former indicators. Through the verification, the indicators of the Summer Residence Index (SIR) was presented in Table 1. Five dimensions and 16 indicators were included in SRI.

3 Materials and methods

3.1 Study areas

Summer residential destinations should have moderate summer temperature, attractive environmental resources, more convenient living conditions and lower living costs. Comparatively, some of two batches of CTDZs (168) reco-

gnized in 2019 and 2020 can satisfy these requirements because of the strict and selective criteria in tourism resources, public services, institutions and policies. These criteria call for public services about 230 scores, tourism supply of 240 scores, resources and environment 100 scores, which appropriately are above 50% of the total basic scores (the other is mainly about institution, policy, marketing). Summer residential tourism destinations must be chosen from summer tourism destinations. China Tourism Academy and China Meteorological Administration has published the best summer tourist cities in 2018 (30 cities) and 2023 (40 cities). China Meteorological Administration published a summer tourism destination list of 37 cities or scenic spots in 2021. Meanwhile, *Summer Habitat City List* (the first 30 cities) for migratory bird justified by suitability index in 2023 by SJTU (Shanghai Jiaotong University) is also referred. Among the 3 lists and CTDZs, the overlapped 32 cities or districts are chosen as the final study areas, i.e. China's first batch of summer residential destinations. The location of these cities is presented in Fig.1. These candidate cities or districts are mainly located in north or southwest of China, in accordance with China's geographical background, and most of these destinations are the leading summer tourism destinations across the country concluded by the scholars[32]. China' southeastern and southern parts are the hottest areas in summer, but there are no more selective summer residential destinations besides the mountains like Lushan and Moganshan. Also, these areas are leading markets across the country and provide higher market potential for summer residential tourism.

3.2 Data collection

For all the 16 indicators, data were mainly collected from statistical yearbook or statistical data, documented data and POI (point of interest) data from Gaode map, and some data from special platforms (Table 1). Data of some indicators should be simply calculated, such as national resorts, 5A(AAAAA), 4A(AAAA) scenic spots and city brands are the most representative attraction for a destination, 7, 5, 2 and 0.5 points were assigned for each kind of resources. At last, sum of each tourism resource number and the assigned score was as the final score. POI density was calculated using POI total number from Gaode map and total area from statistical yearbook of each destination. Other data were directly inquired from relative platforms or statistic yearbooks.

3.3 Methodology

Range method, Entropy weight method and Composite index method were chosen as the core methods. Among all of the 16 indicators, data standardization and weight calculation were the basic steps. Entropy weight method is a widely used objective method for weight calculation. Then Composite index method was employed to calculate the value of each dimension or the total value of SRI for each sampling site. The steps are followed.

(1) Using Range Method to data standardization.

For positive indicator (the bigger the better),

$$X_{ij}=\frac{x_{ij}-x_{\min}}{x_{\max}-x_{\min}}, X_{ij}\in(0,1) \tag{1}$$

For negative indicator (the smaller the better),

$$X_{ij}=\frac{x_{\max}-x_{ij}}{x_{\max}-x_{\min}}, X_{ij}\in(0,1) \tag{2}$$

where, X_{ij} and x_{ij} is separately the standardized and original value for the j^{th} indicator for ith region. x_{max} and x_{min} is separately the maximum and minimum value of the j^{th} indicator. Table 1 has listed the indicators' attribute (positive or negative).

(2) Calculating the weights for each indicator by Entropy weight method,

$$p_{ij}=\frac{x_{ij}}{\sum_{i=1}^{i} x_{ij}} \tag{3}$$

$$e_j=-k\sum_{i=1}^{i} p_{ij}\ln p_{ij} \tag{4}$$

$$k=1/\ln i \tag{5}$$

$$h_j=1-e_j \tag{6}$$

$$w_j=\frac{h_j}{\sum_{j=1}^{n} h_j} \tag{7}$$

where, i is equal to 32, representing the research regions' number; n is 16, indicating indicators' number; e_j means information entropy value; h_j means the coefficient of variation; w_j is the entropy weight of the jth indicator.

(3) Calculating the comprehensive index $f(x)$,

$$f(x)=\sum_{j=1}^{n} x_j w_j \tag{8}$$

Through $f(x)$, value of each dimensions or the total value of 5 dimensions can be calculated.

4 Results

4.1 Potential assessment of summer residential tourism in China

Table 2 is the SIR evaluation results. Present China's summer residential tourism potential of CTDZs is low, only few cities like

Table 1 Indicators of the SRI

Dimensions	Indicators	Attribute	Data source	Weights
Transport and accessibility (TA)	Distance to the nearest airport (p1)	_	Calculation from Gaode Map	0.014 7
	High-speed rail time cost from the nearest origin city (p2)	_	Inquiry from 12306.com	0.071 0
	Highway time from the nearest origin city (p3)	_	Calculation from Gaode Map	0.017 0
Environment and resources (ER)	Average daily summer temperature (June-August) (p4)	+	Calculation based on data from Meteorological record	0.022 6
	Forest coverage (p5)	+	Statistical Yearbook	0.017 4
	Percentage of days with good air per year (p6)	+	Statistical Yearbook	0.015 5
	Residential tourism resources endowment (p7)	+	Weighted calculation from 5A, 4A Scenic spots and National resort	0.022 1
Infrastructure and services (IF)	Density of cultural and recreational facilities (p8)	+	Calculation based on POI (point of interest)	0.219 5
	Density of business service facilities (p9)	+	Calculation based on POI (point of interest)	0.101 7
	Density of medical and health facilities (p10)	+	Calculation based on POI (point of interest)	0.111 4
	Density of accommodation service (p11)	+	Calculation based on POI (point of interest)	0.233 9
Residential cost (RC)	Ratio of housing price and the nearest destination and origin (p12)	_	Statistical data	0.004 6
	Daily price of economical-type hotel (p13)	_	Inquiry from Qunaer.com	0.004 9
Possible market potential (MP)	Scale of the market (p14)	+	Statistical Yearbook	0.032 6
	Consumption level of the market (p15)	+	Statistical Yearbook	0.066 1
	Economic development level of the market (p16)	+	Statistical Yearbook	0.044 9

Note: This map was drawn based on the base map with approval number GS (2023) 2767 from China National Department of Natural Resources standard map service system.

Fig.1 The study area

Laoshan and Beidaihe district present high values near to 0.6 because of longer vacation tradition, better facilities and services, higher reputation and tourism innovation. Most of the districts and cities present from 0.1 to 0.385 4 cities are below 0.1, which means no potential at present phase. The result indicates that China's residential tourism has just started and reflects the status and trend of China's present tourism industry. China has stepped into the transition phase to vacation or leisure time, and vacation tourism product is not popular for all the tourists. Most of the tourists like to choose short-time journey because of holiday system, income level and other factors. Long-stay vacation has been just demanded because of new perspectives and preferences of tourists nowadays. In addition, this result also indicates a better prospect if the country or provinces design some effective chronological strategies for each development stage. Some destinations have done efforts to residential environment, tourism facilities and services to satisfy new requirements of CTDZs.

From Table 2, potential assessment of China's present summer residential tourism shows spatial difference because of push-pull variety of each destination, just like the items used in 5 dimensions. Economical conditions of tourist origins, the aging society, amenities lacking of usual environment, transport and ICT development, social-demographic characteristics and historical factors perhaps differ[31]. Destinations' natural environment, infrastructure and service supply, policies, social and cultural environmental factors can also prompt or impede the development of local summer residential tourism.

4.2 Patterns of summer residential tourism

According to Table 3, 4 districts will be exceptional when recognizing summer residential patterns because of low SRI values, that is Ji'an, Wudalianchi, Jiayin, and Chinan in Northeastern China. Summer residential pattern recognition is mainly based on the contribution of the SRI values, namely the driving factors of summer tourism destinations from comparative perspectives. Among remaining 28 districts or cities, 7 patterns can be concluded because of single driving factor or group of driving factors. From Table 3, single factor-driven pattern of market or living cost is missing. Even in combination with other factors as driving factors, living cost is not seen, which means living cost is not a competitive factor when developing summer residential tourism at this time. Potential advantage of the market is also not obvious, only Yanqin has this kind of advantage, located in the capital city Beijing with about 30 million of potential tourists including the floating population. Among all the patterns, infrastructure and services-driven pattern, traffic

and location-driven pattern account for the most, environment and resources-driven pattern ranks the second. Two factors-driven pattern are mainly traffic and location with infrastructure and services, and environment and resources. As a whole, present summer residential tourism mainly relies on infrastructure and services, traffic and location, environment and resources. This result indicates that summer residential tourism should not only rely on summer temperature comfort and environmental resources, traffic accessibility and hospital facilities economically invested by the governments or enterprises is also important. Services and policies are also important because they can help maintain the sustainable trend. This result is not the same as Nouza' and Bao's result because of new requirements of new tourists, and the residential tourism characteristics.

4.3 Development phase of summer residential tourism

Table 2 shows the results of SRI calculation. We can segment the development phases using SRI value of 32 sampling districts or cities like tourist area life cycle (TALC) does. The justifying standards are presented in Table 4. As above mentioned, 4 districts or cities would be deleted when recognizing the patterns because of their low SRI values. That means these 4 districts or counties are not developing to the direction of summer residential tourism and it can be called Unconscious stage with the SRI value below 0.1. Two typical districts Laoshan in Qingdao and Beidaihe in Qinhuangdao have stepped into the Maturity stage. These 2 areas not only have high-quality infrastructure and services, environmental resources (both urban and coastal), and better reputation, but also have a relatively stable market. And they have kept in step with times' development to satisfy visitors' new requirements. An example is Anay in Qinhuangdao, a typical middle-class community in tourism real estate transition endowed by culture and events. From 0.1 an 0.5, 2 development phases are segmented as Initial stage (0.1−0.3) and Developmental stage (0.3−0.5). Four districts and counties have stepped into development stage, including Yanqing near to the bigger market Beijing−Tianjin−Hebei Region (one of 3 developed regions in China), Penglai near to coastline, Huaxi in Guiyang (a newly booming summer tourism destination), and Jiuzhaigou County which is renown for its natural landscape. That means present China' s summer residential tourism is gradually transitioned from traditional summer tourism because tourists have inherent preference to coastal cities or resource endowment. Comparably, cities at this stage just have moderate hospital conditions, and should refer to effective countermeasures or strategies during developing. About 22 cities are at the Initial stage, which means China's summer residential tourism has just started, and has a better prospect in future. These cities are far from coast and the developed regions like the Yangtze River Delta and Pearl River Delta, but recently developed well in tourism industry, and need more improvement in residential environment and hospital facilities and services. As inspired by TALC theory, characteristics of each phase is roughly discussed through fully consideration about summer residential tourism destinations,

Table 2 Potential assessment results of summer residential tourism

Province	District/County	TA	ER	IF	RC	MP	SRI
Beijing	Yanqing District	0.096 3	0.052 7	0.042 8	0.007 9	0.120 5	0.320 1
Shanxi	Yangcheng County	0.022 2	0.040 7	0.026 2	0.008 8	0.014 5	0.112 3
	Zezhou County	0.090 3	0.031 4	0.018 9	0.008 6	0.014 5	0.163 7
Jilin	Chibei District	0.073 7	0.053 9	0.003 1	0.007 7	0.013 1	0.151 5
	Dunhua	0.077 4	0.040 7	0.005 4	0.008 2	0.013 1	0.144 7
	Chinan District	0.013 0	0.049 7	0.009 2	0.008 6	0.013 1	0.093 7
	Ji'an	0.009 6	0.037 9	0.009 8	0.008 1	0.013 1	0.078 5
Heilongjiang	Jiayin County	0.006 7	0.036 7	0.000 7	0.008 3	0.012 2	0.064 6
	Wudalianchi	0.011 7	0.027 4	0.003 6	0.009 0	0.012 2	0.063 9
Shandong	Laoshan District	0.083 0	0.047 4	0.424 2	0.004 3	0.053 4	0.612 3
	Penglai District	0.056 5	0.061 7	0.127 6	0.008 7	0.053 4	0.307 8
	Rongcheng	0.071 8	0.048 4	0.113 7	0.008 0	0.053 4	0.295 3
Hubei	Shennongjia forestry District	0.065 8	0.056 4	0.006 9	0.008 9	0.037 1	0.175 0
	Lichuan	0.078 0	0.044 1	0.027 9	0.009 1	0.037 1	0.196 1
Guizhou	Huaxi District	0.077 3	0.048 8	0.227 3	0.008 2	0.022 6	0.384 1
	Wudang District	0.078 4	0.051 4	0.093 4	0.008 9	0.022 6	0.254 7
	Panzhou	0.076 4	0.027 3	0.035 1	0.008 2	0.022 6	0.169 7
	Baili Rhododendron	0.015 2	0.034 4	0.022 6	0.008 3	0.022 6	0.103 1
	Chishui	0.022 2	0.055 2	0.029 6	0.007 7	0.022 6	0.137 3
	Libo County	0.085 4	0.060 5	0.013 3	0.008 1	0.022 6	0.190 0
Yunnan	Shilin YAC	0.064 6	0.041 5	0.024 7	0.009 1	0.028 8	0.168 7
	Dali	0.074 3	0.045 2	0.1196	0.007 7	0.028 8	0.275 5
	Tengchong	0.002 9	0.050 5	0.017 0	0.008 1	0.028 8	0.107 3
	Gucheng District	0.060 0	0.039 3	0.091 6	0.007 8	0.028 8	0.227 5
Shaanxi	Huangling	0.083 8	0.034 8	0.014 1	0.008 8	0.027 5	0.169 1
Gansu	Kongtong District	0.012 3	0.021 5	0.053 9	0.008 4	0.008 3	0.104 2
Ningxia HAR	Xixia District	0.027 4	0.036 9	0.101 3	0.007 9	0.021 5	0.195 0
	Shapotou District	0.088 1	0.025 2	0.026 0	0.007 4	0.021 5	0.168 2
Xinjiang UAR	Burqin County	0.009 6	0.041 7	0.029 7	0.004 2	0.018 6	0.103 9
Hebei	Beidaihe District	0.087 5	0.050 9	0.395 2	0.008 9	0.028 0	0.570 5
	Pingshan County	0.026 3	0.030 9	0.075 5	0.009 2	0.028 0	0.169 9
Sichuan	Jiuzhaigou County	0.007 8	0.039 6	0.234 7	0.009 0	0.040 2	0.331 3

Table 3 Patterns of summer residential tourism

No.	Pattern	District/County	Curves
1	Traffic and location-driven pattern (7)	Dunhua, Shilin YAC, Lichuan, Panzhou, Zezhou County, Huangling, Shapotou District	Fig.2A
2	Environment and resources-driven pattern (4)	Tengchong, Yangcheng County, Chishui, Baili Rhododendron	Fig.2B
3	Infrastructure and services-driven pattern (8)	Laoshan District, Huaxi District, Xixia Dis-trict, Jiuzhaigou County, Penglai District, Beidaihe District, Pingshan County, Kong-tong District	Fig.2C
4	Traffic and location, environment and resourcedriven (3)	Libo County, Shennongjia Forestry District, Chibei District	Fig.2D
5	Environment and resource, infrastructure and service-driven (1)	Burqin County	Fig.2E
6	Both infrastructure and service, traffic and location-driven (4)	Dali, Wudang District, Gucheng District, Rongcheng	Fig.2F
7	Both market, traffic and location-driven (1)	Yanqing District	Fig.2G

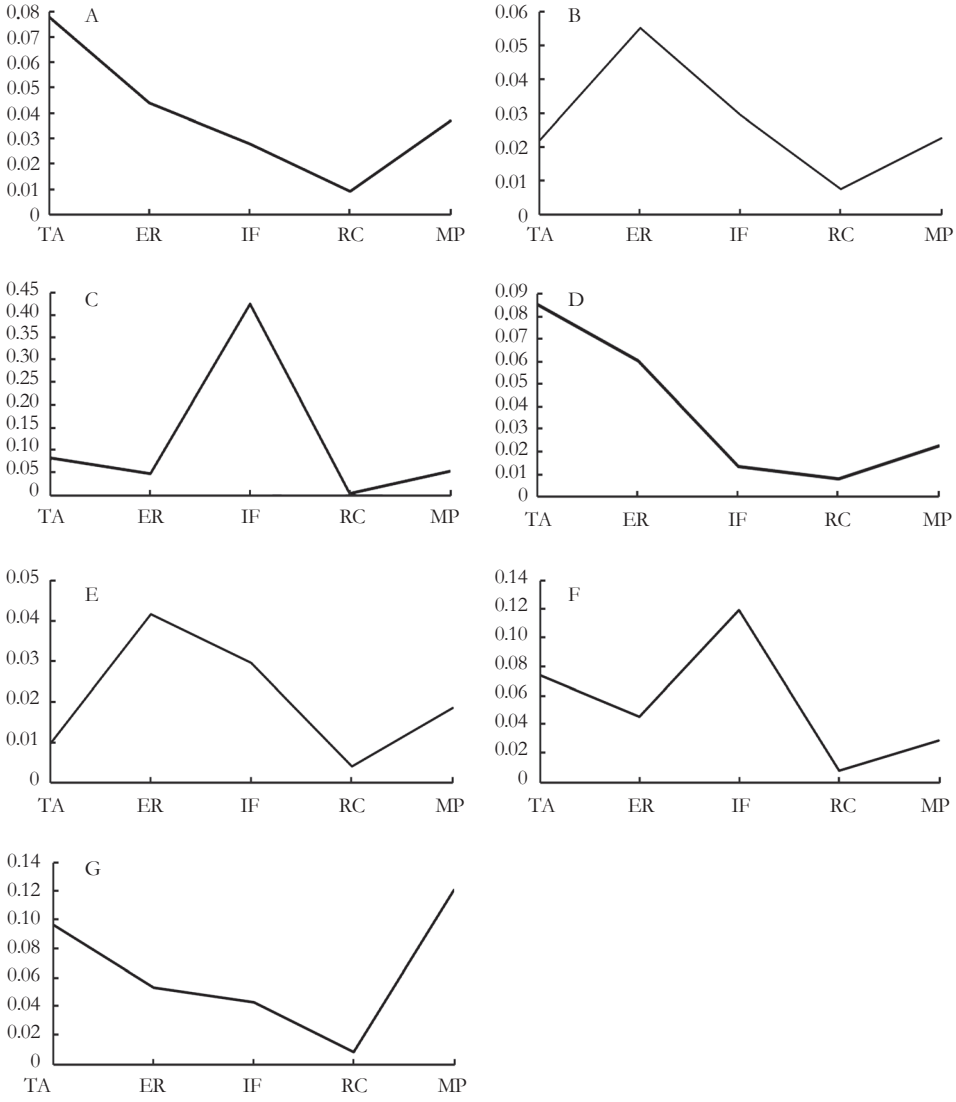

Fig.2 Curves of different summer residential tourism patterns

see Table 4. If cities at maturity stage don't care about the sustainable development and tourism innovation to satisfy the time's new requirements, stagnation or decline may happen and this is the ultimate intention.

For destinations at different development phases, the avenues should be diversified according to actual conditions. The mature destinations should maintain and innovate the service quality, produce new attraction to keep in step with times' requirements. Destinations during developing phase should improve the hospitality level, products variety, and marketing to realize the transition from traditional develop-ment. Initial residential tourism destinations should do basic work in human settlement construction, products development, public services provision, more investment in transport and marketing.

5 Conclusions and Discussion

5.1 Conclusions

This article empirically analyzed the potential, pattern and development phase of China's summer residential tourism destinations based on 32 districts or cities from *Summer Tourism Destination List* (in 2021), the Best Summer Tourist City (in 2018 and 2023), Summer Habitat City List (in 2023) and 2 batches of CTDZs. An index system of 5 dimensions and 16 indicators was established through reference to other scholars' research, previous field survey and experts' opinions. Range method, entropy method and composite index method were employed based on the data of 2022. The main conclusions and findings are following.

(1) Summer residential index and the assessment. Among these 32 destinations, only 2 typical districts' SRI value are near to 0.6, 26 districts or cities are within 0.1−0.5, and 4 destinations are below 0.1, which indicates China's summer residential tourism is not so popular and only few destinations have stepped into higher level. However, about 26 destinations are at medium level, indicating that China's summer residential tourism has just started and has a better prospect.

(2) Pattern recognition and the driving factors. According to the SRI calculation result, 7 patterns can be recognized based on the contribution of the 5 dimensions to SRI values, including 3 single-factor driven patterns and 4 compound factors driven patterns. Single factor-driven patterns are infrastructure and services-driven pattern, 2 traffic and location-driven pattern, environment and resources-driven pattern. Compound factors-driven patterns are both infrastructure and service, traffic and location-driven, both traffic and location, environment and resource-driven, both environment and resource, infrastructure and service-driven, both market, traffic and location-driven patterns. Totally, living cost is missing in destinations' competitive potential. Market

Table 4 Justifying standards for summer development phase

Phase (quantity)	*SRI*	Destinations	Characteristics	Avenues
Maturity stage (2)	$SRI \geqslant 0.5$	Laoshan District, Beidaihe District	▪ High-quality infrastructure and services ▪ Sustainable environmental resources ▪ Stable market and consumption ▪ Better reputation	▪ Preparation for innovation of products or space ▪ Maintain or improve the service quality
Developmental stage (4)	$0.3 \leqslant SRI < 0.5$	Yanqing District, Penglai District, Huaxi District, Jiuzhaigou County	▪ Medium hospital level ▪ Medium residential conditions ▪ Mixed products, less long-stay tourism ▪ Various market segmentation, less vacation tourists	▪ Hospitality needs improvement ▪ Product transition and place making ▪ Marketing adapts to product structure ▪ Accessibility needs improvement
Initial stage (22)	$0.1 \leqslant SRI < 0.3$	Yangcheng County, Zezhou County, Chibei District, Dunhua, Rongcheng, Shennongjia Forestry District, Lichuan, Wudang District, Panzhou, Baili Rhododendron, Chishui, Libo County, Shilin YAC Dali, Tengchong, Gucheng District, Huangling, Kongtong District, Xixia District, Shapotou District, Burqin County, Pingshan County	▪ General residential environment ▪ Not so good supply, weak facilities for vacation ▪ More short-stay tourists, less long-stay tourists	▪ Human settlement to be wholly improved for residence (including transport, environment, industry and public facilities) ▪ Tourism supply innovation (vacation product and public services developing) ▪ Supporting measures of investment, human capital, market management and policies. ▪ Various marketing needs
Unconscious stage (4)	$SRI < 0.1$	Chinan District, Ji'an, Jiayin County, Wudalianchi	No residential tourism	Guiding these regions to summer residential tourism destinations from residential environment improvement, marketing, facilities construction.

potential is only seen in one destination Yanqing District because of higher market demands of Beijing.

(3) Phase segmenting and development avenues. Like tourist area life cycle (TALC) does, Unconscious stage, Initial stage, Developmental stage and Maturity stage can be segmented with the value of below 0.1, 0.1−0.3, 0.3−0.5, above 0.5. Four destinations are under Unconscious stage, 22 destinations is at Initiate stage. ONLY 4 destinations have stepped into development stage and 2 at maturity stage. It means China' summer residential tourism has just started and has a better prospect. For destinations at different development phases, adaptive avenues should be designed to maintain the sustainable tourism trend.

5.2 Discussion

Three topics can be further discussed. During the establishing of SRI index, methodology and indicators selection can be completed in future studies. Present studies are limited because of less references and lack of previous studies, ground theory or meta analysis cannot be used. A tracking study of SRI calculation for each year will be carried to justify the effectiveness of SRI and to check the rationality of the empirical results. As time goes on, policies in housing, residential estate and other aspects should be included as a factor in the SRI index. For example, recent policy named *Domestic Tourism Promotion Plan* (2023—2025) had proposed many strategies, which may bring fast development for these destinations. Data availability should be optimized because of better data sources and new technologies. The second topic is the candidate cities. This study is only based on 32 districts or cities based on the overlaid areas of the four lists. Some other districts or cities in 2 batches of Comprehensive tourism demonstration zone (CTDZ) pilots and provincial CTDZs will be further selection of summer residential tourism destinations because of their positive in tourism and economic development, and should be recognized patterns and segmented development phase to provide effective measures to sustainable development. Macro residential tourism destinations must rely on micro second-homes[31], and China's residential tourism always depend on health and wellness functions. Hence, other health and wellness-driven pilot destinations perhaps can be taken as the candidate summer residential tourism destinations in future. The final topic is about phase segmentation. At present, value intervals have indicated the typical stages. When the summer residential tourism destinations are developing better, perhaps SRI values are higher than present threshold values and the value interval should be changed, which is related to the first topic.

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is set up. Knowledge dimension: mastering community research tools, understanding the participatory design process, and having interdisciplinary theoretical reserves; capability dimensions: demand transformation ability, collaboration and communication ability, and dynamic iteration ability; quality dimensions: social responsibility, and ethical awareness.

(3) Process and outcome evaluation are combined. Process evaluation: recording the depth of community visits during the research stage, collaborative evidence during the design stage, and the implementation capability during the execution stage; outcome evaluation: a dual dimension of "quantitative + qualitative evaluation" is adopted, of which quantitative indicators include data on the improvement of community cohesion after project implementation and ecological benefit monitoring; qualitative indicators include the social impact of media reports and the number of reference and learning cases in similar communities. This evaluation system not only adheres to the core of the landscape architecture major but also integrates social value orientation.

4 Conclusion

Through the systematic construction of the community participatory design training model, this study demonstrates both the necessity and feasibility of integrating social demands into MLA education. The proposed five-dimensional competency matrix and three-dimensional training system not only address the urgent demand for "people-oriented" design professionals in the new urbanization, but also extend the social value of landscape architecture education through interdisciplinary integration and practice-driven innovation. In the future, long-term tracking research can be further deepened to verify the actual impact of the training model on students' career development. It is expected that this research can offer new perspectives for the transformation of landscape architecture education.

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