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Identifying the Response of Ecological Well–Being to Ecosystem Services of Urban Green Space Using the Coupling Coordination Degree Model: A Case Study of Beijing, China, 2015–2023

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Abstract: Understanding the response of the ecological well–being to ecosystem services of urban green space is imperative for urban ecosystem conservation and management. However, few studies have focused on the response process and spatial relationship of ecological well–being to ecosystem services of urban green space in mega cities, while residents' demand and evaluation of ecological well–being have not been fully considered. In this study, the ecological well–being evaluation index system was developed through integrating subjective and objective indicators. Using the main urban area of Beijing as an example, our results indicate that from 2015 to 2023, the ecological well–being has been continuously increasing. Moreover, this study indicated that the coupling and coordination degree between ecological well–being and ecosystem services of urban green space still need to be improved. In addition, three modes of spatial relationship were identified in this study: high coordination area, moderate coordination area, and low coordination area. The finding extracted from these spatial relationship models should provide references for urban green space planning to maintain sustainable urban ecosystem conservation and management.

Keywords: ecological well–being; ecosystem service; urban green space; time series analysis; spatial relationship; Beijing

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1. Introduction

Ecosystem services are ecological features, functions, or processes that directly or indirectly contribute to sustainable human well–being [1]. Urban green spaces (UGSs) provide city dwellers with various types of ecosystem services [2], including microclimate regulation [3], carbon sequestration and oxygen release [4], noise reduction and dust retention, rainwater and flood regulation [5], air purification [6], and leisure and aesthetic enjoyment [7], and so on, which is beneficial for improving the physical and mental health of city dwellers [8]. Extreme weather events such as high temperatures and heavy rainfall occur frequently due to global warming. Meanwhile, urbanization further exacerbates the risk of extreme weather events, posing a serious threat to the continuous improvement of human well–being. This situation is more severe in the main urban areas of Beijing, where population and resources are highly concentrated. Therefore, the perspective of ecosystem services is crucial in the process of urban ecosystem conservation and management.

The ultimate goal of social development is to continuously improve and enhance human ecological well–being, which is becoming an important issue of global concern [9]. Ecological well–being is defined as the welfare and happiness that the ecological environment system brings to the public [10]. Ecological well–being is closely related to ecosystem services and land use pattern. The reason for this is that ecosystem services are the foundation for achieving ecological well–being. The rapid development of urbanization has strongly changed the land use pattern and structure, profoundly affecting the utilization structure, ecological processes, and functions of terrestrial ecosystems, thereby changing the ability of urban ecosystem to directly provide relevant products and services to human society. Based on this, exploring the relationship between ecological well–being and ecosystem services under spatial and temporal evolution has become a crucial research topic in the field of quantifying regional sustainable development. Existing research has divided ecological well–being into resource well–being and environmental well–being based on the productivity of different land use types [11,12]. The relationship between ecological well–being and ecosystem services is very complex and varies with changes in spatiotemporal scale and social environment [13]. The close relationship between the two is reflected in the different impacts of ecosystem services of urban green space on the ecological well–being of city dwellers at different time scales. At the same time, the spatial distribution differences of ecosystem services of urban green space can also have a certain impact on ecological well–being. Therefore, the coupling and coordination analysis of ecological well–being and ecosystem services can provide scientific basis for establishing long–term and effective sustainable human well–being management methods and management policies of ecosystem services in mega cities by studying the response of ecological well–being to ecosystem services of urban green space.

In the context of the continuous deterioration of global environmental and ecological conditions, climate change policies and territorial resilience have become a central issue of academic concern [14]. Meanwhile, urban green spaces, as the only vibrant infrastructure in cities, are seen as a nature–based solution that oriented to climate change adaptation and mitigation. Based on this, previous studies have focused on quantitative analysis of the supply of urban green space ecosystem services, mapping and evaluation of citizens' demand for urban green space ecosystem services, contribution of ecosystem services to human well–being under established backgrounds, and key influencing factors [15–19]. Some studies have emphasized the utilization patterns of urban green space ecosystem services by specific populations, the relationship between a certain type of urban green spaces' characteristics, and the subjective well–being of city dwellers [20–22], while other studies have highlighted the fairness issues of ecosystem services of urban green space and their impact on improving human well–being, obstacles to achieving health benefit of city dwellers, and their cognitive preferences for a certain type of ecosystem services of urban green space [23–25]. These studies have indicated that there is a close correlation between human well–being and ecosystem services of urban green space. In addition, the coupling and coordination relationship between ecological well–being and ecosystem services of urban green space is still under discussion. Ren et al. focused on the relationship between spatiotemporal patterns of ecosystem services and human well–being in the Qinghai–Tibet Plateau [26]. Li et al. emphasized that population urbanization and industrial urbanization are key factors that trigger changes in land use and ecosystem services, further affecting human well–being [9]. Moreover, numerous studies have generally focused on the spatial coupling relationship between human well–being and environmental performance in the watershed, the coupling coordination relationship between urbanization and ecosystem service value, and the coupling and coordination degree between human well–being and ecosystem services in vulnerable and impoverished areas [27–29]. It would be fundamental to analyze the spatial relationship between ecological well–being and ecosystem services [30,31]. Therefore, a comprehensive analysis of the relationship between ecological well–being and ecosystem services of urban green space is possible by using the coupling coordination degree model (hereafter referred to as CCD).

Recent studies have also indicated that the coupling and coordination degree between human well–being and ecosystem services is influenced by multiple factors [32,33]. However, the subjective and objective elements of ecological well–being should be accounted for because human well–being is not only driven by objective indicators [34], but subjective indicators are also important representations of the actual living conditions of city dwellers [23,35,36]. Therefore, the integration of subjective and objective indicators has become a growing trend in current human well–being evaluation research [37,38]. Understanding these driving factors and response processes can provide strong support for continuously improving ecological well–being and achieving sustainable urban ecosystem conservation and management [39–41]. Many studies have shown that the coupling coordination degree model can reveal the connections between two overall systems under different spatiotemporal patterns [30,42,43]. The coupling coordination degree model performs well in evaluating the overall level of conflict or coordination between systems [44–46], but research on measuring the ecological well–being of city dwellers from the perspective of ecosystem services of urban green space needs to be strengthened [9,47]. Few studies have focused on the coupling and coordination relationship between the ecological well–being and ecosystem services of urban green space in mega cities when considering the responses of ecological well–being to ecosystem services [48–50]. Therefore, coordinating the coupling between ecological well–being and ecosystem services of urban green space is also crucial for urban green space system planning and high–quality sustainable region development [51].

In summary, there are indeed many studies related to ecological well–being in the current academia. Compared with existing research, the novelty of this study lies in the use of survey data on ecological construction and urban greening development in Beijing from 2015 to 2023, aiming at conducting empirical analysis on the dynamic changes in the ecological well–being of city dwellers of Beijing from both subjective and objective perspectives, which is filling the gap of "static surplus but dynamic deficiency" in long–term ecological well–being–related research. Therefore, based on the Millennium Ecosystem Assessment (hereafter referred to as MA) as a benchmark for dividing human welfare elements, this study combined with the further expansion of the concept, classification, and indicator definition of ecological well–being by scholars in relevant fields. At the same time, considering the actual situation of the study area, appropriate indicators are selected to establish the ecological well–being evaluation index system. Questionnaire surveys and entropy method are used to quantitatively calculate and analyze the characteristics and changes of ecological well–being in the main urban area of Beijing from 2015 to 2023. Specifically, the objectives of this study were to (1) identify the temporal changes in the ecological well–being of Beijing; (2) quantitatively assess the coupling and coordination degree of ecological well–being and ecosystem services of urban green space; (3) and analyze the spatial relationship between ecological well–being and ecosystem services of urban green space.

2. Materials and Methods

The methodological framework of the research contained the following 6 steps (Figure 1): (1) constructing evaluation index systems of ecological well–being; (2) constructing a model for the coupling degree and coordination degree; (3) constructing the evaluation index system for the coupling and coordination of ecological well–being and ecosystem services of urban green space; (4) constructing the evaluation index system of ecological well–being integrating subjective and objective indicators; (5) evaluating the value of ecosystem services of urban green space; (6) constructing the ecological well–being coordination index and identifying the spatial relationship models.

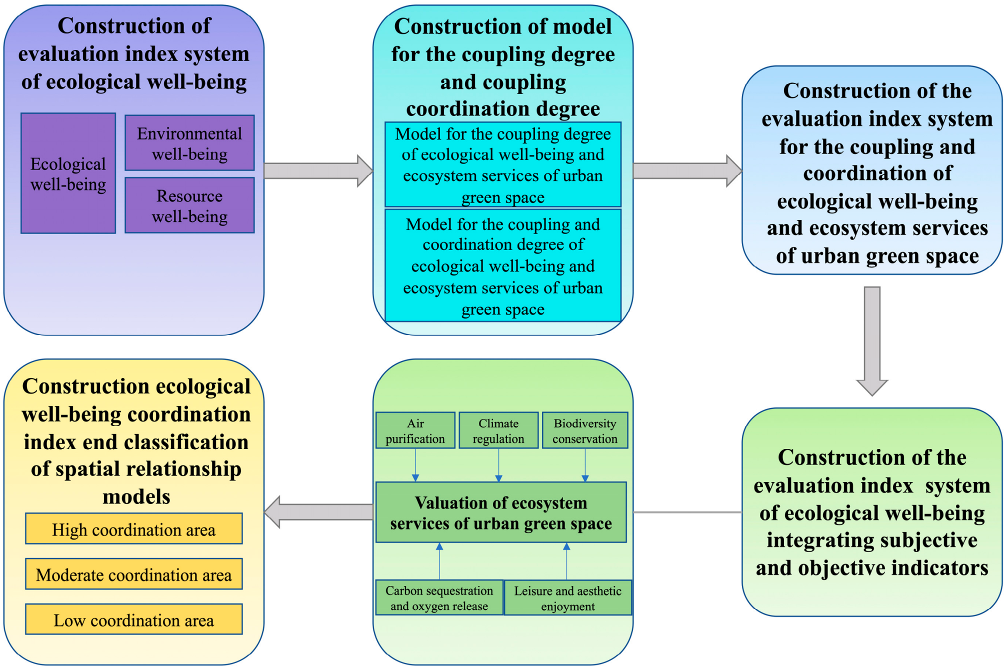


Figure 1. Methodological framework.

2.1. Study Area

Beijing (longitudes 115°22′ E and 117°30′ E and longitudes 39°28′ N and 41°05′ N) is located in the northern end of the North China Plain (NCP), on the alluvial plain of the Wenyu River system and the Yongding River system, with a total area of 1378 km^2. This study analyzes the administrative divisions of the main urban area of Beijing as the basic unit, including six districts: Dongcheng, Xicheng, Chaoyang, Fengtai, Shijingshan, and Haidian (Figure 2). The terrain of Beijing is high in the northwest and low in the southeast, belonging to the semi–humid to semi–arid continental monsoon climate. As of the end of 2023, the permanent population of the main urban area of Beijing was 10,943 million, with a large proportion of construction land and high construction intensity. The population density reached 14,000 people/km^2. The rapid development of urbanization still poses serious challenges to the ecosystem services in the main urban area of Beijing, which is manifested in the serious shortage of green space, inferior air quality compared to other regions, and a low level of ecological environment quality index, thus threating the continuous improvement of the ecological well–being of city dwellers. Beijing launched two rounds of plain afforestation projects in 2012 and 2018. As one of the major ecological projects in Beijing, the two rounds of "One Million–Mu (666 km^2)" plain afforestation projects (hereafter referred to as "OMM" PAP) added 2.02 million–mu (1345.32 km^2) of afforestation and greening area to the city, with the per capita green space area increasing from 39.84 m^2 in 2015 to 42.85 m^2 in 2022. However, some areas still face serious ecological degradation and ecological environment overload. The development goal of urban ecological construction of Beijing is to alleviate the contradiction between urban ecological environment and socio–economic development by improving the living environment in the main urban area and enhancing the urban ecosystem service.

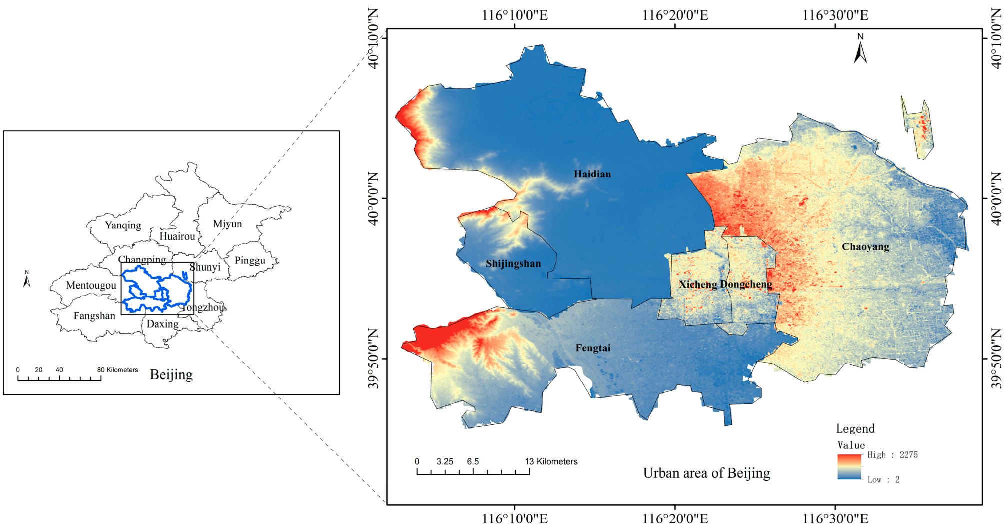


Figure 2. Study area.

2.2. Data Source

The data used in this study for 2015–2023 mainly include urban green resource data, DEM data, ecological environment quality data, fiscal expenditure data, and socio–economic data in the main urban area of Beijing. ① Urban green resource data: per capita green area, green coverage rate, and service radius of park green space in 500 m, collected from the Beijing Municipal Forestry and Parks Bureau (https://yllhj.beijing.gov.cn/zwgk/tjxx/, accessed on 29 May 2024). ② DEM data: obtained from the Resource and Environmental Science and Data Center of the Chinese Academy of Sciences (https://www.resdc.cn/, accessed on 4 June 2024). ③ Ecological Environment Quality Data: Including the Ecological Index (EI), the average noise level in the built–up area, the annual average concentration of $PM_{2.5}$, SO_2, and NO_2, obtained from the report on the State of the Ecology and Environment in Beijing issued by the Beijing Municipal Ecology and Environment Bureau. ④ Financial expenditure data and socio–economic data: The per capita expenditure on public facilities of urban and rural community, per capita supply of public management and public service land, and the number of permanent residents is mainly obtained through the Beijing Statistical Yearbook and the statistical bulletin of national economic and social development of each district. In addition, the price, source, and basis for the evaluation of ecosystem services of urban green space in the main urban area of Beijing were obtained (Table S1 in Supplementary Materials).

2.3. Questionnaire Settings

A field–based survey was designed and implemented with the aim of understanding the city dwellers' perception, preference, and evaluation of ecological well–being and ecosystem services of urban green space since 2015. The questionnaire consists of two parts. The first part collects personal information of city dwellers, including gender, age, education level, occupation, family size, disposable income, etc. The second part is the understanding and satisfaction of city dwellers with ecosystem services of urban green space. The survey content includes "satisfaction evaluation of ecosystem services of urban green space by city dwellers" and "awareness of the importance of ecological well–being by city dwellers". Respondents answered using the 5–point Likert scale format (from 1 = strongly disagree to 5 = strongly agree). Table 1 shows the respondents' sociodemographic characteristics.

Table 1. Descriptive statistics of respondents' characteristics.

Characteristics		Sample N = 2639	Proportion of Population (%) (Census)
Gender	Male	44.7	51.1
	Female	55.3	48.9
Age	20–29	24.1	14.1
	30–39	28.2	21.1
	40–49	17.8	14.6
	50–59	11.2	15.4
	60 and above	18.7	19.6
Education level	Elementary school graduate	2.9	
	Middle school graduate	10.9	
	High school graduate	24.7	
	University degree holder	38.3	
	Graduate school student or graduate degree holder	23.2	
Marriage	Married	31.1	
	Single	64.6	
	None	4.3	
Apartment owner	Yes	67.5	
	No	32.5	
Monthly disposable personal income (CNY)	Below 4000	14.5	
	4000–7999	22.6	
	8000–11,999	23.2	
	12,000–15,999	12.3	
	16,000–19,999	7.9	
	20,000–23,999	3.5	
	24,000–27,999	2.9	
	28,000–31,999	3.8	
	32,000–35,999	3.3	
	Over 36,000	6.0	
Work related to urban landscaping and greening	Yes	11.0	
	No	89.0	
Self–stated health	Very bad	1.0	
	Bad	5.7	
	Normal	30.8	
	Good	47.1	
	Very good	15.4	

In the initial stage of questionnaire design, we held an expert consultation meeting. The expert group is composed of six researchers who have been engaged in teaching and scientific research in the fields of urban landscaping, urban forestry, and ecological well–being for more than 10 years. The expert group provided professional opinions on the comprehensibility of the questionnaire among the residents, rationality of the selection of evaluation indicators, and trained the investigators to help them accurately understand the definition, connotation, and difference of ecological well–being and urban green space ecosystem services. In the implementation stage of questionnaire distribution, we determined the research locations based on the Beijing Landscaping and Greening Standards System, mainly involving park green spaces, square green spaces, and community green spaces. Before the formal survey began, we conducted a three–day pre–survey from 27 to 30 August 2023. The pre–survey aims to make the questionnaire language simpler and easier to understand, while constantly adjusting any potential questions that may arise in the questionnaire. Based on the responses of 85 residents, the preliminary questionnaire has been modified and improved. Subsequently, In the formal field study, we randomly distributed face–to–face questionnaires to residents aged 20 and above. The investigators recorded the latitude and longitude of the questionnaire distribution location. As for city dwellers who cannot understand the ecological well–being and ecosystem services of urban green space, the investigators will repeat and explain each question to the respondents one by one. When respondents have questions about the questionnaire, the investigators will only provide objective explanations to help them understand the problem. On average, completing each questionnaire takes 20–40 min. In the questionnaire collection stage, the investigator checks the questionnaire and eliminates invalid questionnaires with a response rate below 80%. The field study was conducted from 31 August to 6 September, 21 to 27 October, and 1 to 7 November 2023. We eventually included 2639 out of 2910 replies in our final sample with a valid questionnaire rate of 90.7%.

2.4. Evaluation Methods and Construction of Evaluation Index System of Ecological Well–Being

The multi–index comprehensive evaluation method is applied in this study for analyzing the evolution trend of the ecological well–being level of city dwellers in the main urban area of Beijing from 2015 to 2023. The multi–index comprehensive evaluation method is a comprehensive evaluation method that aggregates information from multiple indicators to reflect the overall situation of the evaluated object as a whole. It is widely used in quantitative research on human well–being. The formula is proposed as follows [52,53]:

$$F = \sum_{i=1}^{n} W_i f_i \quad (1)$$

In Formula (1), F is the comprehensive score of ecological well–being; i is a single indicator of ecological well–being; n is the number of indicators; f_i is the standardized score of indicator i; W_i is the weight value of indicator i; $\sum_{i=1}^{n} W_i = 1$. It should be noted that the larger the value of F, the higher the level of ecological well–being.

From the perspective of the social–ecology system, this study defined ecological well–being combined with the data accessibility, field study on urban green space in the main urban area of Beijing, and the existing literature of the ecological well–being issue [12,13]. Meanwhile, appropriate characterization indicators for ecological well–being were selected including security (personal safety, secure resource access, security from disasters), quality of life (adequate livelihoods, sufficient nutritious food, shelter, access to goods), health (strength, feeling well, access to clean air and water), good social relationships (social cohesion, mutual respect, ability to help others), based on the division of human well–being elements in the MA [54]. Ulteriorly, referring to existing research paradigms [52], this study selects appropriate characterization indicators and constructs an evaluation index system for the ecological well–being in the main urban area of Beijing on the basis of comprehensive consideration of natural resources, social and economic development status, existing literature of ecological well–being evaluation [55–61], and data accessibility in Beijing (Table 2).

It should be noted that, in the context of resilient city construction, urban green spaces play an important role in urban emergency management as a nature–based solution. Indicators such as per capita green space area, green coverage rate, and service radius of park green space in 500 m are closely related to the ecosystem services supply of urban green spaces. Therefore, this study considers availability of urban green space as an important indicator for measuring security well–being. Similarly, the implementation of ecosystem cultural services of urban green spaces can enhance city dwellers' social activities and promote the formation and increase of community cohesion. Studies have also shown that the size of urban green spaces and the reasonable spatial layout of infrastructure have a significant impact on the frequency and mode of urban landscaping utilization by city dwellers [62,63]. Therefore, this study uses per capital supply of public management and public service land as one of the indicators to measure good social relations well–being. In addition, EI refers to the Ecological Index issued by the Beijing Municipal Ecology and Environment Bureau, which is a comprehensive index for evaluating water cover, vegetation cover, land load, and biodiversity in urban scale.

Table 2. Evaluation index system for the ecological well–being in the main urban area of Beijing.

Element Layer	Weight	Criteria Layer	Weight	Indicator Layer	Indicator Properties	Weight
Environmental well–being	0.216	Security	0.165	per capita green area (m^2/person)	positive	0.064
				green coverage rate (%)	positive	0.080
		Quality of life	0.175	service radius of park green space in 500 m (%)	positive	0.015
				EI	positive	0.142
				average noise level in the built–up area	negative	0.072
		Health	0.113	the annual average concentration of $PM_{2.5}$ ($\mu g/m^3$)	negative	0.047
				the annual average concentration of SO_2 ($\mu g/m^3$)	negative	0.018
				the annual average concentration of NO_2 ($\mu g/m^3$)	negative	0.083
Resource well–being	0.784	Good social relationships	0.547	per capita expenditure on public facilities of urban and rural community (CNY/person)	positive	0.297
				per capita supply of public management and public service land (hectare/person)	positive	0.180

This study adopts the entropy method to standardize the selected indicators and calculate their weights. The entropy method, as an objective multi–criteria decision analysis method, determines the randomness and dispersion degree of indicators by calculating their weights and entropy values, thereby avoiding biases caused by human factors and achieving objective and scientific evaluation goals. Therefore, it has relatively high credibility. Among them, the smaller the entropy value, the greater the utility value of the indicator, and the corresponding weight will be larger, otherwise the weight will be smaller. The specific processes are as follows:

Assuming there are b evaluation indices, and a evaluation schemes in the evaluation system, the formula of the initial matrix is:

$$X = [X_{mn}]_{a\times b}(0 \leq m \leq a, 0 \leq n \leq b) \tag{2}$$

where X_{mn} represents the n–th evaluation metric of the m–th sample.

In order to reduce the interference that the differences in dimensions and orders of magnitude of various indicators may cause to the evaluation results, it is necessary to standardize the evaluation indicators. The formula is:

$$\begin{cases} Z_{mn} = \frac{X_n - X_{min}}{X_{max} - X_{min}} \\ Z_{mn} = \frac{X_{max} - X_n}{X_{max} - X_{min}} \end{cases} \tag{3}$$

where X_n represents the n–th indicator value, max value is the maximum value of the n–th indicator, min value is the minimum value of the n–th indicator, and Z_{mn} represents the standardized value.

Furthermore, the calculation steps of entropy method are as follows:

Calculate the weight Y_{mn} and construct a matrix of data weight $Y = \lfloor y_{mn} \rfloor_{a*b}$ as follows:

$$Y_{mn} = \frac{Z_{mn}}{\sum_{m=1}^{a} Z_{mn}}(0 \leq y_{mn} \leq 1) \tag{4}$$

Calculate the value of information entropy D as follows:

$$D_n = K \sum_{m=1}^{a} Y_{mn} \ln Y_{mn} \quad (5)$$

where K is a constant, $K = \frac{-1}{\ln a}$.

Calculate the value of information utility E as follows:

$$E_n = 1 - D_n \quad (6)$$

Calculate the weight of the n–th indicator as follows:

$$W_n = \frac{E_n}{\sum_{m=1}^{a} En} \quad (7)$$

Calculate the evaluation value of the sample using the weighted sum formula as follows:

$$U = \sum_{m=1}^{h} Y_{mn} W_{mn} \quad (8)$$

where U represents the comprehensive evaluation value, b represents the number of indicators, and W_n represents the weight of the n–th indicator.

The weight of various indicators of ecological well–being are calculated based on Formulas (2)–(8) [29].

2.5. Construction of Model for the Coupling Degree and Coupling and Coordination Degree

2.5.1. Construction of Model for the Coupling Degree of Ecological Well–Being and Ecosystem Services of Urban Green Space

In order to identify the evolution trend and characteristics of the coupling and coordination degree between ecological well–being and ecosystem services of urban green space in different stages of urban landscaping and greening development, the CCD model is applied in this study for exploring the degree of mutual influence between ecological well–being and ecosystem services of urban green space. The CCD model is mainly used to evaluate the phenomenon of two or more systems interacting and joining together, which can intuitively reflect the dynamic relationship of mutual coordination and dependence between systems. Coupling degree refers to the phenomenon in which two or more systems affect each other through interaction and can be the reflection of the degree of synergy between systems. The higher the coupling degree, the stronger the correlation between systems. Coordination degree refers to the degree of mutual promotion between subsystems and various elements within the system. The higher the coordination degree, the stronger the positive promotion effect between systems.

In this study, the coupling and coordination degree of ecological well–being and ecosystem services is an important basis for measuring whether the ecological well–being of city dwellers and ecosystem services of urban green space develop in a coordinated manner in the main urban area of Beijing. In the process of improving the sustainable supply of urban ecosystem services, by identifying the coupling and coordination relationship between ecological well–being and ecosystem services of urban green space, we can clarify the important directions for optimizing the urban ecological spatial pattern and improving the quality of the ecological environment, as well as the key path for the comprehensive and balanced development of ecological well–being in the main urban area. Meanwhile, the CCD model has been widely applied in research fields related to the coordinated and synchronous development of economy, well–being, and environment [64,65]. The accumulation of a large quantity of existing research can provide methodological support for the implementation of this study. Therefore, the study introduces the CCD model to comprehensively reflect the coupling coordination level between the ecological well–being and ecosystem services of urban green space in the main urban area of Beijing. Specifically, developing a coupling degree model is the first step of the construction of the coupling coordination model between ecological well–being and ecosystem services of urban green space [66]. Based on the existing research [67], the specific process is as follows:

Let $x_1, x_2, \ldots, x_t$ be the t indicators that describe the characteristics of ecosystem services of urban green space. An evaluation function $f(x)$ for ecosystem services of urban green space can be established. Let $y_1, y_2, \ldots, y_s$ be the s indicators that describe the characteristics of ecological well–being, and an evaluation function $g(y)$ for ecological well–being can be established.

$$f(x) = \sum_{i=1}^{t} a_i x_i \tag{9}$$

$$g(y) = \sum_{j=1}^{s} b_j y_j \tag{10}$$

Here, i and j represent the number of indicators for the ecosystem service of urban green space and the ecological well–being of city dwellers. a_i and b_j represent the unknown weight values of various characteristic indices, and $\sum_{i=1}^{t} a_i = 1, \sum_{j=1}^{s} b_j = 1$. According to Formulas (9) and (10), the comprehensive index of ecosystem services of urban green space and ecological well–being are calculated. The larger the value, the better the performance of ecosystem services of urban green space or the higher the level of ecological well–being. Otherwise, the reverse.

Assuming that S_d is the standard deviation, the dispersion coefficients of $f(x)$ and $g(y)$ are:

$$C_v = \frac{2S_d}{[f(x) + g(y)]} = 2\sqrt{1 - \frac{4f(x) \times g(y)}{[f(x) + g(y)]^2}} \tag{11}$$

When the ratio of $\frac{4f(x) \times g(y)}{[f(x)+g(y)]^2}$ is larger, then the value of C_v is smaller. From this, the formula for calculating the coupling degree between ecosystem services of urban green space and ecological well–being is obtained:

$$C = \left\{ \frac{4f(x) \times g(y)}{[f(x) + g(y)]^2} \right\}^k \tag{12}$$

In Formula (12), C is the coupling degree, and its value ranges from 0 to 1; k is the adjustment coefficient. Referring to existing research [68,69], in this study, k is taken as 2. C is close to 1, indicating a good degree of coupling between the ecological well–being and the ecosystem service of urban green spaces, and the system is in a healthy and orderly state; C is close to 0, indicating a poor degree of coupling between the ecological well–being and the ecosystem service of urban green spaces, and the system is in a state of disorderly development.

2.5.2. Construction of Model for the Coupling and Coordination Degree of Ecological Well–Being and Ecosystem Services of Urban Green Space

The degree of coupling can only indicate the degree of mutual influence between ecological well–being and ecosystem services of urban green space, and it cannot reflect the level of coordinated development between ecological well–being and ecosystem services of urban green space. To further reflect the degree of coupling and coordination between ecological well–being and ecosystem services of urban green space in different periods, this paper introduces a coupling coordination degree model. Based on the existing research [70–74], the formula is as follows:

$$S = \sqrt{C \times P} \tag{13}$$

$$P = af(x) + bg(y) \tag{14}$$

Here, S represents the coupling and coordination degree; P is the comprehensive harmony index between the ecological well–being and the ecosystem services of urban green space; a, b is an undetermined weight and assuming that both have the same level of importance in the system, i.e., $a = b = 1/2$, then:

$$P = [f(x) + g(y)] \tag{15}$$

The value of S is between 0 and 1, and the higher the S value, the higher the level of ecological well–being and the ecosystem service of urban green space, and the more coordinated the coupling between the two. Using the median segmentation method, the coupling degree and coupling coordination degree are divided into 6 intervals (Table S2 in Supplementary Materials).

Meanwhile, a reference coefficient $N = g(y)/f(x)$ is introduced to determine the development type of the ecological well–being and ecosystem services of urban green space under the current level of coupling coordination. The coupling coordination development was classified into 18 types (Table S3 in Supplementary Materials).

2.6. Construction of the Evaluation Index System for the Coupling and Coordination of Ecological Well–Being and Ecosystem Services of Urban Green Space

The spatial pattern distribution and physical properties of urban green spaces are important factors affecting the supply level of ecosystem services [75]. The cognitive evaluation of basic parameters such as the quantity, size, and type of urban green spaces by city dwellers objectively describes the quality of urban ecological environment. Therefore, the satisfaction evaluation of city dwellers for urban green spaces is usually combined with research on human well–being [76]. At the same time, the satisfaction evaluation of ecosystem services of urban green space by city dwellers can directly reflect the supply level of ecosystem services of urban green space and the governance capacity of urban landscaping [77,78]. Based on the objectives and indicator selection principles of the coupling evaluation of ecological well–being and ecosystem services of urban green space, this study constructs an indicator system for the coupling and coordination evaluation of the ecosystem service of urban green space and ecological well–being in the main urban area of Beijing (Table 3). Furthermore, this study adopts the entropy method to standardize the selected indicators and calculate their weights.

Table 3. Evaluation index system for the coupling and coordination of ecological well–being and ecosystem services of urban green space.

Indicator System	First Hierarchy	Second Hierarchy	Variable Code	Indicator Weight
The indicator system of ecosystem services of urban green space: $f(x)$	Regulation service	Satisfaction with climate regulation	X1	0.1451
		Satisfaction with rainwater and flood regulation	X2	0.0329
		Satisfaction with noise reduction	X3	0.1355
	Cultural service	Satisfaction with recreation and enjoyment	X4	0.2110
		Satisfaction with aesthetic value	X5	0.2570
	Supporting service	Satisfaction with biodiversity conservation	X6	0.0511
	Providing service	Satisfaction with air purification	X7	0.0853
		Satisfaction with carbon sequestration and oxygen release	X8	0.0822

Table 3. *Cont.*

Indicator System	First Hierarchy	Second Hierarchy	Variable Code	Indicator Weight
The indicator system of ecological well–being $g(y)$	Environmental well–being	per capita green area	Y1	0.0762
		green coverage rate	Y2	0.0749
		service radius of park green space in 500 m	Y3	0.0572
		EI	Y4	0.1277
		average noise level in the built–up area	Y5	0.0740
		annual average concentration of $PM_{2.5}$	Y6	0.0679
		annual average concentration of SO_2	Y7	0.0586
		annual average concentration of NO_2	Y8	0.0863
	Resource well–being	per capita expenditure on public facilities of urban and rural community	Y9	0.2703
		per capita supply of public management and public service land	Y10	0.1070

It should be noted that the difference between Tables 2 and 4 is that Table 2 involves objective well–being indicators, while Table 4 incorporates subjective well–being evaluation indicators on the basis of Table 2. The reason for incorporating subjective evaluation indicators in Table 4 is that although subjective well–being evaluation is an important indicator for measuring quality of life, it reflects the satisfaction of respondents with objective needs [79]. Therefore, an evaluation index system that integrates subjective and objective well–being indicators can more comprehensively reflect the ecological well–being of city dwellers.

Table 4. Index system for measuring the ecological well–being in the main urban area of Beijing.

Element Layer	Weight	Criteria Layer	Weight	Indicator Layer	Weight
Environmental well–being	0.4844	Security	0.2524	per capita green area (m^2/person)	0.0574
				green coverage rate (%)	0.0548
				Satisfaction with biodiversity conservation	0.0584
				Satisfaction with rainwater and flood regulation	0.0545
		Quality of life	0.2555	service radius of park green space in 500 m (%)	0.0698
				EI	0.0582
				average noise level in the built–up area	0.0502
				Satisfaction with climate regulation	0.0553
				Satisfaction with noise reduction	0.0513
		Health	0.2302	the annual average concentration of $PM_{2.5}$ ($\mu g/m^3$)	0.0505
				the annual average concentration of SO_2 ($\mu g/m^3$)	0.0431
				the annual average concentration of NO_2 ($\mu g/m^3$)	0.0513
				Satisfaction with air purification	0.0548
				Satisfaction with carbon sequestration and oxygen release	0.0569
Resource well–being	0.5156	Good social relationships	0.2619	per capita expenditure on public facilities of urban and rural community (CNY/person)	0.0644
				per capita supply of public management and public service land (hectare/person)	0.0644
				Satisfaction with recreation and enjoyment	0.0533
				Satisfaction with aesthetic value	0.0514

2.7. Construction of the Evaluation Index System of Ecological Well–Being Integrating Subjective and Objective Indicators

Combining existing research, it can be found that the measurement method of integrating subjective and objective indicators has become the overall trend and direction for evaluating the well–being level of city dwellers [80]. In view of this, this study adopts subjective and objective ecological well–being indicators to measure the ecological well–

being of city dwellers, in order to comprehensively reflect the level of ecological well–being in each district in urban areas of Beijing. For objective ecological well–being indicators, measurement is conducted based on actual research data, statistical information publicly released by the Beijing Municipal Bureau of Landscape and Greening, and retrieval of secondhand data from relevant statistical yearbooks; for subjective ecological well–being indicators, measure based on the subjective satisfaction evaluation of the city dwellers. Respondents answered using the 5–point Likert scale format (from 1 = strongly dissatisfied to 5 = strongly satisfied). Due to the differences in the nature and dimensions of subjective and objective indicator data, this study applies range normalization to process the original data into dimensionless data and uses entropy method to determine weights, as shown in Table 4.

2.8. Evaluation of Ecosystem Services Value of Urban Green Space

To study the spatial differentiation and pattern characteristics of the ecosystem services value of urban green space in the main urban area of Beijing, this study selects five representative ecosystem services of urban green space, namely air purification, carbon sequestration and oxygen release, climate regulation, leisure and aesthetic enjoyment, and biodiversity conservation, based on the Specifications for Assessment of Forest Ecosystem Services in China (GB/T 38582–2020) [81], for value assessment. This study applies the market value method, the shadow pricing method, the outcome reference method, and the value equivalent method to evaluate the selected ecosystem services value of urban green space [82–84] (Table S4 in Supplementary Materials).

2.9. Construction of Ecological Well–Being Coordination Index and Classification of Spatial Relationship Models

The various ecosystem services provided by urban green space are the foundation for achieving sustainable development in cities and an important indicator of the level of regional sustainable development. The ecological well–being is based on the benefits provided by the urban green space and is closely related to the natural ecological environment of the city on which they rely for survival. Quantifying and synthesizing the indicators between the ecosystem service provided by urban green space and the ecological well–being of city dwellers can be used to analyze and explore the coordination status and spatial differences between the two. Based on this, this study constructs an ecological well–being coordination index (EWCI) to explore the relationship between the proportion of ecosystem service value of urban green space (ESVpr) in each research unit and the proportion of ecological well–being (EWpr) in each research unit, in order to explore the relationship between them. Drawing on existing research results [28], the formulas are as follows:

$$EWCI = \frac{ESVpr}{EWpr} \tag{16}$$

$$ESVpr = \frac{ESV_i}{ESV_s} \tag{17}$$

$$EWpr = \frac{EW_i}{EW_s} \tag{18}$$

Here, $EWCI$ represents the ecological well–being coordination index. ESV_i represents the ecosystem service value of urban green space in the ith research unit of the research area. ESV_s represents the total value of ecosystem service of urban green space in the study area. EW_i is the ecological well–being level of city dwellers in the ith research unit of the research area. EW_s represents the overall level of ecological well–being of city dwellers in the study area.

Meanwhile, combined with the ecological environment and socio–economic development status of the main urban area of Beijing and existing research [85], this study divided the ecosystem services of urban green space and ecological well–being in the main urban area of Beijing in 2023 into five spatial relationship models: when $0.8 \leq EWCI \leq 1$, it is a high coordination area; when 0.6 ≤ *EWCI* < 0.8, it is a relatively high coordination area; when 0.4 ≤ *EWCI* < 0.6, it is a moderate coordination area; when 0.2 ≤ *EWCI* < 0.4 or *EWCI* > 1, it is a relatively low coordination area; when 0 ≤ *EWCI* < 0.2, it is a potential crisis area.

3. Results

3.1. Time Series Analysis of Ecological Well–Being

The ecological well–being (EW) of Beijing showed a continuous upward trend from 2015 to 2023 (Figure 3a). Among them, the growth rate of ecological well–being was the fastest from 2016 to 2017 and from 2018 to 2019. Since 2020, the growth rate of ecological well–being has gradually slowed down, but it still maintains a sustained growth momentum due to the formation of ecological networks in the Beijing plain through continuous urban ecological construction. Especially since 2012, the green coverage and vegetation greenness in Beijing has continued to accelerate, and the implementation of two rounds of the "OMM" PAP have achieved significant ecological, economic, and social benefits. With the implementation of a series of policy and special actions such as urban regeneration, non–capital function redistribution, leaving white space and increasing green space, etc., the urban green coverage rate has steadily increased, the ecological spatial pattern of the main urban area has been continuously adjusted and optimized, the proportion of heat island effect area in the main urban area has been significantly reduced, the livability of the city has been significantly improved, and the level of ecological well–being has been continuously improved. Overall, the changes in the ecological well–being of Beijing over the past 8 years have been influenced by the planning and implementation of the urban landscaping policies, showing a continuously improving development characteristic. Meanwhile, it also indicates that the ecological well–being depends not only on the ecosystem services of urban green space, but also on the external environmental changes of social and economic development such as urban ecological governance capacity and landscaping service level.

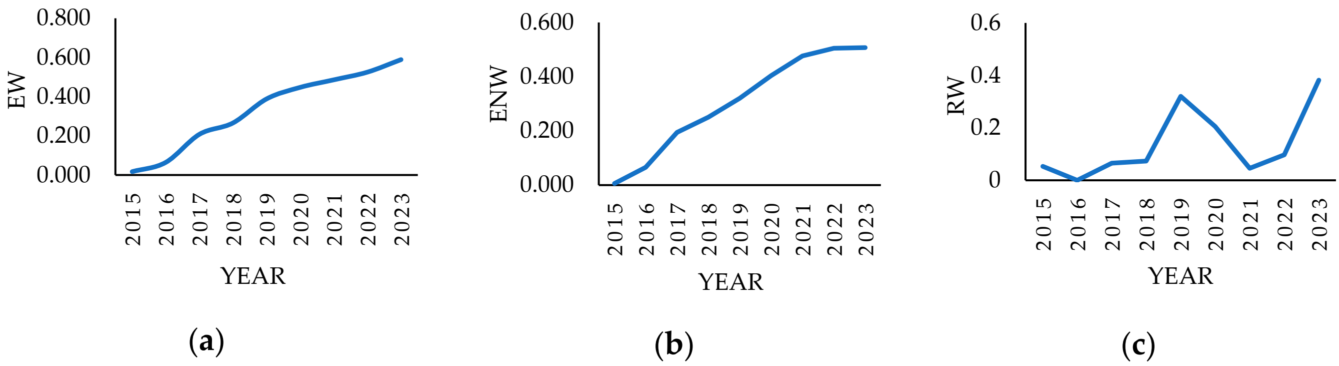


Figure 3. Trends in ecological well–being (**a**) and its constituent elements (**b**,**c**) of Beijing from 2015 to 2023.

The overall level of environmental well–being (ENW) of Beijing has shown an upward trend from 2015 to 2023 (Figure 3b). Among them, from 2017 to 2021, the level of environmental well–being has steadily increased; however, its growth rate has declined compared to 2015 to 2017. Since 2021, environmental well–being has remained at a similar level. The reason was that in the first round of "OMM" PAP of Beijing from 2012 to 2015, urban ecological construction mainly focused on establishing a forest ecological pattern based on large–scale forests in the plain areas. At this stage, the urban green coverage in plain areas has significantly increased, and the growth rate of environmental well–being has also been relatively fast. Since 2018, Beijing has launched a new round of "OMM" PAP, placing greater emphasis on the organic connection between new afforestation and primary forest, and maintaining the integrity of biodiversity and green ecological corridors. Therefore, although the increase in urban green coverage has slowed down, a green ecological system of interconnected natural resources in plain areas has already been formed, and environmental well–being has continued to improve. From 2021 to 2023, under the impact of the COVID–19 pandemic, the progress of urban ecological construction and landscaping projects has been affected, and the growth of environmental well–being has also slowed down.

The resource well–being (RW) of Beijing has shown a fluctuating upward trend from 2015 to 2023 (Figure 3c). Among them, from 2015 to 2017, the resource well–being of Beijing showed a trend of first decreasing and then increasing. From 2018 to 2021, the overall resource well–being showed a trend of firstly increasing and then decreasing. After 2021, as Beijing accelerates the creation of a national forest city, the investment in green infrastructure and land supply for public service has significantly increased, and resource well–being has also improved. At the same time, with the increasing attention of the government and the public to the protection and quality improvement of urban ecological environment, especially the introduction and improvement of policies related to urban ecological construction, urban ecological networks continue to improve, the quality of urban landscape is comprehensively upgraded, and resource well–being reaches a historical peak in 2023. It should be noted that compared to environmental well–being, resource well–being is more sensitive to macroenvironmental changes, and the current acceleration of resilient city construction in Beijing is consistent with the changing characteristics of resource well–being.

3.2. Coupling and Coordination Degree of Ecological Well–Being and Ecosystem Services of Urban Green Space

The coupling degree and coupling coordination degree of the ecological well–being and ecosystem services of urban green space in Beijing are calculated via Equations (9)–(15).

Based on the reference coefficients, the coupling coordination types and coupling stages of the ecological well–being and ecosystem services of urban green space in Beijing between 2015 and 2023 are shown in Table 5.

Table 5. Coupling and coordination types of ecological well–being and ecosystem services of urban green space of Beijing from 2015 to 2023.

Year	f(x)	g(y)	C	S	N	Coupling and Coordination Types	Coupling Stage
2015	0.184	0.026	0.1883	0.1406	0.14	Moderately dysregulated ecology loss type	Low–level coupling
2016	0.234	0.070	0.5026	0.2764	0.30	Moderately dysregulated ecology loss type	Amelioration
2017	0.818	0.235	0.4809	0.5032	0.29	Mildly dysregulated ecology loss type	Confliction
2018	0.749	0.321	0.7056	0.6144	0.43	Intermediate coordinated ecology loss type	Amelioration
2019	0.994	0.477	0.7682	0.7517	0.48	Intermediate coordinated ecology loss type	Amelioration
2020	0.840	0.572	0.9292	0.8100	0.68	Good coordinated ecology loss type	High–level coupling
2021	0.264	0.610	0.7111	0.5575	2.31	Primary coordinated well–being loss type	Amelioration
2022	0.242	0.649	0.6262	0.5282	2.68	Primary coordinated well–being loss type	Amelioration
2023	0.240	0.918	0.4319	0.5001	3.83	Primary coordinated well–being loss type	Confliction

The coupling degree and coupling coordination degree between the ecological well–being and the ecosystem services of urban green space in Beijing showed an upward trend from 2015 to 2023 (Figure 4). In 2015, the coupling degree and coupling coordination degree were the minimum values in the interval and were in a low–level coupling stage, indicating that the correlation between the ecological well–being and the ecosystem service of urban green space was relatively low during this period. Between 2016 and 2019, except for 2017 when the coupling degree was 0.4809, which was in the amelioration stage, all other years were between the critical values of 0.5–0.8, indicating a period of confliction, which means that the ecological well–being began to be positively coupled with ecosystem services of urban green space during this period. By 2020, the coupling degree and coupling coordination degree between the ecological well–being and ecosystem services of urban green space had reached historical peaks, with values of 0.9292 and 0.8100, respectively, indicating a high–level coupling stage. During this period, the relationship between the ecological well–being and ecosystem services of urban green space has shown characteristics of mutual promotion and coordinated development. Between 2021 and 2023, the coupling degree and coupling coordination degree between the ecological well–being and ecosystem services of urban green space have declined. In 2021 and 2022, the two subsystems of ecological well–being and ecosystem services of urban green space showed basic coordinated development characteristics, forming a benign coupling between the two. By 2023, the ecological well–being continues to improve, while the contradiction between ecosystem services of urban green space becomes increasingly prominent.

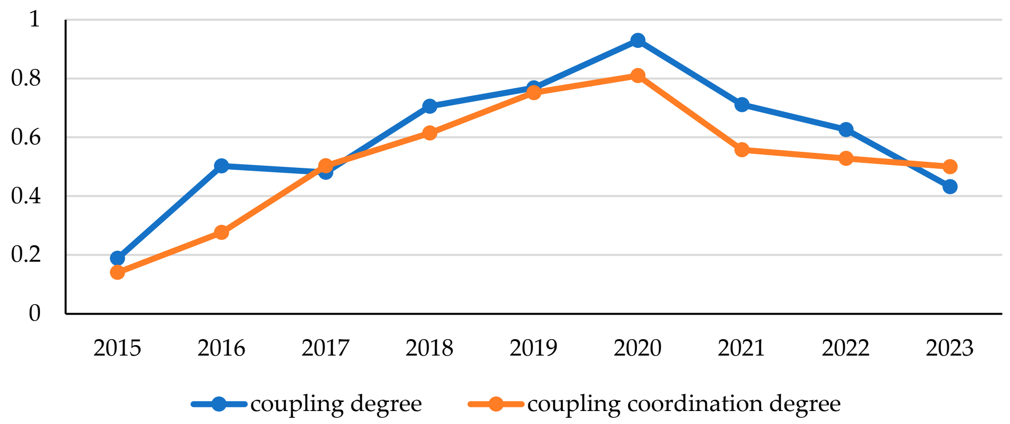


Figure 4. Trends in the coupling degree and coupling coordination degree of ecological well–being and ecosystem services of Beijing from 2015 to 2023.

3.3. Analysis of the Spatial Relationship between Ecological Well–Being and Ecosystem Services of Urban Green Space

As shown in Table 6, the score of ecological well–being in each district of main urban areas of Beijing were calculated via Equation (1). The values of ecosystem services of urban green space in the main urban area of Beijing in 2023 were evaluated as shown in Table 7.

Table 6. The score of ecological well–being in each district of main urban areas of Beijing in 2023.

District	Score of Ecological Well–Being	District	Score of Ecological Well–Being
Dongcheng	0.37	Fengtai	0.62
Xicheng	0.26	Shijingshan	0.80
Chaoyang	0.57	Haidian	0.68

Table 7. Ecosystem services value of urban green space of districts in the main urban area of Beijing in 2023 (Unit: 10,000, CNY).

	Dongcheng	Xicheng	Chaoyang	Fengtai	Shijingshan	Haidian	Total	Average
Air purification	76.80	76.31	1111.84	537.71	305.92	949.67	3058.25	509.71
Carbon sequestration and oxygen release	144.43	143.51	2090.89	1011.20	575.30	1785.92	5751.25	958.54
Climate regulation	266.02	208.08	6964.78	2734.27	2051.60	6018.89	18243.64	3040.61
Leisure and aesthetic enjoyment	260.02	258.36	3764.26	1820.47	1035.72	3215.21	10354.04	1725.67
Biodiversity conservation	637.34	633.28	9226.67	4462.20	2538.68	7880.88	25379.05	4229.84

This study used the natural breaks (Jenks) to divide the ecological well–being level index and the ecosystem services value of urban green space in the main urban area of Beijing in 2023 (Figure 5). The spatial distribution of ecological well–being in the main urban areas of Beijing shows an overall pattern of high in the west and low in the central region (Figure 5a). It can be seen that although the ecosystem services of urban green space continuously provide and maintain ecological well–being, it is not the entire source of ecological well–being for city dwellers. Other non–ecological factors (such as socio–economic attributes, public facility expenditures, public management, and public service land supply, personal subjective feelings) can also affect the evaluation of the level of ecological well–being.

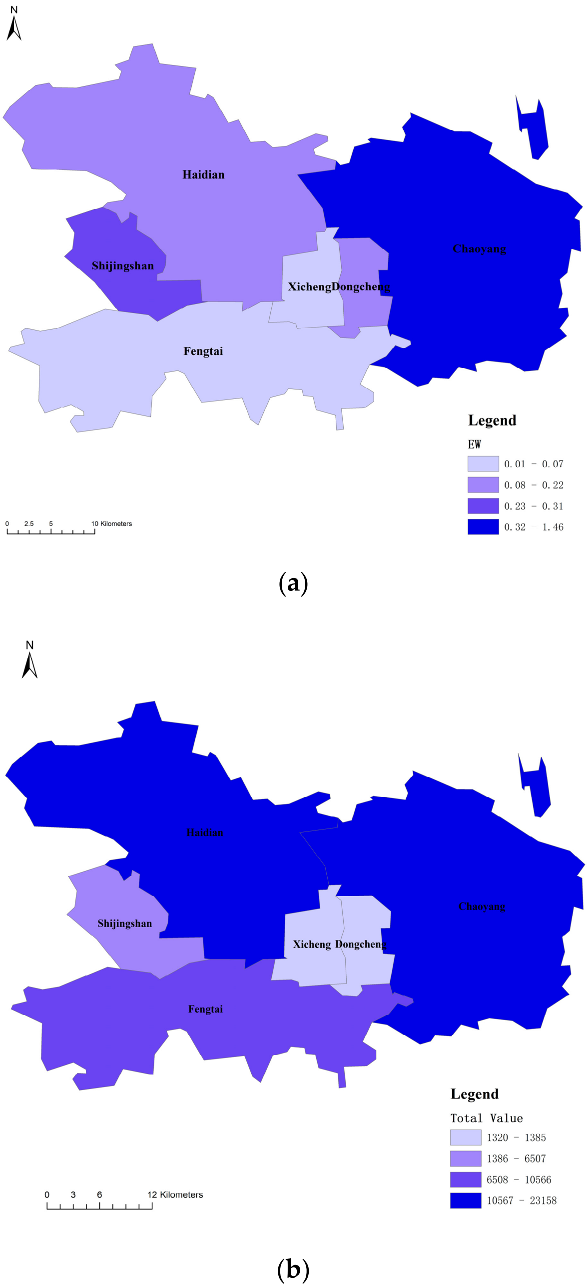


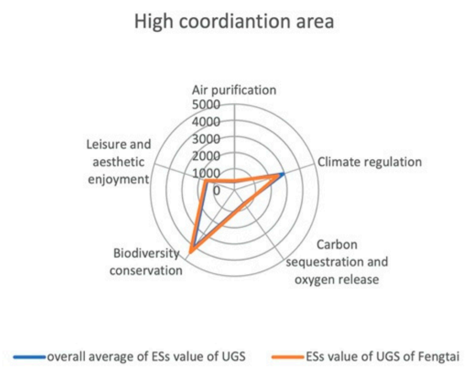
Figure 5. Spatial distribution of ecological well–being (**a**), and ecosystem services value of urban green space (**b**) in the main urban areas of Beijing in 2023.

The high–value areas of ecosystem services of urban green space in Beijing are mostly concentrated in the northwest and eastern regions (Figure 5b). The low–value area is the central region. It can be seen that the area of urban green space significantly affects the ecosystem service value of urban green space. The planning of the green space system and the optimization of the green space pattern in Beijing still need to be further strengthened to enhance the regional ecosystem service and overall coordination.

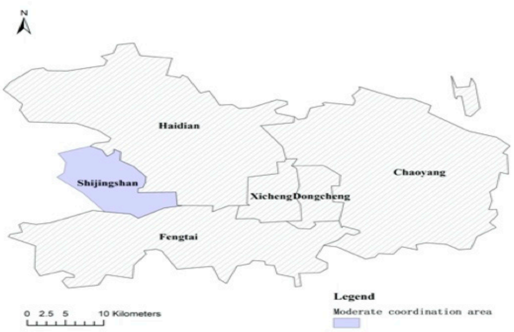
The Fengtai District, located in the southern part of the main urban area of Beijing, is a high coordination area (Figure 6a), which means that the two subsystems of ecological well–being and ecosystem services of urban green space are developing in a mutually promoting and coordinated state. In Fengtai, except for the slightly lower value of climate regulation services compared to the overall average of ecosystem services of urban green space in the main urban area, the value of other ecosystem services of urban green space is higher than the overall average of the main urban area (Figure 6b). The Shijingshan District, located in the western part of the main urban area of Beijing, is a moderate coordination area (Figure 6c), indicating that the current development status of the two subsystems of ecological well–being and ecosystem services of urban green space of Shijingshan is good, and the two are developing in a synchronous and coordinated manner. The various ecosystem service values of urban green spaces in Shijingshan are slightly lower than the overall average of the main urban area (Figure 6d). The low coordination areas between ecological well–being and ecosystem services of urban green space are mainly distributed in the central, northwest, and eastern regions of the main urban area of Beijing (Figure 6e). Among them, the values of various ecosystem services of urban green space in Dongcheng District and Xicheng District, located in the central area of the main urban area, are far lower than the overall average of the main urban area (Figure 6f). This indicates that although there is a trend of mutual promotion between ecological well–being and ecosystem services of urban green space in this area, the level of ecosystem services of urban green space still needs to be improved. The various ecosystem service values of urban green spaces in Chaoyang District and Haidian District are higher than the overall average of the main urban area, indicating that the ecosystem services status of urban green space in this area is good, but ecological well–being is prone to extreme differentiation. This situation requires great efforts to improve the ecological well–being of city dwellers.

(**a**)

(**b**)



(**c**)



(**d**)

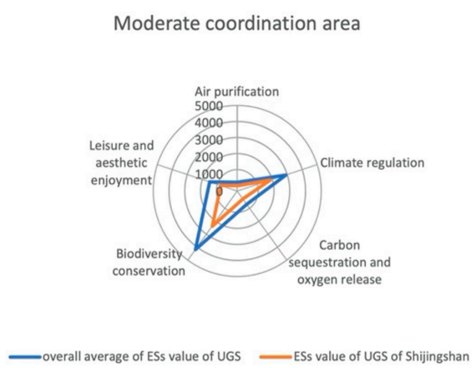


Figure 6. *Cont*.

(**e**) (**f**)

Figure 6. The spatial relationship patterns of ecological well–being (**a**,**c**,**e**) and value of ecosystem services of urban green space (**b**,**d**,**f**) in the main urban areas of Beijing, China.

4. Discussion

This study takes Beijing, a typical mega city, as an example to explore the temporal and spatial relationship patterns of the coupling coordination between ecosystem services of urban green space and ecological well–being in the main urban area of Beijing from 2015 to 2023. It also summarizes and extracts strategies and suggestions for sustainable management and planning of green space ecosystems in mega cities. For mega cities, rapid urbanization leads to a high concentration of population and resources in urban built–up areas, which puts enormous pressure on urban ecosystems. How to promote the coordinated development of urban ecosystem protection and ecological well–being is a key issue that needs to be addressed in the process of improving urban ecological resilience. Therefore, the finding extracted from these spatial relationship models should provide references for urban green space planning of mega cities to maintain sustainable urban ecosystem conservation and management. These findings are also supported by a small but growing body of literature that finds there is great room for improvement in the coordinated development among various subsystems, especially among social and environmental subsystems [86–88].

Although some exploratory research has been conducted, due to the limitations of subjective and objective factors, there are still some areas that need to be improved, deepened, and expanded in this study. Specifically, the relationship between ecosystem services of urban green space and ecological well–being is very complex. The evaluation index system ecological well–being constructed by this research institute, although helpful in understanding the general process of realizing the benefits of ecosystem services urban green space, is actually a great simplification of reality. In the specific scenario analysis, this study mainly considers the changes in urban green resources and public financial investment in landscaping caused by the implementation of urban ecological engineering as the key factors causing changes in ecosystem services of urban green space. However, the exploration of the possible impact of other uncertain factors in macroeconomic development on the value of ecosystem services of urban green space and ecological well–being is not sufficient. In reality, the response process of ecological well–being to ecosystem services of urban green space is much more complex than described by model frameworks, especially since urban green space is the only viable infrastructure in the city, its relationship between ecosystem service supply and ecological well–being will be influenced by natural, socio–economic, and cultural factors (such as public health events). Therefore, in future research, it is necessary to pay more attention to important issues such as the complexity of urban ecosystems, the mechanisms for the formation of ecosystem services of urban green space, and the coupling and coordination relationship between ecosystem services of urban green space and ecological well–being, and to carry out systematic and comprehensive research based on interdisciplinary fields. Meanwhile, In the construction process of ecological well–being evaluation index system, in order to avoid the bias caused by subjective measurement, the objective data sources used for ecological well–being evaluation in this study are all from the Beijing Municipal Bureau of Landscape and Greening and the social and economic bulletins of each district. Therefore, the evaluation index system only involves availability of urban green space and fails to include accessibility of urban green space in the evaluation index system, which can be further improved in future research. In addition, considering the large workload of long–term questionnaire surveys and the limited length of the article, this study only selected a typical ecosystem service of urban green space for analysis. The future research scale and related research results also need to be expanded.

5. Conclusions

Based on the evaluation data of urban green resources and ecological well–being of city dwellers in the main urban area of Beijing from 2015 to 2023, this article mainly analyzes the temporal changes of ecological well–being in Beijing and the coupling and coordination relationship between ecological well–being and ecosystem services of urban green space. In addition, the spatial relationship between ecological well–being and ecosystem services of urban green space in the main urban area of Beijing was examined from 2015 to 2023, and the ecological well–being level of the main urban area of Beijing has shown a continuous upward trend. Notably, compared to environmental well–being, resource well–being is more sensitive to macroenvironmental changes in response. We also found that currently, the ecological well–being of the main urban area of Beijing is constantly improving, but the contradiction between it and the ecosystem services of urban green space is becoming increasingly prominent, and the coupling and coordination between the two subsystems still need to be improved. Furthermore, our results indicate that the spatial distribution of ecological well–being among city dwellers in the main urban areas of Beijing shows an overall pattern of high in the west and low in the central region, where the high–value areas of ecosystem services of urban green space in Beijing are mostly concentrated in the northwest and east, while the central region is a low–value area. At the same time, the ecological well–being of the main urban areas of Beijing and the ecosystem services of urban green space exhibit various spatial relationship patterns. First, the high coordination area is distributed in the southern part of the main urban area of Beijing. Second, the moderate coordination area is Shijingshan District, and currently, the two subsystems are developing in a synchronous and coordinated manner. Finally, the high coordination area is mainly distributed in the central, northwest, and eastern regions of the main urban area of Beijing. Thus, the coordinated development of ecological well–being and ecosystem services of urban green space should be focused on in future urban ecological construction and urban green space system planning to ensure the success and sustainability of these projects.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/f15091494/s1, Table S1: Evaluation and use price of ecosystem service of urban green space in Beijing; Table S2: Classification of coupling and coordination degree between ecological well–being and ecosystem services of urban green space; Table S3: Classification of coordinated development types; Table S4: Evaluation method of ecosystem service value of urban green space.

Author Contributions: Conceptualization, H.G. and Y.W.; methodology, H.G. and Z.Z.; software, H.G.; validation, Y.W., J.F., S.D. and Z.Z.; formal analysis, H.G.; investigation, H.G. and L.M.; resource, H.G.; data curation, H.G. and Y.W.; writing—original draft preparation, H.G. and Y.W.; writing—review and editing, H.G., J.F., S.D. and Z.Z.; visualization, H.G.; supervision, Y.W.; project administration, Y.W.; funding acquisition, Y.W. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest: The authors declare no conflicts of interest.

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