

## Article

# The Influence of Values on Preferences for Ecosystem Services in Urban Green Spaces: Evidence from Chinese Residents

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## Abstract

Urban green spaces (UGS) play a critical role in enhancing urban resilience and livability by delivering a wide range of ecosystem services. Understanding residents' preferences for urban green space ecosystem services (UGES) and their underlying drivers is essential for advancing human-centered and equitable UGS management. Existing studies have largely emphasized socio-demographic and contextual factors, while the role of personal values as deeper psychological drivers of UGES preferences remains insufficiently examined. Values are deeply rooted beliefs that shape cognition and behavior and, as such, provide a powerful theoretical lens for interpreting human–ecosystem interactions. Based on 1080 responses from a nationwide online survey, this study investigates how value orientations influence residents' preferences for UGES in China. The results show that personal values have significantly greater explanatory power for UGES preferences than demographic variables. Specifically, self-transcendence is positively associated with preferences for regulating and cultural services, whereas self-enhancement is positively associated with preferences for provisioning services. These patterns indicate that prosocial and egoistic value orientations underpin preferences for ecosystem services characterized by public versus individual benefits, respectively, suggesting that UGES preferences represent external expressions of individuals' underlying value structures. The opposing value dimensions of conservation and openness to change both exert positive effects on preferences across all three UGES categories, indicating that UGES preferences are jointly shaped by pluralistic value systems. In the context of intergenerational value change and evolving societal expectations, UGS planning should therefore prioritize diversity and inclusivity. Overall, this study demonstrates the central role of value orientations in shaping residents' UGES preferences and highlights the potential of integrating value-based perspectives to enhance preference-sensitive management and value-oriented governance of UGS.

**Keywords:** UGS; preferences for UGES; values; management; Chinese residents



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## 1. Introduction

Rapid urbanization has profoundly transformed global landscapes, replacing natural environments with dense built infrastructure [1]. Currently, approximately 58% of the world's population resides in urban areas, a proportion projected to increase to 68% by 2050 [2]. Although urbanization has generated substantial socioeconomic benefits, it

has simultaneously intensified environmental pressures, including the loss of blue and green spaces [3], biodiversity decline [4], imbalances in ecosystem services [5], environmental pollution [6], urban heat island effects [7], and heightened flood risks [8], with well-documented consequences for both physical and mental health [9–13].

Urban green spaces (UGS), defined as vegetated areas within urban environments [14], play an indispensable role in mitigating the adverse impacts of urbanization. By delivering a wide range of ecosystem services, UGS enhance urban resilience, improve living quality, and support residents' physical and mental well-being. As a result, UGS have become a core component of sustainable urban development agendas, and the United Nations Sustainable Development Goal 11 (SDG 11) explicitly recognizes them as a key foundation for building inclusive, safe, resilient, and sustainable cities. However, constraints related to limited land availability and fiscal resources have led to pronounced spatial heterogeneity in the provision and accessibility of ecosystem services from UGS [15], posing significant challenges to equitable provision and effective management. Such disparities may also undermine the implementation of people-centered development principles. Under conditions of resource scarcity, optimizing UGS planning and maximizing human well-being benefits require not only moderate expansion and improved accessibility, but more importantly, prioritization of ecosystem services that align with residents' preferences and perceived needs. Accordingly, identifying residents' preferences for urban green space ecosystem services (UGES) and their determinants is a critical prerequisite for improving planning efficiency, promoting environmental justice, and advancing people-centered urban governance.

Preferences reflect the importance individuals assign to different ecosystem services based on their lived experiences and constitute a key component of socio-cultural ecosystem service valuation. [16,17]. Understanding residents' preferences can facilitate the coordination of diverse stakeholder needs, support more effective ecosystem management, and enhance social equity in decision-making processes [18,19]. Previous studies have identified a range of factors influencing ecosystem service preferences, including socio-demographics characteristics (e.g., gender, age, education), geographic context, levels of urbanization, livelihood capital, and ecological policies [20–25]. For example, some studies have found that males prefer provisioning services, while females show greater preference for regulating services or cultural services [26,27]. Regarding the relationship between age and ecosystem services preferences, Daigle et al. [28] found that older individuals prefer provisioning services more, whereas younger individuals show a stronger preference for regulating services. Furthermore, education level has been widely confirmed to be positively correlated with preference intensity for ecosystem services [29,30], meaning higher levels of education correspond to stronger preferences. This means higher education levels correspond to stronger preferences. Additionally, residents living in economically disadvantaged and remote rural areas exhibit a clear preference for provisioning services [31], while urban residents in more economically developed areas show a stronger inclination towards regulating and cultural services [32]. Khan et al. [33] found that preferences for regulating and other ecosystem services, as well as perceptions of their changes, exhibit strong spatial heterogeneity (i.e., basin type, urban category, and land cover type of residence). Xu et al. [34] found that the implementation of ecological restoration policies can lead to a decline in stakeholders' preference for provisioning ecosystem services. Moreover, the level of understanding of ecosystem services and the provision of academic information about ecosystem services also influence the public's ecosystem services preferences [35,36]. However, most of these factors are "surface-level variables" [37,38]. Although they are directly observable, they provide limited insight into the underlying psychological mechanisms shaping preferences.

In contrast, values are widely regarded as foundational belief systems that underpin preferences in complex decision-making processes [39,40]. They shape how individuals conceptualize nature, evaluate ecosystem services, and respond to environmental change, thereby influencing cognition, attitudes, and behaviors. Value-based cognitive differences are pervasive in environmental decision-making, as individuals selectively prioritize ecosystem services through value-laden interpretive frameworks. When amplified through social interaction, such differences can contribute to collective divergence or polarization [41]. Divergent value orientations therefore lead to differential prioritization of UGES types, shaping heterogeneous policy support and participatory tendencies. Recognizing values as both core predictors of preferences and strategic entry points for policy intervention is thus essential for advancing equity in green space governance and optimizing ecosystem service allocation. Values are deeply embedded belief systems formed through socialization that embody conceptions of desirable end states or modes of conduct and serve as fundamental psychological constructs guiding evaluation, decision-making, and behavior [42–45]. They are abstract and trans-situational, functioning as enduring motivational drivers that initiate and sustain individual action [46–48]. Among existing frameworks, Schwartz [43] value theory provides a comprehensive and widely validated classification of human values, encompassing ten basic values organized along a motivational continuum. At a higher level of abstraction, these values manifest as two bipolar contrasts (Figure S1). The first dimension, openness to change versus conservation (contrasting values whether embrace change or not), juxtaposes values emphasizing independent thought, action, and support for change (self-direction, stimulation) against those prioritizing conformity, self-restriction, preservation of traditions, and stability maintenance (tradition, security, conformity). The second dimension, self-enhancement versus self-transcendence (contrasting values whether emphasize individual private benefits or public benefits), contrasts values centered on pursuing personal success and dominance over others (power, achievement), with values advocating equal acceptance of others and concern for their welfare (universalism, benevolence).

Ecosystem services, defined as the benefits humans obtain from ecosystems [49,50], are commonly categorized into provisioning, regulating, and cultural services [51]. Provisioning services largely yield rivalrous and excludable private goods, whereas regulating and cultural services predominantly generate non-rivalrous and non-excludable public benefits. The private–public dichotomy inherent in ecosystem services categories intrinsically resonates with Schwartz’s self-enhancement versus self-transcendence dimension. Concurrently, evolving societal expectations of ecosystem services—from traditional cultural benefits (e.g., spiritual fulfillment derived from urban green spaces) to contemporary ecological priorities (e.g., carbon sequestration and hydrological regulation in green development paradigms)—demonstrate structural alignment with Schwartz’s conservation versus openness to change continuum. Consequently, Schwartz’s theoretical framework provides a robust psychological foundation for interpreting ecosystem services preferences, which functionally manifest as motivations shaping human–ecosystem interactions.

Empirical research linking values to ecosystem service preferences remains limited and has focused primarily on natural ecosystems. Hicks et al. [52] assessed resource users’ preferences for coral reef ecosystems in the East African countries’ region and, in conjunction with Schwartz’s values theory, found that individual preferences for ecosystem services are associated with a variety of human values within the same value domain. For instance, preferences for fisheries and materials (provisioning services) are linked to aspirations such as achieving personal success and material wealth, as well as enhancing social power and influence (i.e., self-enhancement). More recently, Schutter et al. [53] investigated the values and ecosystem service preferences of resource users in the Seychelles Islands,

demonstrating that individual ecosystem service preferences are linked to a spectrum of underlying values; however, the relationship between these preferences and values is frequently inconsistent, highlighting a significant disconnect and complex interplay. For example, fishermen's preference for fishing (provisioning service) may stem not only from motivations of self-enhancement (e.g., obtaining food and increasing income) but also from openness to change (e.g., pursuing fishing as a recreational passion). Ecosystem service preferences are not singularly driven by one type of value alone, but by a combination of value orientations. These findings offer a theoretical basis for understanding the mechanisms by which values shape ecosystem service preferences. However, evidence remains limited in urban green space contexts, particularly regarding (i) whether value orientations explain UGES preferences beyond conventional socio-demographic/locational factors, and (ii) whether values mediate the links between those factors and UGES preferences. Addressing these gaps is essential for translating value-informed insights into more equitable and people-centered UGS planning aligned with SDG 11. Therefore, analyzing the influence of residents' values and socio-demographic variables on UGES preferences through a nationwide quantitative survey and comparative/mediation analyses would offer significant theoretical and practical implications.

Against this backdrop, this study examines Chinese residents' preferences for UGES and their underlying values orientations, with a specific focus on the role of values in shaping these preferences. The study addresses two core questions: (1) whether value variables exhibit stronger explanatory power for UGES preferences than socio-demographic variables; and (2) how value orientations influence residents' UGES preferences. By integrating value theory with large-scale empirical evidence, this study advances theoretical understanding of ecosystem service preferences and provides a scientific basis for value-informed UGS planning and governance.

## 2. Materials and Methods

### 2.1. Questionnaire Design

The online questionnaire was developed using the Wenjuan Xing platform ([www.wjx.cn](http://www.wjx.cn)) and consisted of three parts (Figure 1A).

Part 1: Assessment of UGES preferences. Respondents rated the importance of 11 specific UGES items (e.g., temperature mitigation, recreation) using a five-point Likert scale ranging from 1 ("Extremely unimportant") to 5 ("Extremely important"). Because UGES are publicly perceptible and often abstract or multifunctional, an importance-based Likert scale was adopted to minimize cognitive burden and facilitate consistent evaluation across heterogeneous respondents. This approach is widely used in perception- and preference-oriented ecosystem service research and is particularly suitable for large-scale online surveys, where more complex elicitation methods may reduce response quality or completion rates.

Part 2: Assessment of personal value orientations. The Schwartz value survey was used to measure respondents' personal values. This scale depicts a universal framework of motivational value types, offering comprehensive coverage, and has been extensively validated across diverse cultural contexts in over 80 countries worldwide. Respondents rated the importance of each universal motivational value type as a guiding principle in their life on a scale from −1 ("Directly opposes my life principles") to 7 ("Extremely important"). For subsequent statistical analysis, these ratings were rescaled to a 1–9-point range.

Part 3: Collection of socio-demographic and locational information.

Prior to formal distribution, a pre-test ( $n = 30$ ) involving university students who were non-ecology or environmental science majors was conducted to assess feasibility and clarity.

| (A) Basic elements of the survey questionnaire                                                                                                                                                                                                                                                               |                                             |                                                                                                                                                                                                                                                                                            |      | (B) Statistical results         |                     |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------|---------------------|------------|
| 【Part1】 5-Point likert scale for UGES preferences (Below are some descriptions of the benefits that urban green spaces (e.g., greenways, parks, farms, etc.) provide us. Your task is to indicate how important each benefit is to you.                                                                      |                                             |                                                                                                                                                                                                                                                                                            |      | Mean UGES preference level      |                     |            |
| Examples of urban green spaces                                                                                                                                                                                                                                                                               | Urban green space ecosystem services (UGES) | ✓                                                                                                                                                                                                                                                                                          |      | Mean score                      | UGES classification | Mean score |
| <div>Greenways</div>  <div>Parks</div>  <div>Farms</div>  | Carbon sequestration                        | <div><input type="radio"/> 1. Extremely unimportant</div> <div><input type="radio"/> 2. Unimportant</div> <div><input type="radio"/> 3. Neutral</div> <div><input type="radio"/> 4. Important</div> <div><input type="radio"/> 5. Extremely important</div>                                | 4.33 | Regulating and habitat services | 4.32                |            |
|                                                                                                                                                                                                                                                                                                              | Temperature mitigation                      |                                                                                                                                                                                                                                                                                            | 4.31 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Dust retention                              |                                                                                                                                                                                                                                                                                            | 4.39 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Noise mitigation                            |                                                                                                                                                                                                                                                                                            | 4.33 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Water regulation                            |                                                                                                                                                                                                                                                                                            | 4.40 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Biodiversity conservation                   |                                                                                                                                                                                                                                                                                            | 4.18 | Cultural services               | 4.18                |            |
|                                                                                                                                                                                                                                                                                                              | Recreation                                  |                                                                                                                                                                                                                                                                                            | 4.15 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Aesthetics appreciation                     |                                                                                                                                                                                                                                                                                            | 4.20 | Provisioning services           | 3.55                |            |
|                                                                                                                                                                                                                                                                                                              | Food supply                                 |                                                                                                                                                                                                                                                                                            | 3.76 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Energy supply                               |                                                                                                                                                                                                                                                                                            | 3.40 |                                 |                     |            |
|                                                                                                                                                                                                                                                                                                              | Timber supply                               | 3.48                                                                                                                                                                                                                                                                                       |      |                                 |                     |            |
| 【Part2】 9-Point scale for schwartz values survey (Your task is to indicate how important each value is as a guiding principle in your life).                                                                                                                                                                 |                                             |                                                                                                                                                                                                                                                                                            |      | Mean value orientation          |                     |            |
| Schwartz's individual values (Underlying motivational goals)                                                                                                                                                                                                                                                 |                                             | ✓                                                                                                                                                                                                                                                                                          |      | Mean score                      | Value domain        | Mean score |
| Achievement (personal accomplishment and excellence)                                                                                                                                                                                                                                                         |                                             | <div><input type="radio"/> -1. Contrary to your guiding principles</div> <div><input type="radio"/> 0. Not at all important</div> <div><input type="radio"/> 3. Important</div> <div><input type="radio"/> 6. Very important</div> <div><input type="radio"/> 7. Extremely important</div> | 6.80 | Self-enhancement                | 6.13                |            |
| Power (control over people and resources)                                                                                                                                                                                                                                                                    |                                             |                                                                                                                                                                                                                                                                                            | 5.46 |                                 |                     |            |
| Benevolence (helpfulness to others and society)                                                                                                                                                                                                                                                              |                                             |                                                                                                                                                                                                                                                                                            | 7.54 | Self-transcendence              | 7.31                |            |
| Universalism (equality, social justice and tolerance for all)                                                                                                                                                                                                                                                |                                             |                                                                                                                                                                                                                                                                                            | 7.07 |                                 |                     |            |
| Self-Direction (independent thought, creativity, curiosity and freedom of choice)                                                                                                                                                                                                                            |                                             |                                                                                                                                                                                                                                                                                            | 7.22 | Openness to change              | 6.82                |            |
| Stimulation (excitement, novelty, change and daring)                                                                                                                                                                                                                                                         |                                             |                                                                                                                                                                                                                                                                                            | 6.21 |                                 |                     |            |
| Hedonism (pleasure, enjoyment and sensual satisfaction)                                                                                                                                                                                                                                                      |                                             |                                                                                                                                                                                                                                                                                            | 7.02 |                                 |                     |            |
| Security (social order, safety, stability and family security)                                                                                                                                                                                                                                               |                                             |                                                                                                                                                                                                                                                                                            | 7.88 | Conservation                    | 7.17                |            |
| Conformity (compliance with social norms and loyalty)                                                                                                                                                                                                                                                        |                                             |                                                                                                                                                                                                                                                                                            | 6.84 |                                 |                     |            |
| Tradition (respect and commitment customs and religious beliefs)                                                                                                                                                                                                                                             |                                             |                                                                                                                                                                                                                                                                                            | 6.77 |                                 |                     |            |
| 【Part3】 Demographic information statistics (All responses will be recorded anonymously; no one will know which answers belong to you).                                                                                                                                                                       |                                             |                                                                                                                                                                                                                                                                                            |      |                                 |                     |            |
| Gender, Age, Education level, Income, Residence (rural or urban, inland or coastal, province), and Occupation.                                                                                                                                                                                               |                                             |                                                                                                                                                                                                                                                                                            |      |                                 |                     |            |

**Figure 1.** Basic elements of the survey questionnaire and statistical results.

## 2.2. Sample and Data Collection

The study population comprised adult residents of China. Questionnaires were disseminated via WeChat (Tencent, Shenzhen, China; <https://weixin.qq.com>, accessed 15 March 2024), which reported over one billion active users as of March 2024. To increase response rates, snowball sampling was employed, wherein participants were encouraged to share the survey link within their networks. Questionnaires were distributed between March and May 2024 and a total of 1080 valid responses were collected. No personally identifiable information was collected. All data were securely stored, accessed only by the research team, and analyzed in aggregated form to ensure confidentiality and data protection.

As a non-probability sampling method, snowball sampling may introduce selection bias, as participants tend to recruit individuals with similar socio-demographic characteristics or value orientations. As a result, the sample may overrepresent socially connected, younger, and more highly educated urban residents, while underrepresenting populations with limited access to digital platforms. These features limit the representativeness of the sample and constrain the generalizability of the findings. Nevertheless, snowball sampling remains suitable for exploratory research aimed at examining preference structures and value–preference relationships rather than producing nationally representative estimates.

## 2.3. Statistical Analysis

This study used R (version 4.3.1, with RStudio, 2023) and SPSS 26.0 (2019) software to generate visualizations. The reliability and validity of the standardized questionnaire data were assessed using IBM SPSS Statistics 26 software. Cronbach's alpha coefficients for all scales were greater than 0.811, indicating high reliability of the questionnaire; removal of any single item resulted in a decrease in the  $\alpha$  coefficient, confirming the rationality of the scale design.

The core objectives of this study were to examine the differential explanatory power of values versus socio-demographic and locational variables regarding UGES preferences, to investigate the influence of values on UGES preferences, and to explore the mediating role

of values in the relationship between socio-demographic/locational variables and UGES preferences (Figure 2).

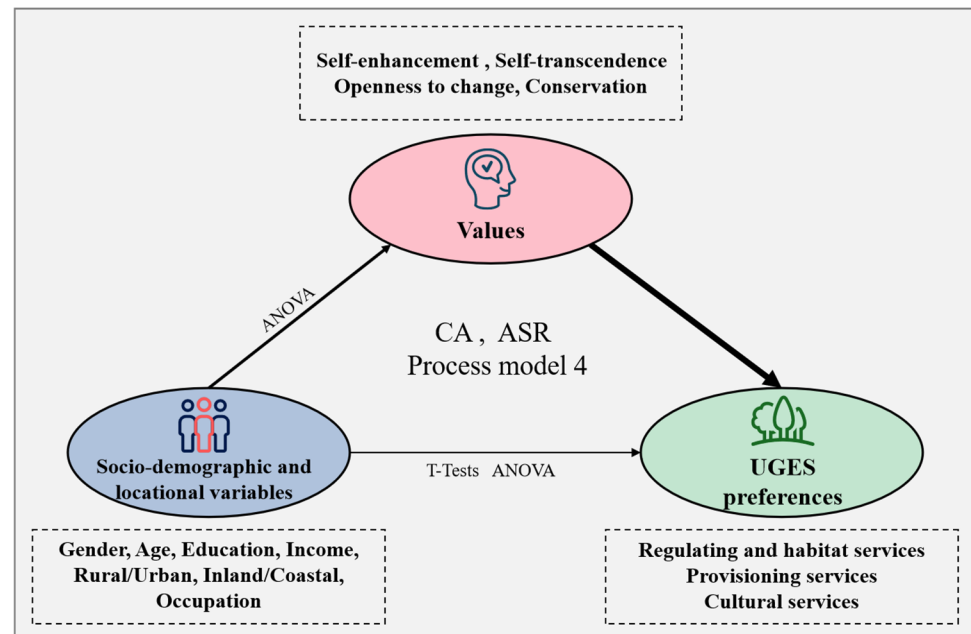


**Figure 2.** The research framework.

To address these goals, all variables were subjected to Z-score standardization to ensure comparability [54,55]. Analytical approaches included descriptive statistics (frequencies and means), Spearman’s correlation analysis (CA), Principal Component Analysis (PCA) with varimax rotation to identify latent dimensions of UGES preferences, independent samples *T*-tests and ANOVA, All Subsets Multiple Linear Regression Analysis (ASR), and Parallel Mediation Modeling (PROCESS model 4 in SPSS). For the ASR, optimal models explaining UGES preferences were selected based on minimized corrected delta Akaike Information Criterion ( $\Delta AICc$ ) using the MuMIn package in R. Standardized regression coefficients were computed, and the relative importance of predictors was quantified through variance partitioning via the rdacca.hp R package. This enabled assessment of the proportional variance contributions from values versus socio-demographic and locational variables to UGES preferences. Furthermore, we established a parallel mediation model with values as the mediator variable to investigate its mediating effects on UGES preferences across diverse socio-demographic and locational variables.

### 3. Results

#### 3.1. Sample Statistics

The respondents exhibited balanced gender representation, a relatively young demographic profile, high levels of education, moderate to high income evenly distributed, a predominantly urban residency pattern, and diverse occupational backgrounds (Table S1 for further details). Most respondents resided in economically advanced regions of China, including first-tier cities (e.g., Beijing, Shanghai), new first-tier cities (e.g., Qingdao, Hangzhou), and second-tier cities (e.g., Jinan) (Figure 3). The data collected likely reflect emerging trends in UGES preferences and value orientations in economically developed Chinese cities, offering relevant insights for cities worldwide with comparable socioeconomic and cultural contexts.

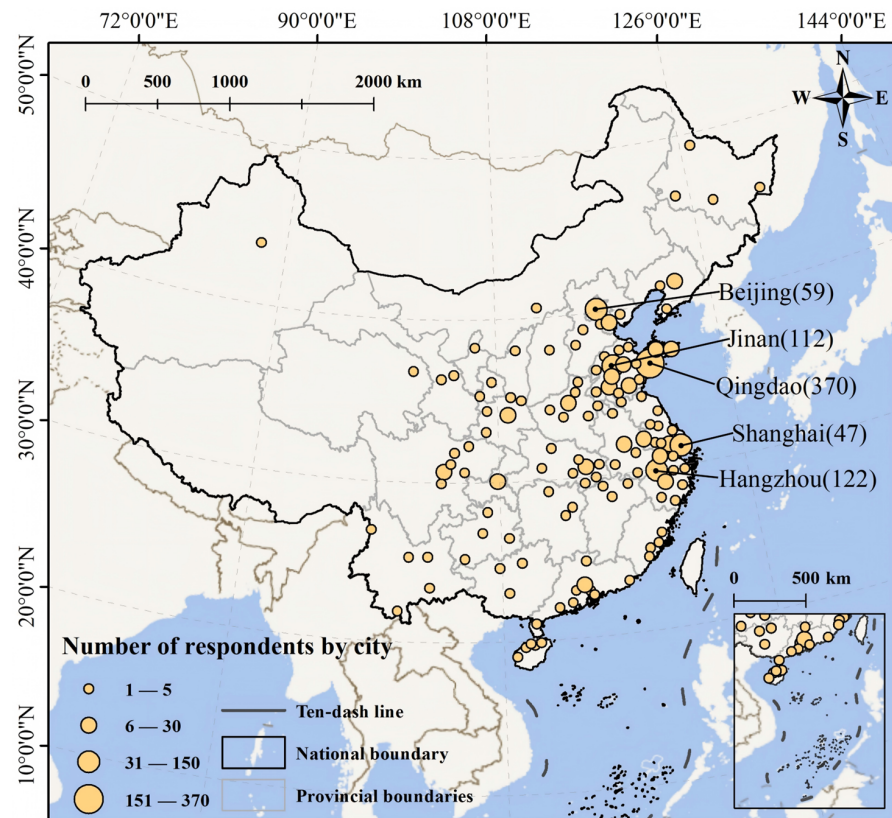


**Figure 3.** Place of origin of respondents.

### 3.2. Overall Ranking of UGES Preferences and Values

#### 3.2.1. UGES Factor Grouping

PCA extracted three major components from the UGES dataset (Figure 4). Together, these components accounted for 78.24% of the total variance. The first component, explaining 56.30% of the variance, was characterized by high loadings (high  $\cos^2$  values) on carbon sequestration, dust retention, temperature mitigation, noise mitigation, and water regulation. The second component (15.12%) exhibited strong loadings on energy, timber, and food supply, while the third component (6.83%) was associated with recreation and aesthetics appreciation.

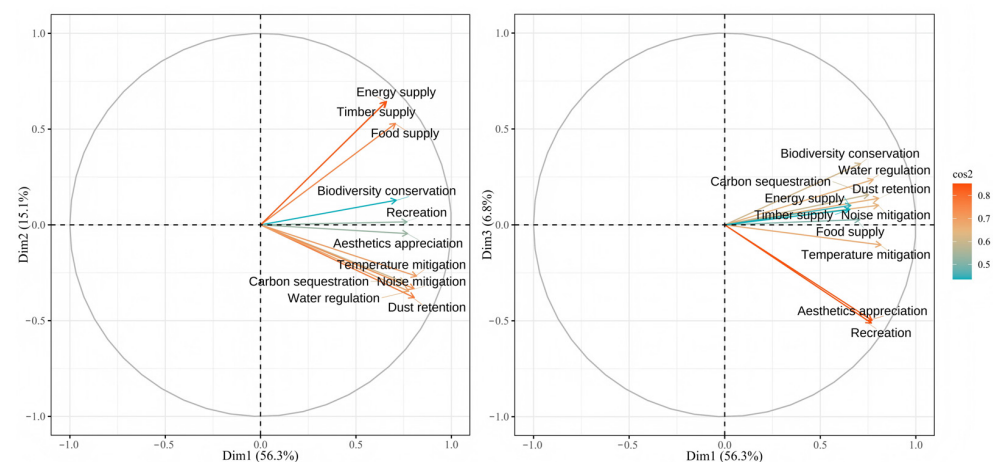


**Figure 4.** Plots of associated variables of the first three axes of the principal component analysis.

Following varimax rotation (converging after five iterations; rotated component matrix shown in Table S2), three distinct factors were ultimately identified. In line with the MA [51]

classification framework, the first factor (eigenvalue = 6.19) was defined as “Regulating and habitat services”, the second factor (eigenvalue = 1.66) as “Provisioning services”, and the third factor (eigenvalue = 0.75) as “Cultural services”.

### 3.2.2. Residents’ UGES Preferences (5-Point Scale)

Respondents showed stronger preference for regulating and habitat services ( $M = 4.32$ ) and cultural services ( $M = 4.18$ ) than for provisioning services ( $M = 3.55$ ). For each service category, preference scores were calculated as the average rating of its constituent items (Figure 2). For instance, preferences were higher for water regulation ( $M = 4.40$ ), dust retention ( $M = 4.39$ ), recreation ( $M = 4.15$ ), and aesthetic appreciation ( $M = 4.20$ ) than for provisioning services such as energy ( $M = 3.40$ ), timber ( $M = 3.48$ ), and food ( $M = 3.76$ ).

### 3.2.3. Residents’ Values (9-Point Scale)

Respondents expressed stronger alignment with values of security ( $M = 7.88$ ) and benevolence ( $M = 7.54$ ), while showing lower levels of endorsement for values such as power ( $M = 5.46$ ) and stimulation ( $M = 6.21$ ) (Figure 2). Following Schwartz’s value theory framework, the ten basic values are grouped into four overarching value domains: self-enhancement, self-transcendence, openness to change, and conservation. Respondents demonstrated higher scores in self-transcendence ( $M = 7.31$ ) and conservation ( $M = 7.17$ ), while exhibiting lower scores in openness to change ( $M = 6.82$ ) and self-enhancement ( $M = 6.13$ ), as determined by averaging the constituent value scores within each domain.

## 3.3. Differences in UGES Preferences and Values Among Demographic Factors

### 3.3.1. Differences in UGES Preferences

T-Tests (gender, rural/urban, inland/coastal) and ANOVA (age, education, income, occupation) revealed significant differences in UGES preferences across several socio-demographic and locational variables, including age, education level, income, urban/rural, inland/coastal, and occupation. For example, younger individuals (aged  $\leq 25$ ) exhibited significantly greater preferences for regulating and habitat services and provisioning services than older respondents (aged  $\geq 41$ ). No significant differences were observed for gender (Tables S3 and S4).

### 3.3.2. Differences in Values Among Different Age Groups

ANOVA results demonstrated significant intergroup differences across age cohorts in value domains such as self-enhancement, self-transcendence, and openness to change (Table 1). Notably, openness to change exhibited a consistent age-related pattern, with younger respondents expressing significantly higher endorsement of openness-oriented values than older age groups.

**Table 1.** Differences in values between age groups.

| Factor | Sub-Factor     | N   | Self-Enhancement    |       | Self-Transcendence  |       | Openness to Change |       | Conservation        |       |
|--------|----------------|-----|---------------------|-------|---------------------|-------|--------------------|-------|---------------------|-------|
|        |                |     | Mean                | S.D.  | Mean                | S.D.  | Mean               | S.D.  | Mean                | S.D.  |
| Age    | $\leq 25$      | 403 | 6.851 <sup>a</sup>  | 1.802 | 7.443 <sup>ab</sup> | 1.554 | 7.532 <sup>a</sup> | 1.396 | 7.141 <sup>ab</sup> | 1.593 |
|        | 26–30          | 101 | 6.015 <sup>b</sup>  | 1.612 | 7.099 <sup>a</sup>  | 1.449 | 6.871 <sup>b</sup> | 1.199 | 6.964 <sup>a</sup>  | 1.330 |
|        | 31–40          | 273 | 5.859 <sup>b</sup>  | 1.495 | 7.119 <sup>a</sup>  | 1.465 | 6.576 <sup>b</sup> | 1.351 | 7.150 <sup>ab</sup> | 1.373 |
|        | 41–50          | 208 | 5.421 <sup>c</sup>  | 1.603 | 7.228 <sup>ab</sup> | 1.402 | 6.147 <sup>c</sup> | 1.366 | 7.186 <sup>ab</sup> | 1.389 |
|        | $\geq 51$      | 95  | 5.568 <sup>bc</sup> | 1.666 | 7.684 <sup>b</sup>  | 1.301 | 5.870 <sup>c</sup> | 1.465 | 7.484 <sup>b</sup>  | 1.233 |
|        | <i>p</i> value |     | 0.000               |       | 0.001               |       | 0.000              |       | 0.069               |       |

The superscript letters (e.g., a, b, c, ab, bc) denote statistically significant differences between groups. If any two groups share one or more identical letters, they are not significantly different ( $p > 0.05$ ). Conversely, if no common letters exist between two groups, they exhibit statistically significant differences ( $p < 0.05$ ).

### 3.4. Spearman Correlation Analysis Among Socio-Demographic and Locational Variables, Values, and UGES Preferences

Significant and stable correlations were observed between values and UGES preferences (Figure S2). Among socio-demographic and locational variables, significant and stable correlations were found between education level, inland/coastal location, occupation, and UGES preferences. However, no significant correlation was observed between gender and UGES preferences. Correlations between age and income with cultural UGES preferences were not significant, and the correlation between rural/urban location and provisioning UGES preferences was also not significant. Additionally, no was identified between conservation and age, income, or rural/urban location. Self-enhancement showed no significant correlation with age or rural/urban location.

### 3.5. Influence of Values and Socio-Demographic and Locational Variables on UGES Preferences

#### 3.5.1. Differences in Explanatory Power of Values and Socio-Demographic and Locational Variables on UGES Preferences

Based on the minimum delta AICc criterion, the three best-fitting models (Models 1, 2, and 3) for explaining UGES preferences have been identified (Table S5). Additionally, a full model (Model 4) incorporating all variables and two reduced models (Models 5 and 6), each containing only one class of explanatory variables, were also evaluated. The results indicated that models relying solely on socio-demographic variables exhibited substantially lower explanatory power for UGES preferences compared to those incorporating value-based predictors.

#### 3.5.2. Optimal Explanatory Model for UGES Preferences

The optimal explanatory model (Model 1; Figure 5) demonstrated that value orientations accounted for a substantial portion of the variance in preferences for regulating and habitat services ( $\text{adj}R^2 = 0.31$ ) and cultural services ( $\text{adj}R^2 = 0.29$ ), with comparatively lower explanatory strength for provisioning services ( $\text{adj}R^2 = 0.21$ ). Overall, value orientations served as significantly stronger predictors of UGES preferences compared to socio-demographic factors. For example, in the model explaining preferences for regulating and habitat services, value orientations (conservation, openness to change, and self-transcendence) and socio-demographic variables (age and occupation) accounted for 86% and 14% of the explained variance, respectively. Despite being theoretically opposing, both conservation and openness to change exerted significant positive effects on preferences for this service category, indicating that regulating and habitat services fulfill multiple value-based objectives.

In summary, both conservation and openness to change had significant and positive associations with UGES preferences. Self-transcendence (e.g., benevolence and universalism) was positively associated with preferences for regulating and habitat services and cultural services, while self-enhancement (e.g., power and achievement) were associated with a preference for provisioning services. In addition, age was a significant predictor of preferences for regulating and habitat services and provisioning services, with younger individuals displaying stronger preferences for both categories. These findings underscore the need for future UGS management to address both the functional diversity of UGES and the heterogeneity in value realization across service categories.

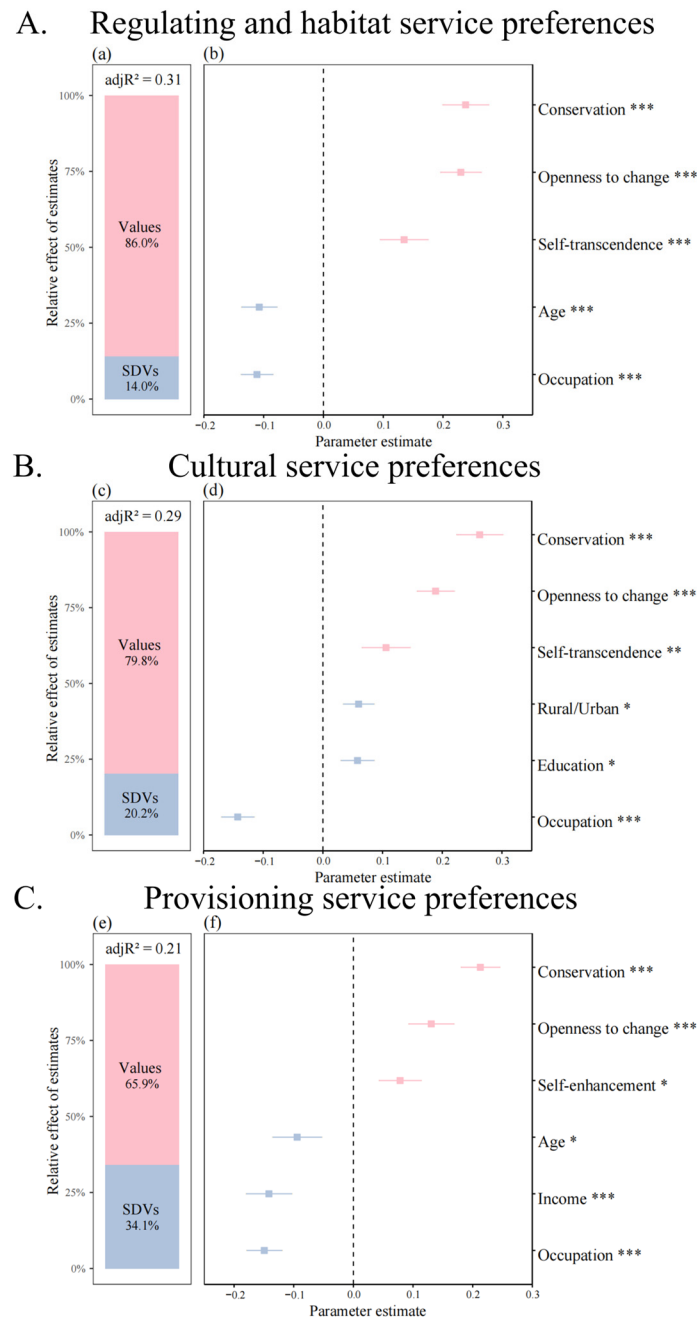


**Figure 5.** Relative effects of predictors of values and socio-demographic and locational variables (SDVs) for UGES preferences, including regulating and habitat service preferences (A), cultural service preferences (B), and provisioning service preferences (C). The figure shows the mean parameter estimates (standardized regression coefficients) for the model predictors and their associated 95% confidence intervals, as well as the relative importance of each type of predictor (expressed as a percentage of variance explained). The figure represents the best model selected based on  $\Delta \text{AICc}$ . \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

### 3.6. The Mediating Role of Values in Socio-Demographic and Locational Factors-Related UGES Preferences

A parallel mediation model was employed to investigate the mediating role of values in the association between socio-demographic and locational factors and UGES preferences (Figures 6, 7 and S3–S7). The results indicate that values significantly mediate the indirect effect of many socio-demographic and locational factors (e.g., age, education level, income, inland/coastal) on UGES preferences. Many socio-demographic factors exhibit stronger

effects when employ values as mediators, which exert indirect effect on UGES preferences (e.g., age, Figure 6; education level, Figure S4). For example, age had a negative effect on regulating and habitat and provisioning preferences; adding value of openness to change and self-transcendence, which was more approved by younger people, increases the effect of model (Figure 6). It is demonstrated that values increase the explanatory power of the socio-demographic factors, which have significant effect on UGES preferences. Some socio-demographic and locational factors do not have significant effect on UGES (e.g., income, Figure 7; inland/coastal, Figure S6). However, incorporating values in models will create significant effect. For example, income does not have direct significant effect on regulating and habitat preferences, but path models through openness to change create a significant indirect effect (Figure 7). It is demonstrated that in some circumstances, socio-demographic factors (e.g., income) may not be the deciding factor on UGES preferences, but values are.

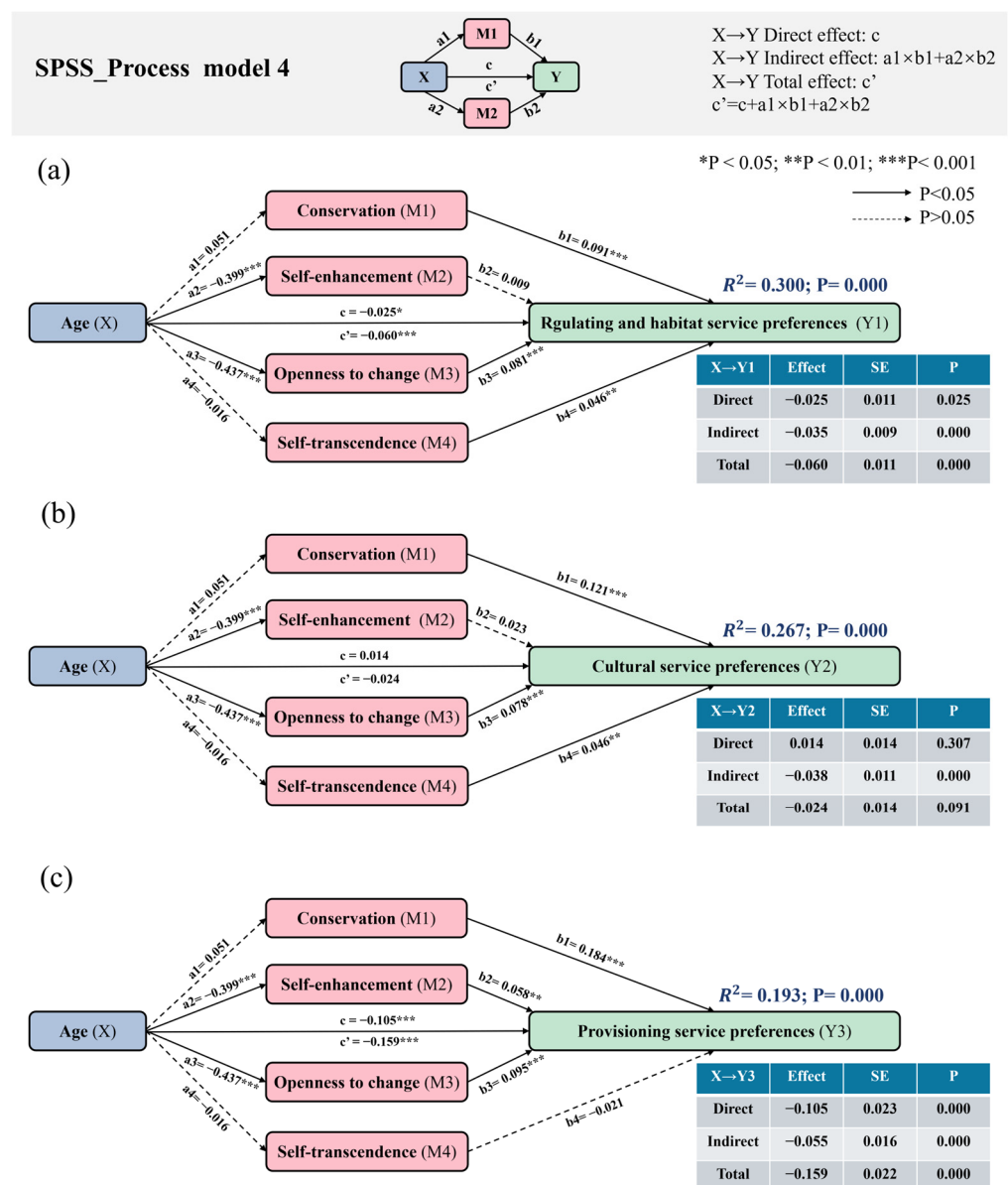


**Figure 6.** Value-mediated models of the effect of age on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Age was coded as  $\leq 25$  (1), 26–30 (2), 31–40 (3), 41–50 (4), and  $\geq 51$  (5) for the regression analysis.

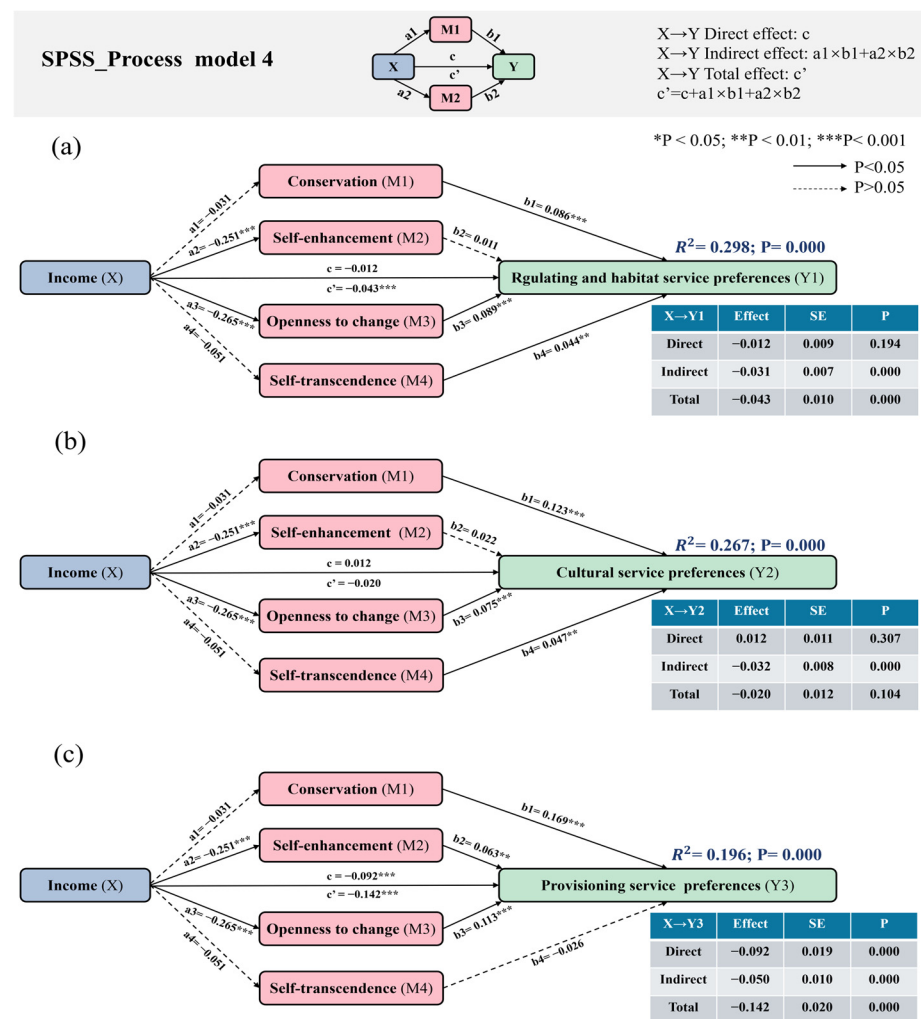


**Figure 7.** Value-mediated models of the effect of income on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Income was coded as  $\leq 2000$  (1), 2001–3000 (2), 3001–5000 (3), 5001–8000 (4), and  $\geq 8001$  (5) for the regression analysis.

Taken together, the mediation analyses reveal several consistent patterns. Across multiple socio-demographic and locational variables, openness to change and self-transcendence emerge as the most recurrent mediators, particularly for regulating and habitat services and cultural services. These value dimensions frequently transmit or amplify the effects of age, education level, and income on UGES preferences, whereas self-enhancement plays a more limited mediating role and is primarily associated with provisioning service preferences. In many cases, the inclusion of values transforms weak or non-significant direct effects of socio-demographic variables into significant indirect effects, highlighting the central role of value orientations in structuring how socio-demographic differences are translated into ecosystem service preferences.

## 4. Discussion and Policy Implications

### 4.1. Values as Core Drivers of UGES Preferences

Value orientations emerged as the most influential predictors of residents' preferences for UGES, consistently outperforming conventional socio-demographic indicators. This finding accords with established theoretical and empirical work demonstrating that values constitute the foundational basis of environmental perceptions, attitudes, and behavioral intentions [56]. In explaining preferences for regulating and habitat services and for cultural

services, value orientations accounted for 86% and 80% of the explained variance, respectively, substantially exceeding the contribution of socio-demographic variables. These results indicate that, within the scope of variables examined, values function as particularly strong predictors of individual ecosystem service preferences.

Beyond their direct effects, values also played a significant mediating role in shaping UGES preferences. Socio-demographic factors such as age, education, and income exerted stronger indirect effects on preferences when transmitted through value orientations, a pattern consistent with the well-established “value-mediated” mechanism in environmental psychology [47,57]. The present findings extend this mechanism to the context of UGES. At the same time, the explanatory power of the optimal ASR models remained moderate (adjusted  $R^2 = 0.21\text{--}0.31$ ), a level comparable to that reported in prior research on individual preferences. Such residual variance is expected in social research and likely reflects unobserved situational, contextual, and experiential influences.

Future studies could enhance explanatory power by incorporating additional factors, including ecological conditions, perceived environmental quality, patterns of green space use, and place-based cultural or institutional contexts. Integrating residents’ direct environmental experiences with value-based and socio-demographic variables may provide a more comprehensive understanding of preference formation and improve the empirical basis for value-informed UGS planning.

#### 4.2. UGES Preference Differentiation and Convergence Under Pluralistic Value Systems

Residents’ preferences for different categories of UGES display both differentiation and convergence under the coexistence of multiple value orientations. Multiple value dimensions were significantly associated with UGES preferences, although the direction and strength of these relationships varied across service types. This pattern indicates that ecosystem service preferences do not represent the expression of a single dominant value, but rather emerge from the combined influence of coexisting and sometimes competing value orientations.

Self-transcendence values, such as benevolence and universalism, showed consistently positive associations with UGES preferences, particularly for regulating and habitat services and for cultural services. This finding aligns with prior research indicating that individuals with stronger self-transcendence orientations tend to prioritize ecological protection, environmental quality, and collective well-being. In contrast, self-enhancement values, such as power and achievement, were more closely linked to preferences for provisioning services, reflecting a greater emphasis on material benefits and direct utility [44]. Ecosystem service preferences may therefore be interpreted as context-dependent reflections of individuals’ core value orientations rather than as direct or isolated expressions of any single value dimension [56,58].

Notably, both conservation (e.g., security, tradition) and openness to change (e.g., stimulation, autonomy)—often conceptualized as opposing motivational orientations—were positively associated with preferences for regulating services. Although this result may appear counterintuitive, it underscores the multifunctional and broadly shared benefits of regulating services. From a conservation-oriented perspective, services such as air purification, climate regulation, and risk mitigation contribute to environmental stability, safety, and order. From an openness-to-change perspective, these same services enhance adaptive capacity, innovation, and improvements in urban quality of life.

This apparent convergence of opposing value orientations suggests that preferences for regulating services arise from interactions among multiple values within a pluralistic system rather than from a single motivational source. Regulating services thus functions as a point of consensus among individuals holding diverse and sometimes tension-filled value

orientations. These findings reinforce the central argument that values are core drivers of UGES preferences, while preference formation reflects complex, non-linear interactions among coexisting values.

While these results support the coexistence of multiple value dimensions in shaping UGES preferences, the extent to which such patterns generalize may depend on the socio-cultural profile of the study sample. In a predominantly young, highly educated, and urban context, values related to openness to change and self-transcendence may be more salient, potentially strengthening preferences for regulating and cultural services and making “shared-benefit” functions (e.g., air purification, climate regulation, hazard mitigation) more widely recognized. At the same time, the relatively weaker prominence of self-enhancement-oriented motivations in this sample may contribute to the comparatively lower preference intensity for provisioning services. Therefore, the observed value–preference configuration—including the simultaneous positive roles of conservation and openness to change for regulating services—should be interpreted as reflecting how multiple value motivations can align around urban-regulating benefits under specific socio-cultural conditions, rather than as a universally fixed structure across all demographic groups.

Beyond explaining UGES preferences at an empirical level, these findings also offer theoretical insights for the classic values–behavior framework. Traditional value theories often emphasize motivational conflicts between opposing value dimensions, such as conservation versus openness to change. However, the present results suggest that, in the specific context of urban green spaces, such value dimensions do not necessarily operate in competition. Instead, they may function in a complementary or cooperative manner when different values converge on a shared evaluative object. Regulating services in urban environments simultaneously satisfy conservation-oriented motivations (e.g., security, stability, risk reduction) and openness-oriented motivations (e.g., adaptability, innovation, and improved quality of urban life). As a result, preferences emerge not from a single dominant value, but from the alignment of multiple value dimensions around context-specific benefits. This finding extends value–behavior theory by highlighting that the translation of values into preferences is contingent on situational characteristics of the choice context, where ostensibly opposing values can jointly reinforce preference formation rather than cancel each other out.

#### *4.3. Generational Value Shifts and Emerging Trends in UGES Preferences*

Clear age-related differences were observed in residents’ preferences for UGES. Younger respondents (see Figure S8 for the distribution of socio-demographic and locational characteristics of the young population) exhibited stronger preferences for regulating and habitat services as well as for provisioning services compared with older age groups, a pattern consistently supported by descriptive statistics, regression analyses, and mediation models. These results indicate that age is a salient correlate of variation in UGES preferences within the study population.

Importantly, these age-related differences are closely linked to underlying value orientations. Younger respondents demonstrated stronger endorsement of openness to change and self-transcendence, both of which were positively associated with preferences for regulating and functional ecosystem services. This finding suggests that generational variation in UGS preferences may be partly explained by differences in value orientations rather than by age *per se*. Such patterns are consistent with prior evidence that individuals with stronger prosocial and change-oriented values are more likely to prioritize ecosystem services associated with collective benefits and long-term sustainability.

While these value orientations may reflect broader socio-economic and educational transformations, the cross-sectional nature of the data precludes causal inference regarding generational value change. Accordingly, the findings should be interpreted as indicative of potential pathways linking age, values, and ecosystem service preferences rather than as definitive evidence of value shifts over time.

#### *4.4. Policy Implications*

The empirical results indicate that regulating and habitat services and cultural services are the most highly valued UGES categories among the surveyed respondents, particularly among younger and more highly educated residents in economically developed Chinese cities. The strong explanatory role of value orientations further suggests that residents' UGES preferences are closely tied to underlying motivational and psychological factors rather than being determined solely by observable socio-demographic characteristics. Together, these results suggest that incorporating value-based perspectives into urban green space planning may help improve the alignment between ecosystem service provision and residents' preferences in comparable urban contexts.

These findings highlight the potential value of incorporating value-based perspectives into UGS planning and governance. Given pronounced heterogeneity in preferences across age groups and value orientations, uniform or one-size-fits-all UGS provision strategies may be insufficient under conditions of limited land and fiscal resources. Instead, planners and decision-makers may benefit from adopting more inclusive and value-responsive approaches that explicitly account for differences in residents' motivations and priorities. The positive association between regulating services and multiple value dimensions further suggests that such services may serve as point of convergence across diverse social groups. Emphasizing shared-benefit services, such as climate regulation, air purification, and water regulation, may therefore facilitate consensus-building and public support for UGS initiatives in rapidly urbanizing cities.

These policy implications should be interpreted as context-specific rather than universally prescriptive. The findings primarily reflect preference patterns among socially connected, urban residents in economically developed regions of China, and their applicability may vary across different socio-economic, cultural, and institutional settings. Future UGS planning efforts would benefit from integrating value-based insights with local ecological conditions, governance frameworks, and participatory processes to enhance both effectiveness and equity in ecosystem service provision.

## **5. Conclusions and Limitations**

This study demonstrates that personal value orientations constitute the primary drivers of residents' preferences for urban UGES, exerting a stronger and more consistent influence than conventional socio-demographic variables. Among young and relatively well-educated residents in large and economically developed Chinese cities, preferences for regulating (e.g., water regulation, dust retention) and cultural (e.g., aesthetic appreciation, recreation) services were generally stronger than for provisioning services (e.g., energy and supply). These patterns reflect the influence of value dimensions such as self-transcendence, conservation, and openness to change. More broadly, the findings suggest that UGES preferences can be understood as context-dependent expressions of underlying value structures rather than as fixed or universally shared priorities.

Several limitations should be acknowledged. First, the use of an online survey combined with snowball sampling likely resulted in the overrepresentation of younger, more highly educated, and socially connected urban residents, while underrepresenting older populations and individuals with limited access to digital platforms. Accordingly, the

findings should not be generalized to all Chinese residents but are most applicable to socio-demographically similar groups in rapidly urbanizing cities. The prominence of self-transcendence values and the strong preference for regulating services may therefore partly reflect sample composition rather than population-level patterns. Second, the analysis relies primarily on group-level averages, which may obscure meaningful heterogeneity within age, education, or value groups. Individual differences in lived experience, environmental exposure, and local ecological conditions may give rise to preference patterns that are not fully captured by mean-based models.

Finally, the cross-sectional and self-reported nature of the data limits causal inference regarding value formation and preference change. Future research should employ more diverse and demographically balanced samples, adopt distribution-sensitive or subgroup-specific analytical approaches, and integrate survey-based data with field-based ecological measurements. In addition, combining importance-based Likert assessments with more nuanced preference elicitation methods, such as choice experiments or trade-off-based designs, could further strengthen the empirical foundation for value-informed UGS planning.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su18041834/s1>, Figure S1: The Schwartz value wheel. Schwartz's theory of fundamental human values proposes this value structure in which the four main value areas (Openness to change, Conservatism, Self-enhancement, and Self-transcendence) can be categorized into more specific values (within the wheel); Figure S2: Spearman's rank correlation coefficient between Socio-demographic and locational variables, Values, and UGES preferences. Socio-demographic and locational variables: Gender (Gnd), Age, Education (Edc), Income (Inc), Rural/Urban (R/U), Inland/Coastal (I/C), Occupation (Occ); Values: Self-enhancement (Self-e), Openness to change (Open), Self-transcendence (Self-t), Conservation (Cons); UGES preferences: Regulating and habitat service preferences (Reg), Cultural service preferences (Cul), Provisioning service preferences (Pro). \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; Figure S3: Value-mediated models of the effect of gender on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Gender was coded as male (0), female (1) for the regression analysis; Figure S4: Value-mediated models of the effect of education on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Education was coded as High school and below (1), Bachelor (2), Master (3) for the regression analysis; Figure S5: Value-mediated models of the effect of rural-urban attribute on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Rural-urban attribute was coded as rural (0), urban (1) for the regression analysis; Figure S6: Value-mediated models of the effect of locational attribute on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Locational attribute was coded as inland (0), coastal (1) for the regression analysis; Figure S7: Value-mediated models of the effect of occupation on UGES preferences. Panels (a–c) illustrate the mediation models for regulating and habitat service preferences, cultural service preferences, and provisioning service preferences, respectively. Occupation coding is specified in Table S1; Figure S8: Socio-demographic and locational profile of the young population; Table S1: Socio-demographic and locational characteristics of respondents; Table S2: Results of factor analysis of social preferences for ecosystem services in urban green spaces; Table S3: Variability in UGES preferences among socio-demographic and locational variables; Table S4: Variability of UGES preferences across occupational characteristics; Table S5: Optimal model for UGES preferences interpretation and model with all variable factors and single class variable factors, color-filled sections indicate the corresponding factor variables included in the model; Table S6: Diagnostic results of covariance matrix for optimal regression models. Refs. [43,59] are cited on the supplementary material.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding authors.

**Conflicts of Interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Abbreviations

The following abbreviations are used in this manuscript:

|      |                                      |
|------|--------------------------------------|
| UGS  | Urban green space(s)                 |
| UGES | Urban green space ecosystem services |
| SDG  | Sustainable Development Goals        |

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