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The Linkage Between Cultural Ecosystem Services and Local Culture

Guolunan Yang * and Masahiro Sato

Graduate School of International Cultural Studies, Tohoku University, Sendai 980-8576, Japan; masahiro.sato@tohoku.ac.jp

* Correspondence: yang.guolunan.t7@dc.tohoku.ac.jp

Abstract

A deep interplay exists among cultural ecosystem services (CES), local culture, and sustainable environmental management, forming a critical foundation for sustainability. Understanding the linkage between CES and local culture can assist policymakers in designing holistic conservation strategies and sustainably managing natural resources effectively. To capture its multidimensional nature, local culture is assessed through local cultural values (LCV) and the emotional (PI) and functional (PD) aspects of human–place bonds (PA). A questionnaire survey incorporating the contingent valuation method was conducted in Jinan City, eastern China. The results show that: (1) CES influence LCV only through PA; (2) the internal interaction process among cultural elements follows PD ⇒ PI ⇒ LCV; and (3) the overall pathway is CES ⇒ PD (β = 0.252) ⇒ PI (β = 0.708) ⇒ LCV (β = 0.573). This study, for the first time, revealed this comprehensive pathway linking CES and local culture, highlighting the mediating role of PD in this connection. These findings suggest that policymakers and urban planners should emphasize the functional dimension (PD) of human–place bonds to enhance environmental resource management, support sustainable use, and increase public acceptance of local policies by strengthening CES.

Keywords: cultural ecosystem services; local culture; local cultural values; place attachment; place identity; place dependence; sustainable environmental management

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Academic Editor: Jean-Claude Thill

Received: 18 September 2025
Revised: 14 October 2025
Accepted: 20 October 2025
Published: 23 October 2025

Citation: Yang, G.; Sato, M. The Linkage Between Cultural Ecosystem Services and Local Culture. *Sustainability* **2025**, *17*, 9420. https://doi.org/10.3390/su17219420

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1. Introduction

Cultural ecosystem services (CES), local culture, and sustainable environmental management have a complex linkage. CES, which are non-material benefits derived from ecosystems, play a crucial role in shaping local culture [1–3], which in turn influences behavior and policy regarding ecosystem management [2,4,5]. For example, Mongolians' connection with grasslands fosters nature worship, encouraging them to view these landscapes as sacred and worthy of protection.

Understanding how CES affect local culture enables policymakers to emphasize human–nature relationships, design comprehensive conservation strategies, and manage resources effectively. Acknowledging this link may also reinforce individuals' willingness to sustainable resource use.

However, although the relationship between CES and local culture has been theorized in prior research [1–3], empirical evidence remains limited. This study seeks to fill that gap by empirically examining how CES influence local culture.

Following previous studies that measure culture through cultural values [6–11], this research assesses local culture using local cultural values (LCV) related to environmental

conservation. Theoretically, LCV can be considered as the moral dimension of local culture, because they are the place-specific manifestations of universal moral principles (e.g., justice). Defined as evaluative beliefs shared within a city or region regarding what is significant, worthy, or meaningful [2,12], LCV are the contextualized guidelines that translate abstract moral principles into practical, locally based actions for individual decision-making in support of sustainable environmental protection.

However, one limitation of using LCV to measure local culture is that they do not capture other key dimensions [11], such as material traits, emotional characteristics, and lifestyle aspects of a society or social group [13]. One such dimension, significantly shaped by CES, is human–place bonds. Local culture emerges from the interaction between people and their environment [2,3,14], with human–place bonds developing through historical experience, shared beliefs, emotions, symbols, and cultural meaning [15]. Social psychologists often conceptualize these bonds using the notion of place attachment (PA), defined as the positive connection people have with meaningful environments [15]. Including the bonding dimension (PA) alongside the moral dimension (LCV) offers a more comprehensive view of local culture and deepens our understanding of its link with CES.

When incorporating PA into the measurement of local culture, this study distinguishes between its emotional and functional components: place identity (PI) and place dependence (PD).

In summary, this study empirically examines how CES influence local culture by addressing both moral (LCV) and bonding (PA) dimensions, the latter being further divided into PD and PI. Specifically, two research questions are addressed:

1. What are the effects of CES on LCV and PA?
2. What are the internal processes within local culture among PI, PD, and LCV?

The study makes several contributions. First, while previous studies have primarily focused on the moral dimension to measure culture [6–11], this research offers a multidimensional perspective by incorporating human–place bonds (PA). Second, the present study distinguishes between emotional and functional bonds, thereby refining the examination of CES's impacts on PA. Finally, this study explores the internal relationships among PI, PD, and LCV, providing empirical evidence on the strength and interdependence of these cultural dimensions from moral and bonding perspectives.

The remainder of this paper is structured as follows: Section 2 reviews the literature and develops the hypotheses. Section 3 presents the research area. Sections 4 and 5 outline the survey design and data analysis results. Section 6 discusses the findings in comparison with previous research and the role of the linkage between CES and local culture in sustainable environmental management. Section 7 concludes the study.

2. Literature Review and Hypotheses Development

2.1. Cultural Ecosystem Services

Most existing research has predominantly focused on the role of CES in sustainability decision-making, such as addressing urban sustainability [16], forest management [17], landscape management and planning [18], mangrove protection [19], and land management [20]. However, these studies often overlook how local culture mediates the influence of CES on such decision-making. Moreover, Yang and Sato [21] indicated that water-related CES and local cultural values can encourage water-saving behaviors among households through strengthening perceived behavioral control. Nonetheless, their study did not explicitly examine the linkage between CES and local culture.

2.2. Cultural Ecosystem Services and Sustainable Development

Sustainable development calls for balancing the needs of present and future generations [22]. It can be framed by environmental, economic, and social pillars [23,24]. Because of the strong influence of culture on ecological balance, social justice, and self-reliance [25], a growing literature has extended the social pillar into the socio-cultural pillar [26–29]. This extended pillar underscores that culture is a foundational driver in the transition to a sustainable society [25,27,29].

Within this socio-cultural pillar, CES promote sustainable development through two primary pathways. First, these cultural benefits, such as sense of place, cultural heritage values, and spiritual values, are essential components of human well-being and cultural identity [3,30–32]. Second, these benefits motivate environmental conservation practices [1,2,4,21,33–35] and support cultural and recreational economies [3,36,37].

2.3. Local Culture

Culture is a multi-layered construct consisting of material (e.g., artifacts, buildings, practices) and immaterial elements (e.g., cultural meaning, cultural values, human–place bonds) [5,11]. This study focuses specifically on the intangible elements of local culture that emerge from human–environment interactions. These are the key components of local culture that govern and interpret human behaviors [5,11,14]. We capture these in particular using the concepts of LCV and PA.

PA has been operationalized in diverse constructs in the literature, including as a single construct [38–41], and through components like PI and PD [34,42–45], social bonding [42,43,46], nature bonding [42], place affect [45,47], and place satisfaction [48]. The dual construct of PI and PD has gained wide acceptance [15,49], since PI reflects the symbolic or emotional bond with a place [49], while PD represents the functional relationship based on how well a location supports recreational needs or goal attainment [50]. In line with this popular perspective, the present research conceptualized PA as a dual construct comprising PI and PD.

2.4. The Linkage Between Cultural Ecosystem Services and Local Culture

CES provide a variety of cultural benefits to humanity, such as health, sense of place, knowledge, and inspiration, and shape local culture (e.g., values, meanings, symbols, traditions, cultural diversity, artifacts, and social relationships) through the interaction between environmental spaces and cultural practices [1,3,14]. Through valuing the sense of place associated with recognized features of their surrounding ecosystems [3], many people develop their positive human–place bonds [15]. When CES allow individuals to live comfortably, meet recreational needs, or pursue goals, people may develop functional dependence on that place. Similarly, emotional bond can deepen when individuals associate locations with positive experiences and memories [15]. Zhang et al. [34] found that perceptions of CES positively influence PA among national forest park visitors. Based on this, this research hypothesizes:

H1. *CES positively impact PD.*

H2. *CES positively impact PI.*

H3. *CES positively impact LCV.*

2.5. Local Cultural Values, Place Identity, and Place Dependence

Research by Kuo et al. [51] and Wan et al. [52] suggested that PD positively affects PI; in other words, a place's ability to meet individuals' needs fosters emotional attachment.

Valizadeh et al. [47] found that both functional and emotional bonds influence farmers' moral norms regarding water conservation. That is, the stronger the farmers' bonds with place, the more their perceived rules and commitments of morality to water saving are reinforced [47]. For example, when these bonds are strong, farmers are more likely to feel a sense of personal responsibility to conserve agricultural water and recognize the value of such actions. Guided by moral principles, LCV reflect evaluative beliefs about the worth and importance of environmental protection. Thus, when a place supports people's needs and fosters emotional ties, individuals may develop evaluative beliefs oriented toward environmental protection. Accordingly, the present study proposes:

H4. *PD contributes to the emergence of PI.*

H5. *PD contributes to the formation of LCV.*

H6. *PI positively impacts the formation of LCV.*

The research framework and associated hypotheses are illustrated in Figure 1.

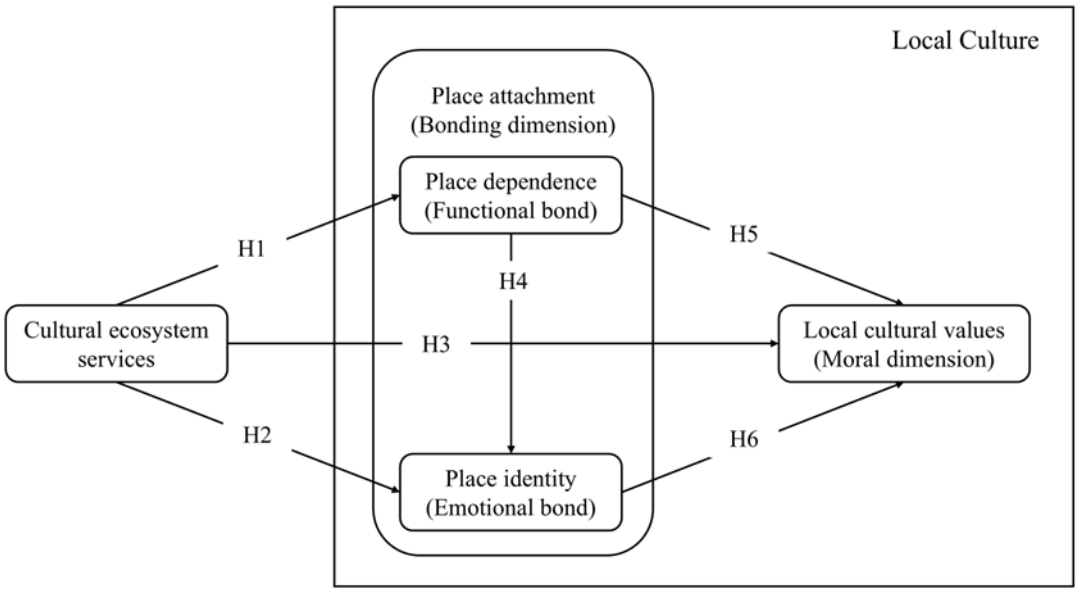


Figure 1. Research framework and hypotheses.

3. Research Area

Jinan City is located in eastern China, with a population of 9.2 million across 10 districts and two counties [53]. The city is home to 1209 springs that provide abundant CES. The administrative divisions of Jinan City are shown in Figure 2. Jinan City can be divided into the central and the marginal areas. The central area includes four districts: Lixia, Shizhon, Huaiyi, and Tianqia. These comprise Jinan's downtown and are close to the spring landscape.

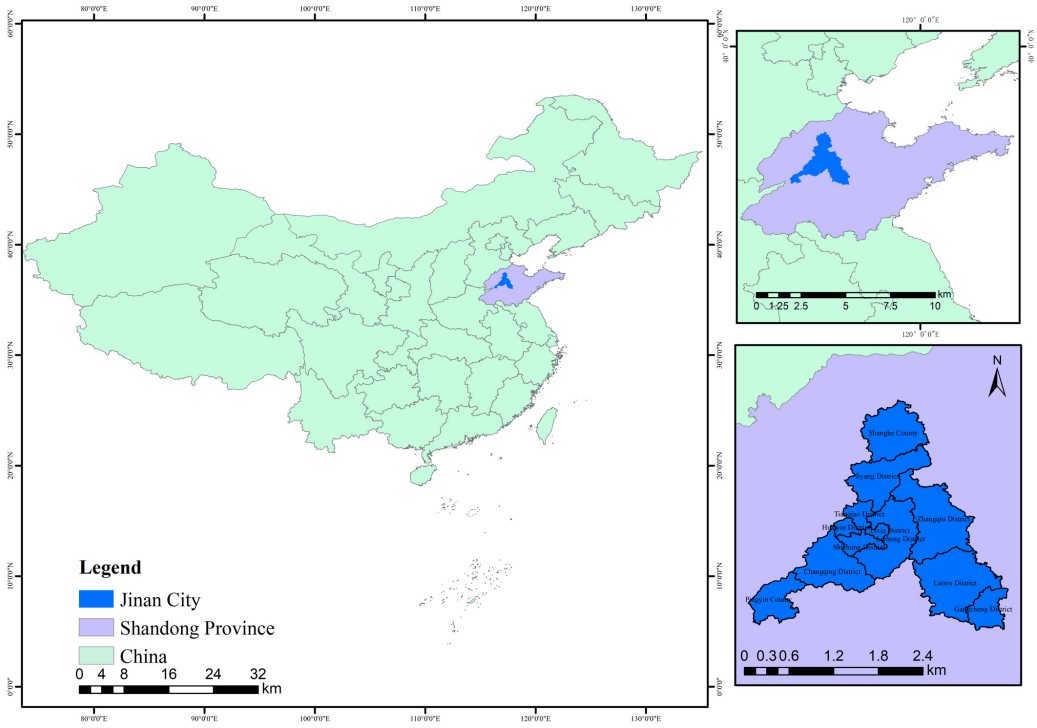


Figure 2. Location of Jinan City.

Since the 1970s, overexploitation led to the gradual cessation of spring flow. In response, the government promoted local culture focused on spring protection and sustainable development through newspapers, educational programs, and news broadcasts. These efforts led to the resurgence of spring activity in 2003. In 2019, the spring cultural landscape was added to China's tentative list for World Heritage sites. The city's iconic springs have fostered strong human–place bonds among residents.

4. Methods

4.1. Survey Implementation

A street survey was conducted in each district and county of Jinan City. Leaflets with QR codes were distributed to permanent residents (duration of residence $\geq$ one year) in the streets between October 2023 and April 2024. The respondents answered the questionnaire online by scanning QR codes. To target the permanent residents, the questionnaire asked about their residence time (in years) in Jinan City. The leaflets and questionnaire website also stated the aim and described the procedure of this research. To ensure anonymity, the questionnaire did not collect any respondents' home addresses or other identifying information.

A total of 1500 leaflets were distributed, and 572 responses were collected, of which 404 were valid. In these 404 questionnaires, all respondents gave a specific willingness to pay (WTP) for CES, ranked their statement of LCV, PI, and PD, and answered their basic sociodemographic information. The sample covers all districts and counties of Jinan City. Of the total valid sample, 242 respondents reported residing in the central area and 161 respondents in the marginal area, while one respondent selected "prefer not to answer".

This sample exceeds the minimum required, which is ten times the number of latent variables (10 $\times$ 4), for partial least squares structural equation modeling (PLS-SEM) [54].

4.2. CES Valuation

This study employed the contingent valuation method (CVM) to quantify the CES of Jinan's spring landscapes. A survey-based technique, CVM estimates nonmarket values

through a hypothetical scenario followed by a question on respondents' WTP [55,56]. A key strength of CVM is its ability to capture all CES categories [57].

Using the four protection and restoration projects implemented by the Jinan government from 2021 to 2025 [58], this research developed a hypothetical scenario and used a payment card question to assess respondents' WTP (Table 1).

Table 1. Hypothetical scenario, question, and payment card of CVM.

Hypothetical scenario	In order to maintain the springs' gushing and protect historical artifacts, the Jinan government proposed two specific goals. First, to increase the days of groundwater levels higher than 28.15 m from 98 to 200 in years of normal precipitation (647.9 mm); Second, to repair and protect 166 damaged or insufficiently protected cultural landscapes of the springs. For achieving the above two goals, the Jinan government planned to conduct four projects during 2021–2025 including: 1. Groundwater Monitoring System, 2. Restoration Project of Infiltration Areas, 3. Improvement Program in Landscapes, 4. Famous Springs Protection Master Plan II.
Question	If you are willing to pay for the four projects to protect the cultural values of the spring environment in Jinan, how much are the highest amounts of Chinese Yuan you would want to pay during 2021–2025 at one time? (Please answer the total amount you want to pay including the actual payment that you are already paying for these projects.)
Payment card	A. 0 Yuan, B. 10 Yuan, C. 20 Yuan, D. 30 Yuan, E. 50 Yuan, F. 70 Yuan, G. 90 Yuan, H. 140 Yuan, I. 180 Yuan, J. 220 Yuan, K. Other: _____ Yuan

4.3. Measurements of LCV, PI, and PD

LCV was measured using four items focusing on spring-related environmental protection and sustainable development in Jinan. PI and PD were assessed using the Abbreviated PA Scale (APAS), a validated instrument that addresses inconsistencies in previous PA studies [49]. APAS's strength lies in its brevity and cross-cultural applicability.

All items were rated on a seven-point scale (1 = extremely disagree, 7 = extremely agree) and randomized in the questionnaire to prevent inductive bias. Measurement details are listed in Table 2.

Table 2. Description of the variables, factors, and measurement items.

Latent Variable	Indicator	Measurement Item	Mean	S-W Test
Local cultural values	LCV1	The spring environment is important for Jinan City.	6.48	0.483 ***
	LCV2	The urban development of Jinan City needs to protect the spring environment.		0.573 ***
	LCV3	"Protection of springs takes priority over all" is the most important principle in the development process of Jinan City.		0.706 ***
	LCV4	All of Jinan's development plans must ensure the maintenance of a good spring environment (for example, protection and repair of spring landscapes, and maintenance of spring gushing).		0.67 ***
Place identity	PI1	I am very attached to Jinan City.	6.16	0.608 ***
	PI2	Jinan City is very special to me.		0.811 ***
	PI3	I identify strongly with "I am proud to be from Jinan City."		0.76 ***
Place dependence	PD1	Jinan City is the best place for me to live.	5.25	0.882 ***
	PD2	No other place can compare to Jinan City for living.		0.907 ***
	PD3	I would not substitute any other city for the activities I do in Jinan City.		0.884 ***

*** $p < 0.001$.

4.4. Statistical Analysis

Shapiro–Wilk test results indicated non-normal data distribution (Table 2). Therefore, this study utilized PLS-SEM for analysis. PLS-SEM is a causal modeling tool that maximizes the explained variance of dependent variables and accommodates non-normally distributed data [54]. This is achieved through a bootstrap method that resamples from the original data to generate a large and representative bootstrap sample [54]. The assessment of PLS-SEM consists of two separate stages: the evaluation of measurement models and the evaluation of the structural model [54].

5. Results

5.1. Respondent Profile

Among the respondents, 54.7% were female and 41.8% male. Most (77.5%) held a bachelor's degree as their highest level of education. A majority (88.1%) were aged 18–40. This pattern likely reflects the relatively young demographic characteristics in Jinan City [53], though it exhibited a particularly high proportion of participants under the age of 31. This may be attributed, in part, to a greater tendency among younger, highly educated individuals to engage with street surveys via QR codes on their smartphones. In terms of residency, 24.8% had lived in Jinan for 21–30 years, 16.3% for 4–6 years, and 14.9% for either 1–3 or 31–40 years. 68.1% of respondents reported a monthly income between 4001 and 12,000 Chinese Yuan, aligning with the general wage distribution in Jinan City [59]. Detailed sociodemographic information is provided in Table 3.

Table 3. Respondents' profile.

Demographic Variable		Number	Percentage
Gender			
	Female	221	54.7%
	Male	169	41.8%
	Prefer not to answer	14	3.5%
Educational Level			
	Elementary school	1	0.2%
	High school	17	4.2%
	University/college	313	77.5%
	Graduate school	67	16.6%
	Prefer not to answer	6	1.5%
Age			
	18–30	229	56.7%
	31–40	127	31.4%
	41–50	35	8.7%
	51–60	12	3%
	≥61	1	0.2%
Residence Time (Years)			
	1–3	60	14.9%
	4–6	66	16.3%
	7–10	55	13.6%
	11–20	41	10.1%
	21–30	100	24.8%
	31–40	60	14.9%
	≥41	22	5.4%
Monthly Income (CNY)			
	0–4000	88	21.8%
	4001–8000	189	46.8%
	8001–12,000	86	21.3%
	≥12,001	40	9.9%
	Prefer not to answer	1	0.2%

5.2. Evaluation of Measurement Models

The measurement models were evaluated for reliability, validity, and multicollinearity. Specifically, reliability was assessed utilizing indicator reliability and internal consistency

reliability, while validity was examined through convergent validity and discriminant validity [54,60]. Figure 3 summarizes the reliability and validity criteria [54,60,61].

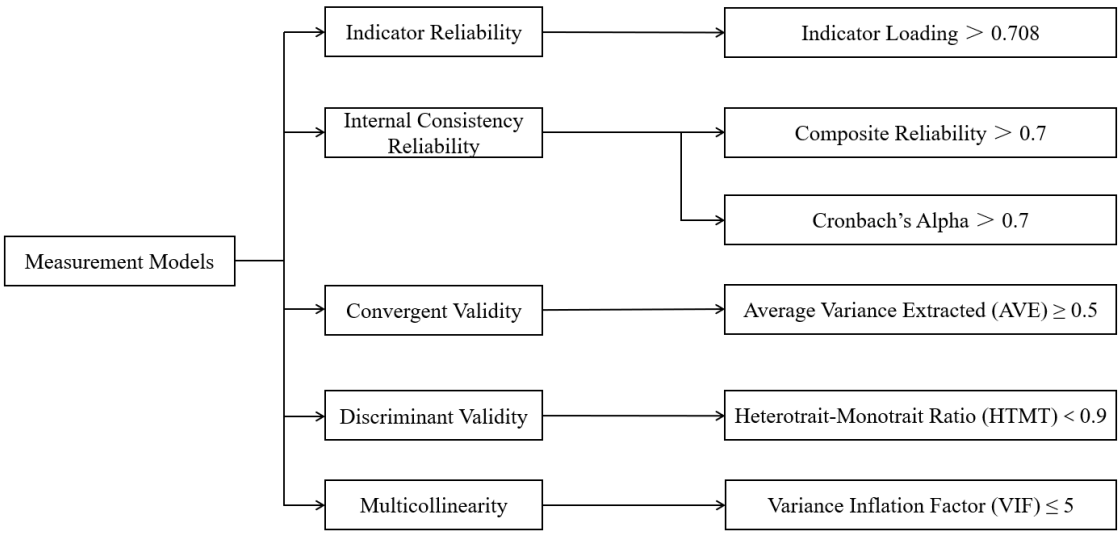


Figure 3. Evaluation criteria of measurement models.

First, indicator reliability was assessed by examining indicator loading. Our results of indicator loading ranged from 0.820 to 0.931 and were greater than 0.708, indicating the indicators LCV, PI, and PD had acceptable item reliability [60]. Subsequently, composite reliability and Cronbach's Alpha were utilized to evaluate internal consistency reliability. Both values exceeded 0.827 and were below 0.921, indicating satisfactory reliability [60].

Next, Average Variance Extracted (AVE) was employed to assess convergent validity. The AVE values for PI, PD, and LCV were 0.743, 0.795, and 0.730, respectively. All of them exceeded the threshold of 0.5, thus suggesting this model had sufficient convergent validity [54]. Discriminant validity can be further measured by the Heterotrait–Monotrait Ratio (HTMT). All HTMT values fell between 0.28 to 0.846, each of them below 0.9, which confirms sufficient discriminant validity [61].

Finally, the value of the variance inflation factor of indicators ranged from 1.760 to 3.169, all less than five, indicating no multicollinearity concerns.

The detailed results of the evaluation of measurement models are presented in Tables 4 and 5.

Table 4. Construct reliability, validity, and collinearity statistics.

Latent Variables	Indicator	Indicator Loading	*p*-Value	Cronbach's Alpha	Composite Reliability	Average Variance Extracted	Variance Inflation Factor
Place identity (PI)	PI1	0.858	0.000	0.827	0.897	0.743	1.951
	PI2	0.849	0.000				1.760
	PI3	0.879	0.000				1.985
Place dependence (PD)	PD1	0.931	0.000	0.870	0.921	0.795	3.169
	PD2	0.862	0.000				2.145
	PD3	0.881	0.000				2.322
Local Cultural Values (LCV)	LCV1	0.849	0.000	0.877	0.915	0.730	2.510
	LCV2	0.897	0.000				3.102
	LCV3	0.820	0.000				2.113
	LCV4	0.850	0.000				2.425

Table 5. Heterotrait–Monotrait ratio (HTMT).

Variable	CES	LCV	PD	PI
CES				
LCV	0.078			
PD	0.272	0.503		
PI	0.258	0.688	0.846	

5.3. Evaluation of the Structural Model

The structural model was assessed using the coefficient of determination (R^2), the blindfolding-based cross-validated redundancy measure (Q^2), and path coefficients with corresponding statistical significance.

As shown in Figure 4, the R^2 value for PD is 0.063, indicating weak explanatory power for this construct [54]. The R^2 values for PI and LCV are 0.525 and 0.352, respectively, demonstrating high explanatory power for both [54]. The Q^2 values for PD, PI, and LCV are 0.038, 0.047, and 0.001, all greater than zero, suggesting the model has predictive accuracy for these variables [60].

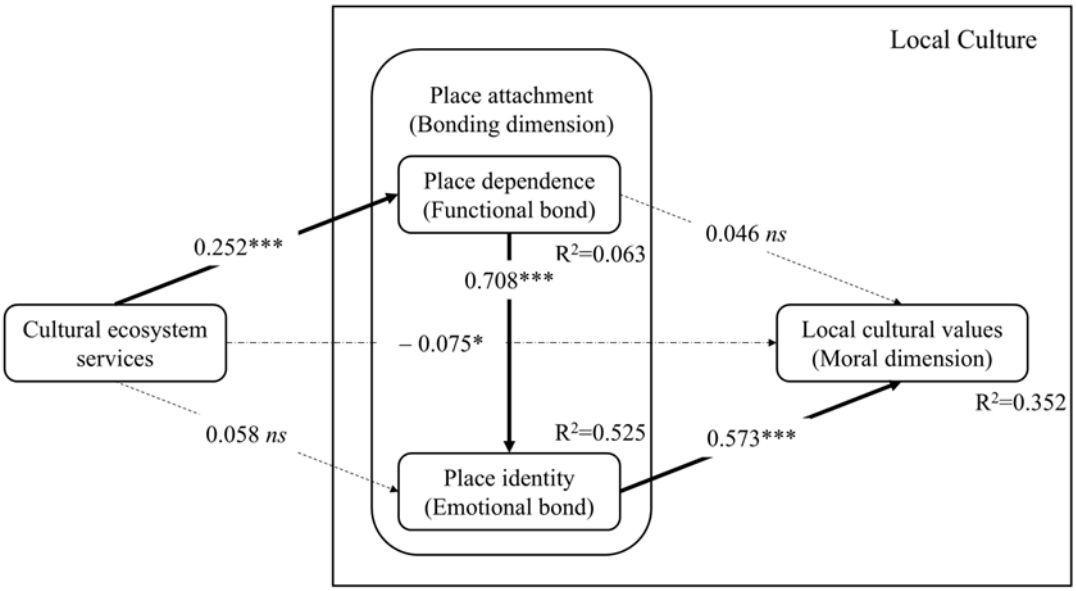


Figure 4. Results of standardized estimation (* $p < 0.05$; *** $p < 0.001$; ns: nonsignificant).

Path coefficients show that CES ⇒ PD, PD ⇒ PI, and PI ⇒ LCV are significant at the 0.001 level, with coefficients of 0.252, 0.708, and 0.573, respectively. However, the CES ⇒ PI and PD ⇒ LCV paths are statistically insignificant. The CES ⇒ LCV path has a coefficient of −0.075, which is weakly significant at the 0.05 level.

5.4. Diversity in Subareas

As summarized in Table 6, the means of CES, PI, PD, and LCV are higher in the central area of Jinan City than in the marginal area. Results from the Mann–Whitney U test further indicate that the means of PI, PD, PD1, PD2, and LCV1 exhibit significant differences ($p < 0.05$) between the central area and the marginal area. This indicates that the distance between residents' homes and the spring landscapes may influence residents' perception of CES.

Table 6. Average values and median difference of indicators.

Indicators	Central Area	Marginal Area	Median Difference	Mann–Whitney U (p Value)	Cohen's d
CES	81.9	69.2	0	0.496	0.143
PI	6.2	6.0	0.333	**0.018**	0.201
PI1	6.5	6.4	0	0.123	0.121
PI2	6.0	5.8	0	0.056	0.168
PI3	6.1	5.9	1	0.104	0.216
PD	5.4	5.1	0.167	**0.031**	0.217
PD1	5.5	5.1	1	**0.013**	0.255
PD2	5.4	5.1	0	**0.039**	0.179
PD3	5.3	5.0	1	0.186	0.151
LCV	6.5	6.4	0	0.212	0.157
LCV1	6.7	6.6	0	**0.016**	0.172
LCV2	6.6	6.5	0	0.293	0.107
LCV3	6.4	6.2	0	0.221	0.158
LCV4	6.4	6.4	0	0.207	0.09

A multigroup analysis was performed to test for differences in path coefficients across the two areas (Table 7). The results reveal that any observed differences in coefficients are statistically insignificant. This suggests that the linkage between CES and local culture follows the same pathway between the central and marginal areas in Jinan City.

Table 7. Difference in path coefficients (central area vs. marginal area).

Path	Difference	1-Tailed p Value	2-Tailed p Value
CES ⇒ LCV	0.021	0.396	0.396
CES ⇒ PD	−0.088	0.835	0.165
CES ⇒ PI	−0.099	0.883	0.117
PD ⇒ LCV	0.019	0.451	0.451
PI ⇒ LCV	−0.078	0.683	0.317
PI ⇒ PD	−0.028	0.325	0.325

6. Discussion

6.1. Effect of Cultural Ecosystem Services on Local Culture

Our results indicate that CES positively influence local culture. This empirical evidence supports theoretical perspectives suggesting that CES contribute to the emergence of local culture [1–3]. Moreover, our findings highlight the specific pathway through which CES relate to dimensions of local culture: CES influence the moral dimension (LCV) only through the bonding dimension (PA). This study revisits this point in a later subsection.

However, CES exert varied effects on the two components of PA. First, CES positively affect PD, suggesting that non-material ecosystem benefits can foster a sense of dependence when they help individuals achieve goals or fulfill recreational needs. For example, the spring landscape in Jinan City offers substantial recreational value and attracts tourists. During the eight-day Spring Festival holiday in 2025, it received 2.08 million visitors. This influx generated economic benefits for local residents and contributed to their dependence on the city.

Second, CES do not directly affect PI. This suggests that non-material benefits from a place do not directly foster an emotional bond. One interpretation is that people's psychological processes differ when evaluating CES versus PI. The former entails economic and objective valuation (how much non-material benefit one gains), while the latter reflects affective and cognitive processes rooted in experiences, memories, meanings, and emo-

tions [15,49], limiting direct connection. Thus, CES may influence PI indirectly, with PD acting as a mediator in our framework.

Third, CES negatively affect LCV, with a small path coefficient and weak significance. This suggests a slight tendency among respondents to offer a lower WTP yet report higher LCV. One possible explanation is the public good nature of CES and the prevalence of free riding. Individuals may perceive the springs' CES and recognize the worthiness of spring protection in Jinan City. However, when their valuations of CES translate into WTP, a preference may emerge to make others bear the cost of projects for spring protection. Consequently, it results in a weak negative path from CES to LCV in this research. Furthermore, prior studies indicate that interactions between humans and nature foster local culture [2,3,14]. The weak significance ($p < 0.05$) may also imply that CES influence LCV through mediators rather than directly.

6.2. Internal Processes of Local Culture: Relationships Among PD, PI, and LCV

The results highlight internal linkages between the bonding and moral dimensions of local culture. First, PD significantly influences PI, consistent with findings by Kuo et al. [51] and Wan et al. [52], who showed that functional benefits support emotional bonds in Taiwan and Hong Kong. A place's ability to meet individuals' practical needs may serve as a foundation for emotional attachment.

Second, PD does not directly influence LCV, differing from Valizadeh et al. [47], who found a direct effect of PD on farmers' water-saving moral norms. This divergence may reflect the nature of PD, which signifies functional ties (e.g., recreation or livelihood) that may be insufficient for fostering LCV. These values may instead require a stronger sense of identity and belonging, better represented by PI. Thus, PD alone may not lead to the development of LCV without mediation.

Third, PI significantly and positively affects LCV. Our results align with those of Valizadeh et al. [47], who reported that emotional bond contributes to environmental moral norms. This suggests that individuals with strong emotional connection to a place are more likely to adopt evaluative beliefs supporting environmental stewardship. Moreover, PI appears to mediate the relationship between PD and LCV, indicating that a functional bond can lead to evaluative beliefs when accompanied by emotional attachment.

6.3. Overall Process of CES Influencing LCV

The findings reveal the specific pathway through which CES influence local culture. According to our framework, the overall process is: CES ⇒ PD ⇒ PI ⇒ LCV. This demonstrates that human–place bonds (PA) mediate the link between CES and LCV. In other words, CES affect LCV indirectly through PD and PI. These results underscore CES as a driver of cultural formation and emphasize the interconnectedness of bonding and moral dimensions within local culture.

6.4. Linkage Between Cultural Ecosystem Services, Local Culture: Toward Sustainable Environmental Management

The interactions among CES, local culture, and sustainable environmental management are complex and interdependent. While numerous studies have integrated CES into sustainability frameworks [16–21], they tend to consider CES as an isolated driver, overlooking their role in affecting the broader local cultural system, as well as their potential to initiate multi-level effects on sustainable outcomes. In contrast, the CES ⇒ PD ⇒ PI ⇒ LCV pathway proposed in this study provides a holistic framework to understand how the linkage between CES and local culture contributes to sustainable environmental management.

As shown in Figure 5, the influence of CES on sustainable environmental management extends beyond direct impacts. It also operates by generating local cultural motivations

that drive such initiatives. This dual role also applies to PI. Existing studies indicated that emotional bonds can positively affect sustainable environmental management, such as domestic water-saving [38,62], recycling [52], and environmentally responsible behaviors [51]. Our results revealed that PI may also indirectly impact such management, mediated through LCV.

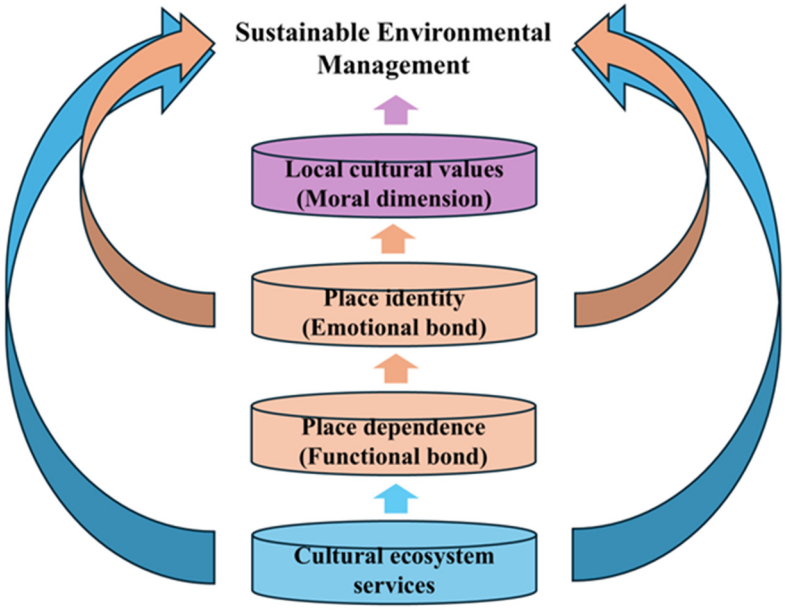


Figure 5. The interaction between CES, local culture and sustainable environmental management.

Notably, prior studies indicated that PD, the functional bond, has a weak or insignificant influence on pro-environmental behaviors, whereas PI and LCV show more positive influences [21,47,63–65]. This may lead policymakers to underestimate or neglect the role of this functional bond in promoting such behaviors.

Our findings offer a reassessment of PD's function from this holistic perspective. The CES ⇒ PD ⇒ PI ⇒ LCV pathway revealed that PD does not play an insignificant role; rather, it plays an essential bridge that facilitates the transformation of CES into a deeper emotional bond and LCV regarding environmental protection. In other words, the influence of PD is primarily indirect, as it mediates the transfer from CES to PI and LCV and thereby promotes sustainable environmental management, rather than direct. Such indirect mechanisms are challenging to identify unless PD is examined within the linkage between CES and local culture.

6.5. Practical Implications

This study offers a comprehensive perspective on the relationship between CES and local culture by integrating both moral (LCV) and bonding (PA) dimensions. Two practical implications arise for environmental resource management and sustainable development.

First, the functional aspect of human–place bonds (PD) should be emphasized when promoting sustainable practices. Although prior studies suggest that PD exerts weaker direct influence on environmental behaviors than PI [21,47,63,64], our results indicate that PD affects both PI and LCV, directly and indirectly. This implies that PD fosters environmental engagement by strengthening the emotional bond and shaping LCV. Urban planners and policymakers should enhance the functional quality of environments; for example, by expanding recreational opportunities and supporting individuals' goal attainment to foster stronger PI and LCV. Jinan, for instance, maintains spring flows for public enjoyment and offers housing subsidies to highly educated newcomers, thereby reinforcing PD.

Second, policymakers and urban planners can improve public acceptance of local environmental policies, such as water pricing reforms, by enhancing CES. Since CES affect PD, PI, and LCV both directly and indirectly, increasing residents' exposure to CES may reinforce their evaluative beliefs regarding environmental protection and human–place bonds. For example, Jinan's four spring restoration projects (2021–2025) aim to improve CES delivery and support broader policy goals.

6.6. Methodological Limitations and Future Directions

This study has two limitations. First, this study examined the relationship between CES and local culture, focusing on moral and bonding dimensions. However, local culture is multifaceted and includes elements such as artifacts, traditions, knowledge systems, and religion. Additionally, although the role of PD in linking CES and local culture, which the present study focuses on, may be plausible in other local areas as long as CES facilitate people's goal achievement and recreation, this finding might not necessarily be applicable to other types of CES such as religious values. Future research could explore how CES influence these dimensions in diverse cities and regions, enabling a more holistic understanding and supporting integrated environmental policymaking.

Second, the sample included a relatively high proportion of younger and urban respondents, likely due to the street-based survey method and QR-code-based questionnaire, which younger, tech-savvy individuals were more inclined to complete. Future studies should aim for more representative sampling, including older and rural populations, to better capture the relationship between CES and local culture across demographic contexts.

7. Conclusions

This study provides empirical support for theoretical claims that CES shape local culture. To examine this relationship across multiple cultural dimensions, this research developed a framework incorporating CES, human–place bonds (PA: PI and PD), and LCV. In contrast to previous studies that primarily centered on the moral dimension of culture, this research introduces PA to capture multiple dimensions of culture, including material traits and emotional characteristics of a social group or society. Furthermore, to extend prior studies, this research delineates the bonding dimension (PA) into the functional bond (PD) and emotional bond (PI), thereby advancing the understanding of the influence of CES on the bonding dimension. Data were collected via a street survey in Jinan City using a seven-point scale to measure PI, PD, and LCV, and the CVM for CES.

Findings from the PLS-SEM model show that: (1) CES affect LCV only through PA; (2) The internal processes within local culture follow the sequence PD $\Rightarrow$ PI $\Rightarrow$ LCV; and (3) The overall influence of CES on LCV occurs via the pathway CES $\Rightarrow$ PD $\Rightarrow$ PI $\Rightarrow$ LCV.

This comprehensive perspective on the linkage between CES and local culture provides insights for sustainability. These results highlight the importance of the functional bond (PD) in environmental protection and the sustainable use of natural resources, given its impact on both PI and LCV. Moreover, enhancing CES can foster public support for local environmental policies.

The limitations of this study include its narrow focus on the moral and human–place aspects of local culture, thereby overlooking other elements and regional differences. Additionally, the sample's proportion of younger and urban participants is relatively high. To address the limitations of this research, future studies should further examine the relationship between CES and additional layers of local culture using varied indicators across both rural and urban populations in diverse cities or regions.

Author Contributions: Conceptualization, G.Y. and M.S.; Methodology, G.Y. and M.S.; Software, G.Y.; Validation, G.Y.; Formal analysis, G.Y. and M.S.; Investigation, G.Y.; Data curation, G.Y.;

Writing—Original Draft Preparation, G.Y.; Writing—Review and Editing, M.S.; Visualization, G.Y. and M.S.; Supervision, M.S.; Project Administration, M.S.; Funding acquisition, G.Y. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by JST SPRING, Grant Number JPMJSP2114. The APC was funded by Tohoku University Support. Program for the Article Processing Charge (APC) FY2025.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Graduate School of International Cultural Studies Research Ethics Committee, Tohoku University, on 20 September 2023 (protocol code 2023–15).

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

Data Availability Statement: The raw data supporting this study's findings are available from the authors upon request.

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

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