苏州乡村水域空间生态系统文化服务评价及其优化策略研究

Research on Evaluation and Optimization Strategies of Cultural Ecosystem Services of Rural Water Spaces in Suzhou

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摘要

苏州“以水成聚，因水而兴”的地域特征是影响广域范围城乡空间发展演进的关键要素。水域空间是城乡公共空间的重要组成部分，其所能提供的美学、游憩、教育、文化等生态系统文化服务（CES）是公众需求的核心指向。伴随着城镇化的快速推进，如何通过CES的有效供给实现水域空间存量更新与文化复兴，是当下亟待解决的现实问题。本研究通过识别苏州水域空间CES类型，以当地典型水域空间为研究案例，引入重要性－绩效分析法，进而建立CES类型与景观要素及特征之间的联系。研究采集了公众对景观要素及特征的CES重要性和绩效水平的评价数据，实现了对水域空间CES供需关系的测度与评价，进而依据“继续维持－过度表现－毋须优先－重点改善”的优化需求策略分区，从水网生态治理、挖掘水乡特色资源、强化在地项目策划三个方面提出促进苏州水域空间CES有效供给的规划策略与建设指引。

关键词

水域空间；生态系统文化服务；重要性－绩效分析法；景观要素及特征；优化策略；苏州

ABSTRACT

Suzhou City enjoys its regional water networks as a driver to promote the evolution of urban-rural landscapes, where water space is an important part of urban-rural public spaces that defines spatial characteristics, supports public health, and offers recreational opportunities. Cultural ecosystem services (CES) ranging from aesthetics, recreation, education to culture are the core public demands and a key aspect in shaping the identity and vitality of water spaces. However, along with the rapid urbanization, the historical city-water spatial pattern, social connections and relations, and regional cultural spirit have gradually faded away. Such problems can be addressed through inventory renewals and cultural revivals of water spaces based on CES enhancement. This research introduces the Importance–Performance Analysis to study CES of water spaces by examining representative water spaces of Suzhou, in order to examine the correlations between CES types and landscape elements/factors. By collecting the residents' assessment data on the importance and performance of a series of landscape elements/factors, this research measures and evaluates the demand–supply relations of the studied water spaces, conducts a strategic zoning to identify the landscape elements/factors to maintain, of over-supply, needs no priority or to improve, respectively. Finally, the paper proposes planning strategies and construction guidance for enhancing water space CES in Suzhou in the aspects of ecological management of water network, highlighting of water town image, and planning and scheming of local projects.

KEYWORDS

Water Spaces; Cultural Ecosystem Services; Importance–Performance Analysis; Landscape Elements and Factors; Optimization Strategies; Suzhou

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1 引言

随着生活水平的提升，人们对于城乡公共空间品质、健康的生活模式和休闲方式的追求不断提升。水域空间，即“水面空间、水陆过渡空间和周边陆域空间内一切自然和人文各要素及其关系的总和”[1]，是城乡公共空间的重要组成部分，也是塑造城乡空间特色、实现公共健康与休闲体验的重要载体。美学、游憩、教育、文化等生态系统文化服务是公众需求的核心指向[2][3]，也是水域空间特色塑造与活力营建的重要环节。苏州作为水网地区的典型代表，“以水成聚，因水而兴”的地域特征是促进广域城乡景观演变的关键要素。然而，伴随城镇化的快速推进，传统“城水相依”的空间形态、社会交往与关系、地域文化精神等日渐消解[4]，如何通过生态系统文化服务的有效供给实现水域空间存量更新与文化复兴，是当下亟待解决的现实问题。

生态系统文化服务（cultural ecosystem service，简称CES）作为4类基本生态系统服务（ES）类型之一，联合国千年生态系统评估（MEA）将其定义为“人们通过精神丰富、认知发展、反思、娱乐和审美体验从生态系统中获得的非物质利益”[5][6]。相较于其他服务，CES的获取需要人类亲身参与，其效益可以反映在提供乡村美感、旅游机会、自然教育等诸多方面，而这正是乡村水域空间复兴的重点，对水域空间优化意义重大。现阶段，CES评价多借助“货币价值”上的成本耗费或经济收益的计算[7][8]，研究成果多采用单一的游憩或娱乐指标[9]，针对CES的全面性和整体性评估不足[10]；此外，从CES的非物质性和无形性的本质出发[11]，基于货币价值衡量的方法无法完全地体现人类感知和主观偏好，并且难以在规划编制和实施层面生成可操作、可落地的决策，尤其面向的是数据相对匮乏的乡村地区。在这一背景下，研究引入重要性—绩效分析法，选取苏州水乡典型水域空间作为研究对象，进行水域空间CES研究，旨在提出面向CES效益提升的规划策略与建设指引。

2 研究方法

CES获取需要公众亲身参与，接触（使用）自然环境，即与植被、水体、建筑、设施等景观要素产生互动。研究在明确水域空间CES类型的基础上，通过统计频度建立CES与景观要素之间的关联，并采用问卷调查获取居民对景观要素重要性和绩效的评价数据，进而通过优化需求策略分区，实现对苏州水域空间CES供需关系的衡量与评价。

1 Introduction

With people’s living standard reaching a higher level, their need for quality urban-rural public space, healthy lifestyle, and recreational activities increases. Water space, namely “the sum of all natural and cultural elements and their relationships in water surface space, transition space between land and water and surrounding land space,”[1] is an important part of urban-rural public spaces that defines spatial characteristics, supports public health, and offers recreational opportunities. Cultural ecosystem services ranging from aesthetics, recreation, education to culture are the core public demands[2][3] and a key aspect in shaping the identity and vitality of water spaces. Suzhou City enjoys its regional water networks as a driver to promote the evolution of urban-rural landscapes. However, along with the rapid urbanization, the historical city-water spatial pattern, social connections and relations, and regional cultural spirit have gradually faded away[4]. Such problems can be addressed through inventory renewals and cultural revivals of water spaces based on the enhancement of cultural ecosystem services.

Cultural ecosystem service (CES hereafter), as one of four categories of ecosystem services (ES), is defined by Millennium Ecosystem Assessment (MEA) as “the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences.”[5][6] Compared with other ES, the gaining of CES requires in-person experience. CES benefits include offering opportunities for rural aesthetics, tourism, and natural education, which are the key objectives for rural water space revival and of significance to optimize water spaces. At present, CES assessment usually monetarily quantifies the cost or economic benefits[7][8] and uses single recreational index[9], but less on its overall benefits[10]. Besides, considering the immaterial and intangible nature of CES[11], the monetary measurement cannot fully indicate human perception or subjective preference, and little help inform practical decisions on planning formulation and implementation, especially in rural area where data are relatively hard to acquire. This research introduces the Importance–Performance Analysis to study CES of water spaces by examining representative water spaces of Suzhou, and then proposes planning strategies and construction guidance for CES benefit improvement.

2 Research Method

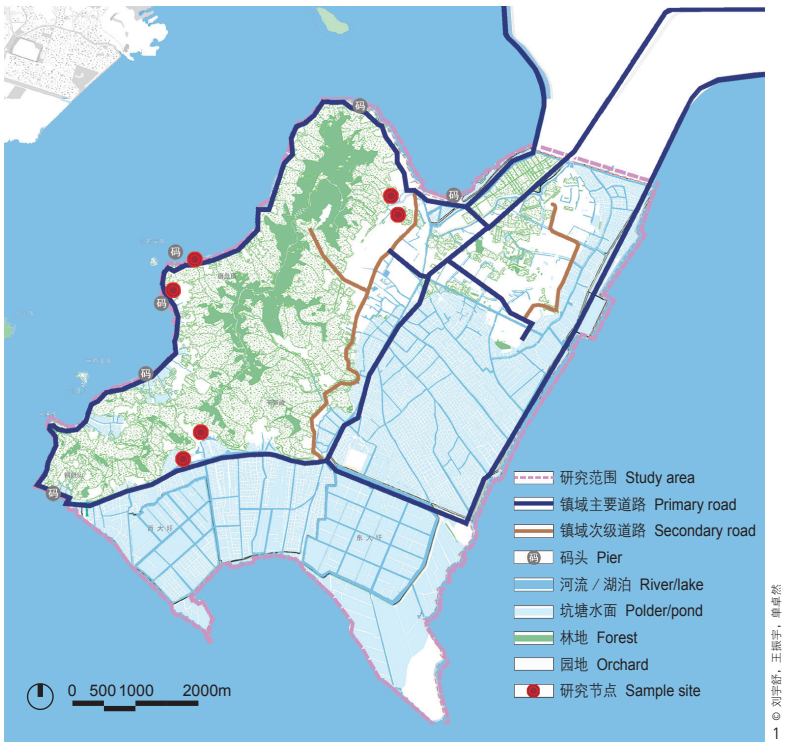
Gaining CES requires the user’s in-personal experience to contact and use the natural environment, and to interact with landscape elements such as vegetation, water, structures, and facilities. By identifying several CES categories of water spaces, this research attempts to establish the relations between CES and landscape elements through statistical frequency analysis, and then collect local residents’ evaluation data for the importance and performance of landscape elements through questionnaire survey, so as to measure and evaluate CES demand and supply of the water spaces in Suzhou on the basis of a strategic zoning analysis.

2.1 研究对象

研究选取江苏省苏州市东山镇作为对象。东山镇位于太湖东南岸东山半岛西南部，距苏州古城区37km，镇域总面积96km^2；“一山七水”——“一山”指莫厘山，“七水”指东山内陆通向太湖的7条历史主干外河道——是东山地区的主要空间环境要素，域内存在临湖、临河、临圩等水域空间，类型丰富，具有打造江南水乡特色、公共空间品质提升、居民休闲康养的重要价值。本研究在东山镇选取6个地理条件相似、经济发展水平相当、文化环境同源且使用程度较高的样本水域空间展开研究，包括北部临河型节点2个，西部临湖型节点2个，以及南部临圩节点2个（图1）。

2.2 水域空间CES类型识别

本研究以学界广泛认可和应用的罗伯特·科斯坦扎等人[12]、鲁道夫·S·德·赫鲁特等人[13]、MEA[14]、海拉·萨吉等人[15]对CES的内涵表述为基本框架，咨询来自城市规划、城市设计、风景园林等领域的专家共15位，将苏州水域空间CES初步归纳为美学、旅游、康养、教育、文化遗产、宗教精神、地方认同7类。考虑到苏州乡村文化遗产与地方认同感建立具有同源性和同质性[16]，在本研究中归为一类，统一表述为“传承历史文化”；考虑到康养、旅游的获取与游憩活动的关联性，且在初期调研中发现公众对其的认知相对混淆，故将其合并、统一表述为“提供游憩机会”；而鉴于宗教精神获取普遍性和感知度量性的不足[17]，本研究暂不讨论；研究将美学、教育分别表述为提供乡村美感、提供自然教育。由此，本研究从提升乡村美感、提供游憩机会、提供自然教育、传承历史文化4个方面展开对苏州乡村水域空间CES的探讨。



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1. 研究区域与节点
2. 影响CES的景观要素及特征提炼

2.1 Study Sites

The research focuses on Dongshan Town of Suzhou, Jiangsu Province, China. Located in the southwest of Dongshan Peninsula and on the southeast shore of the Taihu Lake, the 96-square-kilometer town is 37 km from the historic center of Suzhou. The town boasts its natural mountain-river system known as “one mountain and seven rivers”—the Moli Mountain, and seven major water courses connecting the Dongshan inland with the Taihu Lake—which greatly shape the regional spatial pattern of Dongshan. The diverse waterfront spaces (lakefront, riverfront, polderfront, etc.) contribute to the moulding of the identity of Chinese Jiangnan (south of the Yangtze River) towns, improving the quality of public spaces, and promoting residents’ recreational benefits and healthy lifestyle. This research selected 6 frequently-used water spaces of similarity in geography, economic development level, and cultural traditions as study samples, including 2 riverfront sites in the north, 2 lakefront sites in the west, and 2 polderfront sites in the south (Fig. 1).

2.2 Identification of Water Space CES Categories

Adopting the CES connotation by Robert Costanza et al.[12], Rudolf S. de Groot et al.[13], MEA[14], and Hila Sagie et al.[15] widely accepted and applied in academia, and consulting 15 experts from Urban Planning, Urban Design, and Landscape Architecture, this research identifies the water space CES of the study area into 7 categories, namely aesthetics, tourism, health care, education, cultural heritage, religion/spirit, and emblematic interaction (or place identity). Given the homology and homogeneity between the cultural heritage and the emblematic interaction of rural Suzhou[16], this research unified them into the one category as “historical and cultural heritages.” In view of the close relations between health care, tourism, and recreational activities, as well as the public’s confused cognition about these concepts discovered in preliminary survey, this research unified them as “recreational opportunities.” This research had to eliminate the study on the religion/spirit category due to the low universality and the difficulty in perceptual measurement[17]. The categories of aesthetics and education are expressed respectively as “rural aesthetics” and “nature education.” Thus, this research studies and discusses the rural water space CES in Suzhou by examining their supporting capacities in rural aesthetics, recreational opportunities, nature education, and historical and cultural heritages.

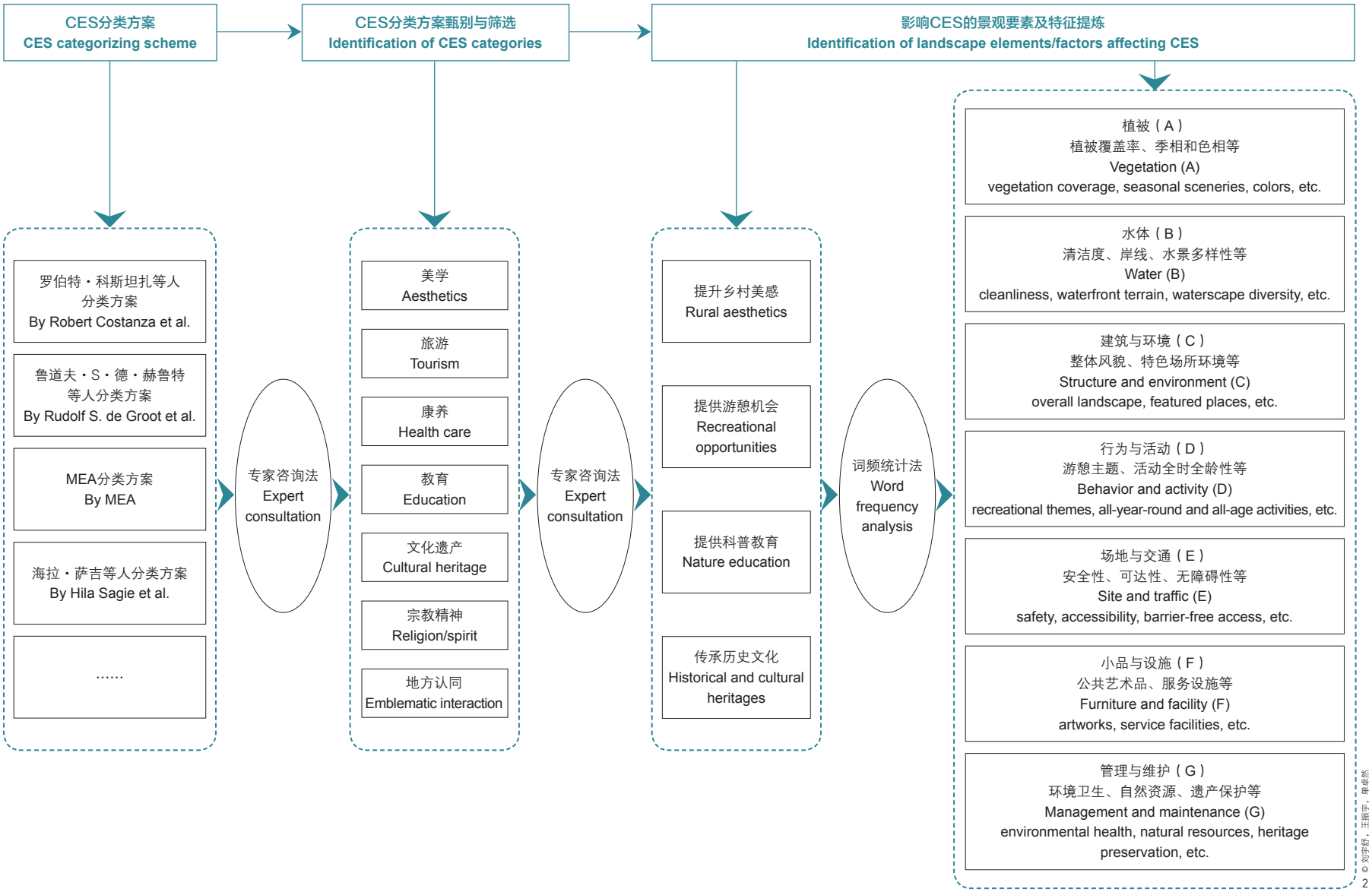
2.3 Identification of the Landscape Elements/Factors Affecting CES

From the perspective of user perception and experience, this research searched the China National Knowledge Infrastructure (CNKI) database with terms of

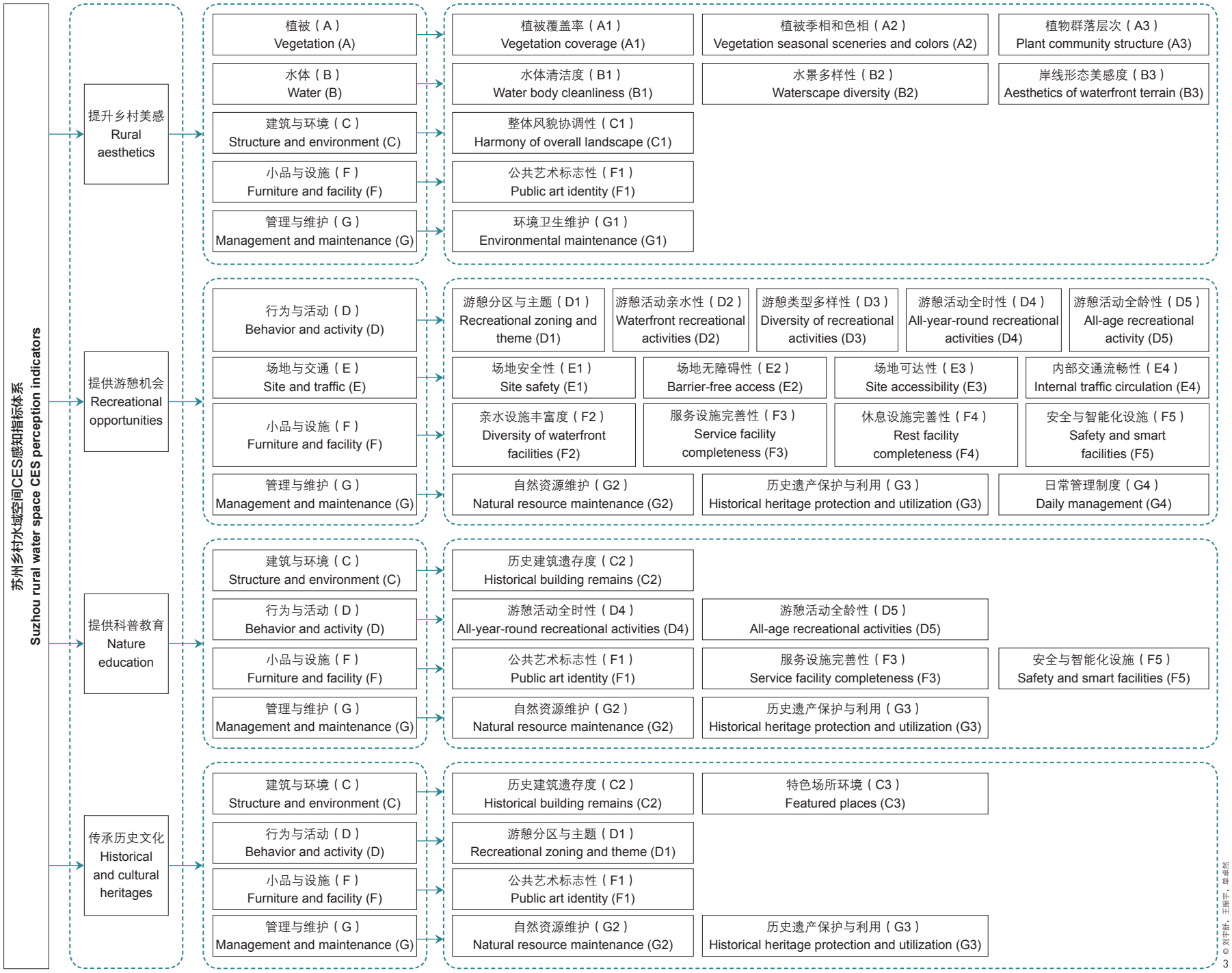
1. Map of the study area and the sample sites
2. Identification of landscape elements/factors affecting CES

2.3 影响CES的景观要素及特征提炼

从使用者感知和体验角度出发，在CNKI数据库中，以“文化生态服务”“生态系统服务社会价值”主题词为检索条件1，“美学”“旅游”“康养”“教育”“文化遗产”“地方认同”主题词为检索条件2进行检索，每个检索条件内主题词为“或含”关系，两个检索条件为“并且”关系。在Web of Science核心合集数据库中，将检索式#1“TS=(cultural-ecosystem-service) OR TS=(ecosystem-service social value)”和检索式#2“TS=(aesthetic) OR TS=(tourism OR eco-tourism) OR TS=(spiritual AND (experience OR value OR interaction)) OR TS=(education OR educational value OR intellectual interaction) OR TS=(cultural heritage value) OR TS=(emblematic interaction)”按照“AND”关系进行组配检索。研究共抓取近10年有效核心期刊文献165篇，统计景观要素及特征出现的频次，提炼对CES产生影响的景观要素及特征（图2）。再次咨询上述15位专家，经过初选和终选两轮甄别、筛选与调整，最终确定“文化生态服务”(cultural ecological service) and/or“生态系统服务社会价值”(social value of ecosystem service) combining with terms of“美学”(aesthetics) and/or“旅游”(tourism) and/or“康养”(health care) and/or“教育”(education) and/or“文化遗产价值” (cultural heritage) and/or“地方认同”(emblematic interaction). The papers from the Web of Science Core Collection database were retrieved by set #1 “TS=(cultural-ecosystem-service) OR TS=(ecosystem-service social value)” and set #2 “TS=(aesthetic) OR TS=(tourism OR eco-tourism) OR TS=(spiritual AND (experience OR value OR interaction)) OR TS=(education OR educational value OR intellectual interaction) OR TS=(cultural heritage value) OR TS=(emblematic interaction)” with the combine set of “AND.” 165 papers published in the recent decade from core journal collection were collected. The research then analyzed the word frequency of landscape elements/factors affecting CES for a further identification (Fig. 2). After consulting the 15 experts again, through two rounds of screening and adjustment, 27 landscape



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适用于苏州乡村水域空间的4大类、7小类，共27项景观要素及特征（图3）。

2.4 CES评价调研

研究团队于2019年5月进行了现场踏勘、访谈、座谈等形式的初期调研，针对苏州水域空间CES的类型展开基本预判；并于2019年7~10月通过线上、线下相结合的方式展开CES评价的问卷调查——线上在问卷星平台、线下在6个水域空间节点发放问卷。问卷针对影响CES的景观

elements/factors in 4 categories and 7 sub-categories were selected for the study of rural water spaces in Suzhou (Fig. 3).

2.4 CES Evaluation Surveys

A preliminary survey, including filed investigation, interviews, and meetings, was taken place in May, 2019, roughly outlining a baseline for CES categorization of the study area. This research carried out online and on-site questionnaire surveys of CES evaluation during July to October, 2019. The online survey was launched

表1：调查问卷数量分布表
Table 1: Questionnaire statistics

受访者年龄构成 Age of respondents	临湖型样本 Lakefront sample sites				临河型样本 Riverfront sample sites				临圩型样本 Polderfront sample sites			
	线下 On-site	线上 Online	合计 Sum	随机提取 Random selection	线下 On-site	线上 Online	合计 Sum	随机提取 Random selection	线下 On-site	线上 Online	合计 Sum	随机提取 Random selection
0~17岁 1 ~ 17	5	8	13	11	7	4	11	11	7	5	12	11
18~34岁 18 ~ 34	12	40	52	12	7	28	35	12	10	32	42	12
35~59岁 35 ~ 59	13	10	23	23	15	14	29	23	13	17	30	23
60岁及以上 Older than 59	9	12	21	15	11	10	21	15	9	8	17	21
合计 Total	39	70	109	61	40	56	96	61	39	62	101	61

要素及特征，采用李克特五级量表展开重要性和绩效评价（打分），期间共发放346份问卷，有效问卷296份。接着根据苏州2020年人口结构①，即0~17岁、18~34岁、35~59岁、60岁以上的占比为18:19:38:25，进行随机提取，最终，研究获得采用183份（表1），并以此展开相关数据分析与评价。

2.5 重要性－绩效分析法

本研究采用重要性—绩效分析法（简称IPA法）分析受访者的CES评价结果。IPA法是通过研判使用者对产品／服务的价值期待与实际表现的关系，来制定产品／服务未来发展策略的分析方法，其最早可追溯到20世纪70年代，由约翰·A·马尔蒂拉等人提出[18]，并在此后广泛应用于旅游策划[19]、景观质量评价[20]、历史街区更新[21]、公共空间活化[22][23]等方面。应用IPA法进行分析时将建立象限模型，以重要性水平（I）为横轴，绩效水平（P）为纵轴，以I、P的平均值作为X—Y轴的分割点形成4个象限（图4）；其中重要性对应CES需求，绩效对应CES供给，以此分析CES的供需关系。

第Ⅰ象限“继续保持”，景观要素及特征的重要性高且绩效高，CES呈现供需匹配状态，未来在维持现状的基础上继续强化自身优势，积极凸显特色；第Ⅱ象限“过度表现”，景观要素及特征的重要性低但绩效高，CES呈现供给冗余状态，未来短期内无需花费过多精力；第Ⅲ象限“毋须优先”，景观要素及特征的重要性和绩效均较低，未来短期

① 数据来源：2020年苏州市户籍人口统计年报。
① Sourced from the Suzhou Demographic Yearbook of 2020.

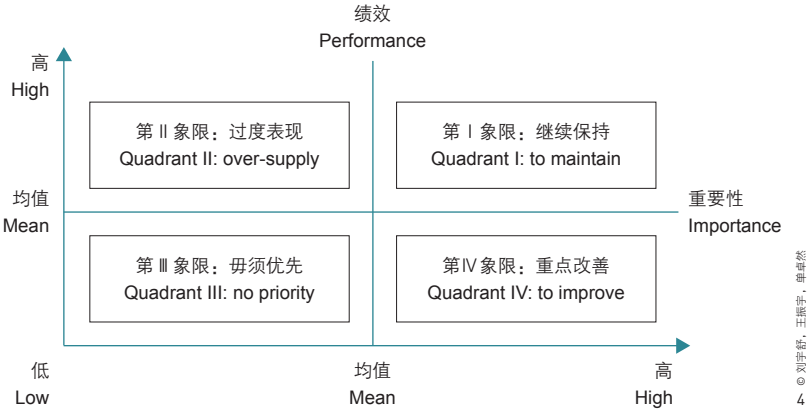
on the wjx.com website, and on-site questionnaires were conducted in every sample site, both of which evaluated (rated) the importance and performance with Likert scale for the landscape elements/factors affecting CES. 346 questionnaires were delivered, among which 296 were valid. According to the demographic structure of Suzhou in 2020①, i.e. the proportion of 0 ~ 17, 18 ~ 34, 35 ~ 59, and older than 59 is 18:19:38:25, finally 183 questionnaires were randomly obtained to analyze and evaluate related data (Table 1).

2.5 Importance–Performance Analysis

This research adopts the Importance–Performance Analysis (IPA) to interpret the CES assessment results. IPA developed by John A. Martilla et al. in the 1970s is “an easily-applied technique for measuring attribute importance and performance [that] can further the development of effective marketing programs”[18]. It now has been widely applied in tourist planning[19], landscape quality evaluation[20], historical block renewal[21], and public space revitalization[22][23]. IPA establishes quadrant models which takes importance value (I) as abscissa axis and performance value (P) as vertical axis, and the mean values of I and P as thresholds of the four quadrants (Fig. 4). In its original marking sense, the CES importance can be understood as the corresponding demand, and CES performance as the corresponding supply.

The Quadrant I “to maintain” indicates that the landscape element/factor sees both high CES importance and performance, suggesting a state of demand–supply matching that needs to be maintained and strengthened as a local distinctiveness. The Quadrant II “over-supply” indicates that the landscape element/factor is considered a low importance but of high performance, suggesting which does not need new investments in the near future. The Quadrant III “no priority” indicates that the landscape element/factor is considered less important and poor in

3. 苏州乡村水域空间CES感知指标体系
3. Suzhou rural water space CES perception indicators



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4

4. IPA象限模型
5. 各景观要素及特征IPA评价结果
6. 各景观要素及特征IPA评价结果在象限模型中的分布

4. IPA quadrant model
5. IPA evaluation results of landscape elements/factors
6. The IPA results of each landscape element/factor mapped in the quadrant model

内各类资源和策略配置不应优先考虑此区域的要素及特征，但随着经济水平和居民需求层次的提升，长期来看或可成为发展的机会区；第Ⅳ象限“重点改善”，景观要素及特征重要性高但绩效低，CES供给无法满足需求，未来应采取积极措施，重点改进。因此，研究着重针对第Ⅳ象限“重点改善”区的因子展开优化策略的制定。

3 研究结果与分析

运用前述方法，笔者从两个方面展开结果分析：一是从总体层面，通过分析各景观要素及特征在公众视野中的预期重要性和现实绩效评价的高低水平，明晰苏州水域空间CES需求与制约要素；二是从水域空间类型层面，通过分析研究区域的CES重要性—绩效水平以及供需关系，分析影响4类CES供给的景观要素类型及特征。

3.1 各类景观要素及特征IPA评价结果

根据调查问卷结果，各类景观要素及特征的重要性I值均值为4.42，绩效P值均值为3.23；重要性前5项分别为B1（4.74）、C3（4.70）、G1（4.70）、G2（4.63）和F3（4.60）；重要性后5项分别为B2（3.99）、F2（4.11）、B3（4.13）、D3（4.14）、C1（4.23）。绩效前5项分别为D2（3.74）、C1（3.62）、C3（3.55）、B3（3.52）、G1（3.37）；绩效后5项分别为A3（2.8）、F2（2.82）、E2（2.90）、F1（2.96）、F5（3.00）（图5）。IPA分析结果显示，处于第Ⅳ象限（CES重点改善区）的景观要素及特征为C2、G4、F1、G3、F4和E2，可划定为实现苏州水域空间CES供给的有待优先改善的要素及特征（图6）。

3.2 各类CES的IPA评价结果

根据景观要素及特征的IPA分析结果，将提高乡村美感（$\bar{I}$=4.39，$\bar{P}$=3.25）、提供游憩机会（4.41，3.22）、提供自然教育（4.45，3.12）、传承历史文化（4.56，3.23）作为象限划分依据，以研判研究区域内不同类型水域空间CES的供需关系（图7）。

3.2.1 提高乡村美感方面

B1、F1、G1的I值较高，表明这些为提高乡村美感方面的重要景

performance, suggesting that which should not be prioritized in resource allocation in the near future—this does not deny its long-run potential along with economic growth and the increase of residents' demands. The Quadrant IV "to improve" indicates that the landscape element/factor is evaluated with high importance but of low performance, suggesting an in short supply of CES, which demands more improvement measures in the future. This research then focuses on proposing optimization strategies for the landscape elements/factors in Quadrant IV.

3 Research Results and Analyses

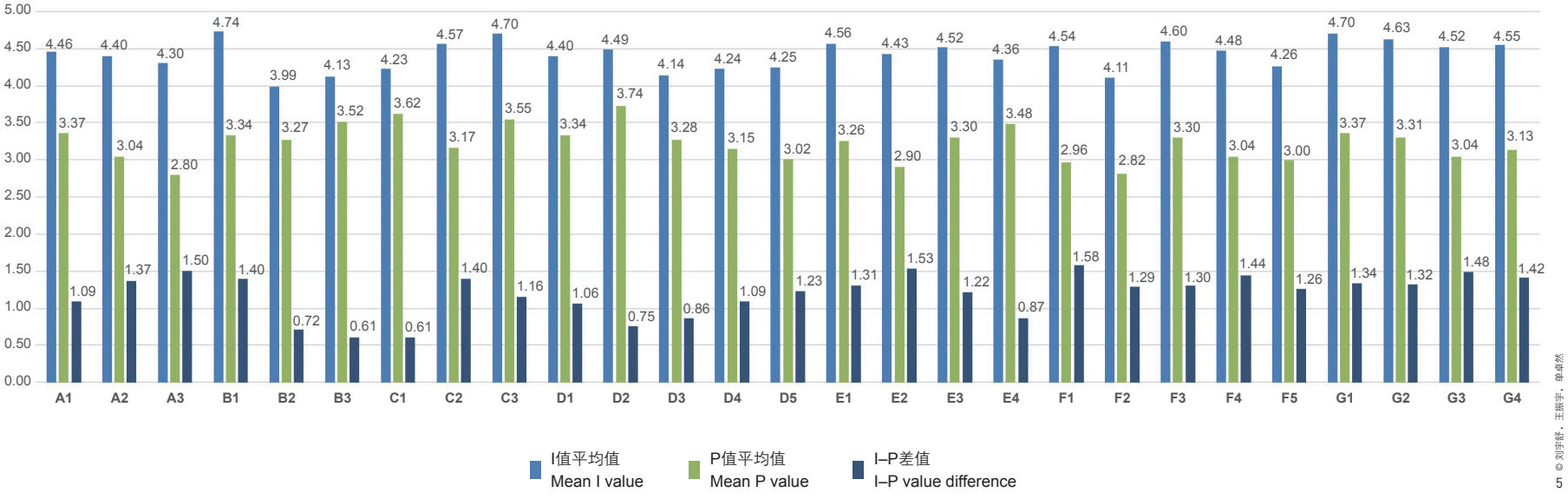
Using above-mentioned methods, the research first analyzes the expected importance and the evaluated actual performance of each landscape element/factor, to outline the demands and restrictions of water space CES in Suzhou; and then the research examines the CES importance–performance correlations of each water space type in the study area, to reveal the landscape elements/factors affecting CES supply.

3.1 IPA Evaluation Results of Landscape Elements/Factors

According to the questionnaire results, the mean importance value of landscape elements/factors is 4.42, and the mean performance value is 3.23. The top five elements/factors of importance are B1 (4.74), C3 (4.70), G1 (4.70), G2 (4.63), and F3 (4.60); the last five of that are B2 (3.99), F2 (4.11), B3 (4.13), D3 (4.14), and C1 (4.23). The top five elements/factors of performance are D2 (3.74), C1 (3.62), C3 (3.55), B3 (3.52) and G1 (3.37); the last five of that are A3 (2.8), F2 (2.82), E2 (2.90), F1 (2.96), and F5 (3.00) (Fig. 5). IPA results show that the landscape elements/factors identified in Quadrant IV are C2, G4, F1, G3, F4, and E2, which are the elements/factors needing to be prioritized in the improvement of water space CES supply in Suzhou (Fig. 6).

3.2 IPA Evaluation Results of Each CES Types

According to the IPA results of the landscape elements/factors, the quadrant model for each water space type is established by taking the mean I value and P value as the thresholds—4.39 and 3.25 for rural aesthetics, 4.41 and 3.22 for



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观要素及特征。其中，临河型B1的P值较高，说明其现状CES感知获得了公众的普遍认可；临湖型B1的P值较低，为制约此类水域空间乡村美感的关键；临圩型B1虽然位于第Ⅰ象限，但其P值（3.37）仅比均值高0.14，对照其对于体现美学价值的高重要性，未来也应引起重视；F1在临河型和临圩型水域空间均位于第Ⅳ象限，对于提高乡村美感同样起到较强的制约作用；G1在临河型水域空间的P值低于其他景观要素及特征，亟待优化。

3.2.2 提供游憩机会方面

在旅游和康养价值方面，临湖型景观要素及特征除D1、D3以外其他13项I值均高于均值，且D1、D3的I值接近均值，临圩型有9项高于均值，临河型仅D2、C3表现出较高需求。这表明公众对于临湖型水域空间提供游憩机会的期待较高，并认为这类水域空间是旅游与康养价值的主要载体；同时，D4、D5、E2、E3、E4、F2位于重点改善区，其



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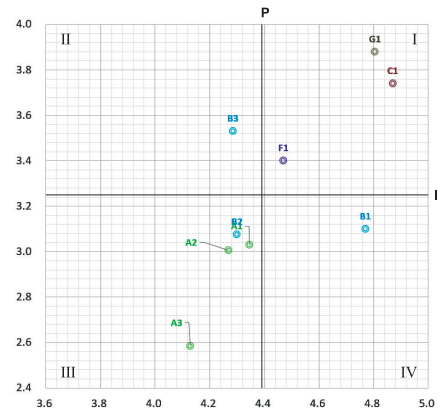
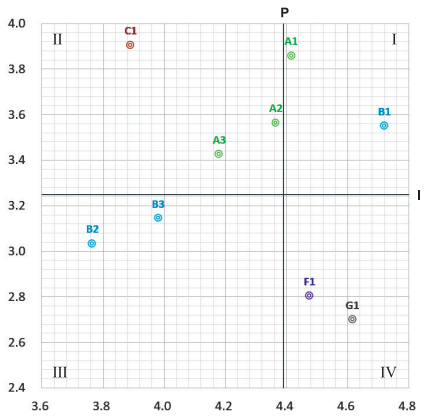
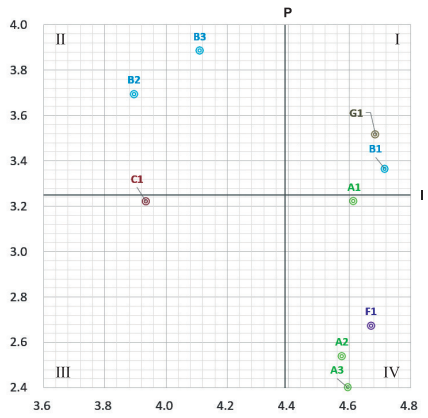
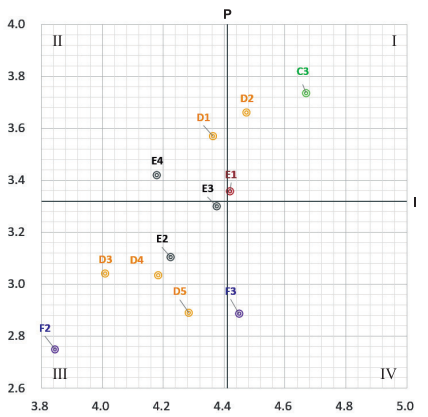
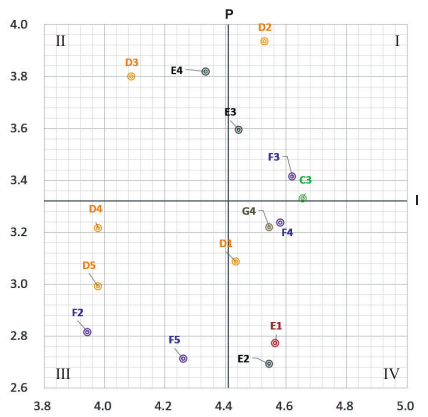
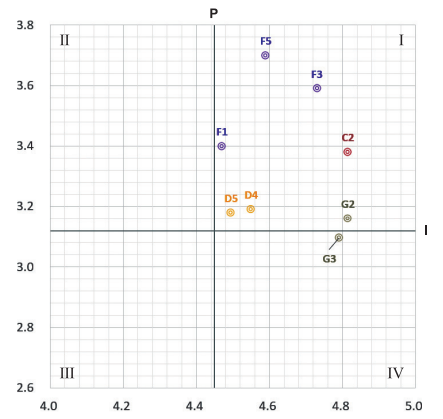
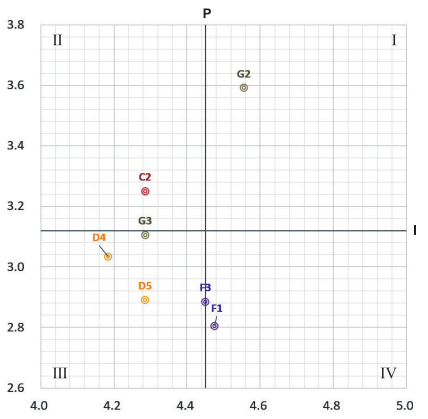
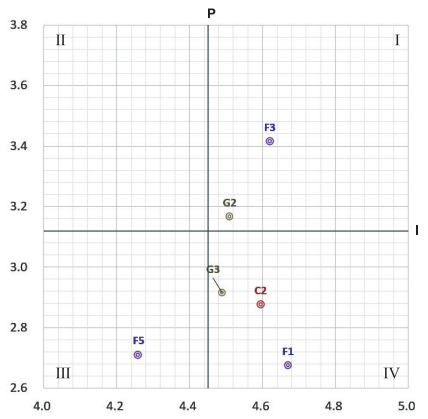
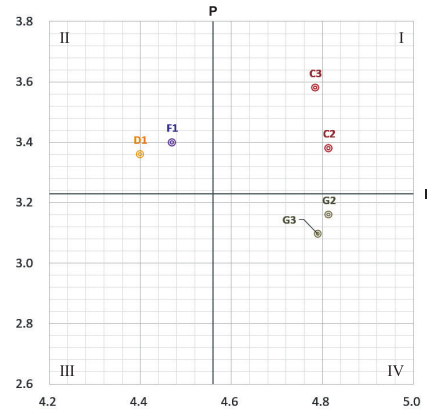
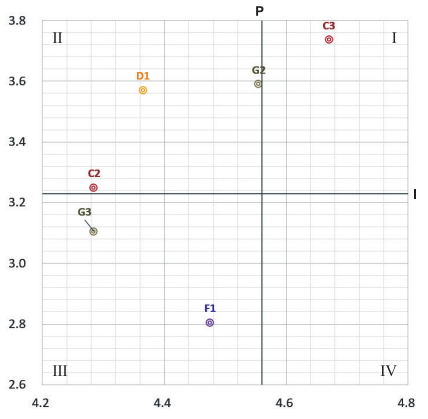
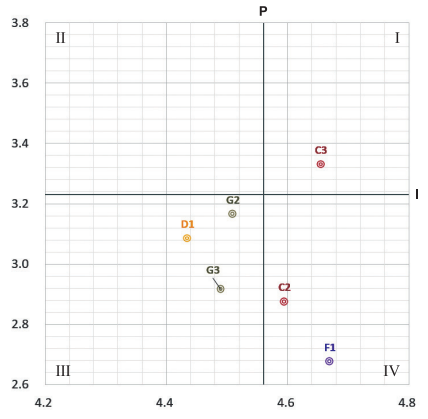
recreational opportunities, 4.45 and 3.12 for nature education, and 4.56 and 3.23 for historical and cultural heritages—to examine the CES demand–supply relations of different water space forms in the study area (Fig. 7).

3.2.1 The Aspect of Rural Aesthetics

B1, F1, and G1 are of high I values, suggesting which are an important landscape elements/factors for enhancing rural aesthetics. Specifically, the riverfront sample sites have a relatively higher P value in B1, indicating that the service of water body cleanliness is well perceived by the residents; that of the lakefront sample sites is relatively lower, revealing that water body cleanliness negatively impacts the rural sense of beauty of lakes; although the B1 of polderfront sample sites B1 is mapped in Quadrant I, its P value (3.37) is slightly higher than the mean value, which should attract more attention in the future due to its importance in affecting rural aesthetics. The F1 of riverfront and polderfront sample sites is mapped in Quadrant IV, showing which are negatively impacting the CES supply in rural aesthetics. The P value of G1 of riverfront sample sites is lower than other elements/factors which needs to be prioritized in optimization.

3.2.2 The Aspect of Recreational Opportunities

The landscape elements/factors of lakefront sample sites have a higher I value (than the mean value) except for D1 and D3, yet that of which two is just slightly lower than the mean value; there are 9 elements/factors of polderfront sample sites exceed the mean value in importance; while, riverfront sample sites are evaluated less in offering recreational opportunities—only D2 and C3 have a higher I value. These results indicate that the public have a strong expectation for gaining recreational opportunities by lakefront sites, suggesting a great potential of such water spaces in improving the local tourism and health care. To be specific, D4, D5, E2, E3, E4, and F2 are mapped in Quadrant IV, among which E2, E3, and E4 are in short supply due to the spatial separation cut by highways along the lake shore,

CES类型 CES categories	临湖型样本 Lakefront sample sites	临河型样本 Riverfront sample sites	临圩型样本 Polderfront sample sites
提高乡村美感 Rural aesthetics			
提供游憩机会 Recreational opportunities			
提供自然教育 Nature education			
传承历史文化 Historical and cultural heritages			

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中E2、E3、E4供给不足源于滨湖环山公路所造成的空间割裂，而D4、D5、F2是制约临湖型水域空间提供游憩机会的关键景观要素及特征。此外，C3和D2在三类水域空间中均位于第Ⅰ象限，表明其在各类型水域空间中均可提供较好的游憩机会。

3.2.3 提供自然教育方面

在教育价值方面，不同类型水域空间的供需情况差异较大，临湖型景观要素及特征基本位于第Ⅰ象限，表明临湖型水域空间具有较高的教育价值，且其提供的自然教育获得了公众认可；临河型景观要素及特征I值基本低于均值，表明临河型水域空间在提供自然教育方面相对薄弱，提供自然教育并非其核心CES；临圩型景观要素及特征I值基本高于均值，表明临圩型水域空间是提供自然教育的重要载体，但C2、F1、G3有待进一步提升。F3在三类水域空间中均位于第Ⅰ象限，表明其是彰显自然教育价值的重要载体。

3.2.4 传承历史文化方面

三类水域空间在历史文化传承和地域特色保持方面整体情况较好，绝大部分要素及特征位于第Ⅰ、第Ⅱ、第Ⅲ象限，仅临圩型C2、F1存在一定的供给不足，改造更新需求相对迫切；同时，C3在三类水域空间中均位于第Ⅰ象限，体现了其在文化遗产价值和地方认同方面的重要载体作用。

4 讨论

本文通过分析苏州市东山镇水域空间CES供需水平和关系，优化或限制供给的景观要素及特征，对照IPA模型的策略区划，可见水质提升与文化遗产保护始终是苏州水乡水域空间特色营建的基础和重要环节，也是提高乡村美感、传承历史文化方面CES供给的有效手段；而满足全时性、全龄性等多元需求的活动策划、亲水设施设计、场所营造对于游憩机会的提供至关重要；公共艺术标志性与服务设施则在提高乡村美感、提供自然教育、传承历史文化等诸多方面具有一定的积极意义。因此，研究从水网生态治理、水乡特色挖掘、在地项目策划三个方面提出提升苏州水域空间CES有效供给的规划策略与建设指引：

7. 各类CES的IPA评价结果在象限模型中的分布

thus D4, D5, and F2 become the key landscape elements/factors affecting the supply of recreational opportunities by lakefront spaces. Among the three water space types, C3 and D2 are mapped all in Quadrant I, suggesting featured places and waterfront recreation activities play an important role and see a well performance in this regard.

3.2.3 The Aspect of Nature Education

The demand–supply relations of different water space types vary a lot. The landscape elements/factors of lakefront sample sites in this regard are almost mapped in Quadrant I, suggesting that such water spaces have a higher educational value, and the service of nature education is well perceived by the users. Riverfront sample sites' elements/factors are all lower than the mean value, revealing such spaces play a weaker role in providing nature education—in other words, supplying nature education is not the core CES for such spaces. The I value of each landscape element/factor of polderfront sample sites exceeds the mean value, implying that such water spaces play an important role in providing nature education, where however C2, F1, and G3 need to be further improved. F3 is mapped all in Quadrant I across the three water space types, showing its weight in manifesting the value of nature education.

3.2.4 The Aspect of Historical and Cultural Heritages

All the three water space types are highly scored in supplying CES in historical and cultural heritages—nearly all the landscape elements/factors are mapped in Quadrants I, II, and III, and only C2 and F1 of polderfront sample sites are in short supply and need improvement efforts. The C3 of the three water space types is all mapped in Quadrant I, showing that it is a key actor to improve cultural heritage value and place identify or emblematic interactions.

4 Discussions

By analyzing the CES demand–supply status and relations in Dongshan Town, Suzhou, identifying the landscape elements/factors positively or negatively affecting the CES supply, and referring from the IPA models, this paper claims that water quality improvement and cultural heritage protection are the baseline for cultivating local characteristics of water towns, and greatly influence the CES supply regarding rural aesthetics and historical and cultural heritages. The all-year-round and all-age programing for diverse activity needs through the design of waterfront facilities and place making are of great importance for providing recreational opportunities. Public art identity and service facilities are considered a driver to improve rural aesthetics, provide nature education, and celebrate historical and cultural qualities. Therefore, this research proposes the following planning strategies and construction guidance for enhancing water space CES in Suzhou in the aspects of ecological management of water network, highlighting of water town image, and planning and scheming of local projects.

7. The IPA results of each CES type mapped in the quadrant models

1）坚持水网生态治理，保障水乡生态本底资源：乡村水域空间发展与利用应充分尊重水环境的生态过程与人文过程，保障其良好的生态资源本底与可持续的绿色运营[24]。一方面，建议通过切断污染源、调整土地利用、引入水质监测机制等手段，改善和维护水系质量[25]；另一方面，也可通过划定水域功能分区，限制出入水口、水流动性弱势区等生态敏感度高的区域的滨水活动量与活动类型[26]。

2）挖掘水乡特色资源，注重水域空间亲水设计：在乡村水域空间发展过程中应充分支撑生态过程、生态体验和生态教育[27]；农旅、商旅、文旅相互融合，梳理与挖掘区别于城市水景特色的乡土景观要素体系，营造特色化的公共空间与场所[28]；运用乡村特有的文化语汇和乡土特色，依托水系流向，因时因地地设计水域空间的景观节点、景观轴线、慢行步道、视觉通廊、景观界面、轮廓线等元素，凸显以“水”为核心的水域空间亲水设计[29]；并通过具有水乡特色标志物及标识系统[30]，调动视觉、听觉、触觉等多感官体验，营造尺度适宜、形象亲和、乡味浓郁的景观，以强化地方性感知与记忆，唤醒乡村活力与乡土魅力。

3）强化在地项目策划，提升游憩体验与参与度：秉持自然—人文结合的理念，在充分尊重地方遗产空间、文化场景、地方习俗、及宗教礼法的基础上，针对水域空间展开特色化的游憩区、游憩线路、游憩设施、游憩产品设计[31]；可通过拼贴手法、场景再现、隐喻暗示、抽象比拟等设计手法，策划多元的在地项目和高参与度的特色活动，强化“人”在水环境中的游憩体验，引导公众的CES身心感知。此外，挖掘景观要素自然教育价值，通过图文标识、动态导览、集中培训等方式，应用多媒体形式建立水系生态过程、乡土动植物习性、地方节庆习俗等方面的解说系统[32]，为外地旅客与本地居民提供多视角感知体验，同时为艺术、民俗、建筑等提供丰富的美学滋养。

5 结论

遍布江南水网地区的乡村聚落无不演绎着与水的共生共荣。而盲目的城镇化正在改变乡土、乡音、乡愁的传统面貌。苏州作为典型的中国传统水网地区，亟待从人类福祉视角出发，重新审视人与乡村、人与

1) Strengthening the ecological management of water network and ensuring the ecological pattern and resources of water towns. The development and utilization of rural water spaces should pay a high attention to the local processes in ecology, humanity, and culture, so as to ensure the sustainable management of ecological resources[24]. On the one hand, it is suggested to improve and maintain water system quality through pollution control, land use adjustment, and water quality monitoring[25]; on the other hand, water functional zoning can help limit the usage and types of waterfront activities in river inlets and outlets, the water areas with low water flows, and other sensitive eco-zones.

2) Highlighting water town image, utilizing water resources, and improving waterfront design. Ecological process, experience, and education should be fully supported in the creation of rural water spaces[27]. Integrating agricultural, business, and cultural tourisms, a landscape system consisting of vernacular elements that are different from urban waterscapes can be built, so as the featured public places[28]. According to the natural flow direction of water systems, unique cultural vocabularies and native features can be used to design a series of landscape nodes, axes, trails, corridors, interfaces, and outlines, to highlight the characteristics of waterfronts[29]. By forming landmarks and signage systems with water town characteristics[30] that can stimulate the users’ multi-sensory experience (visual, hearing, tactile, etc.), comfortable human-scale landscapes of rural aesthetic and cultural qualities can be created, so as to strengthen the perception of locality, collective memories, and rural vitality and charm.

3) Strengthening the planning and scheming of local projects, and improving users’ recreational experience and public participation. Combing the ideas in nature and humanity and fully respecting local heritage spaces, cultural scenes, local customs, and religious rites, the design on the featured recreational areas, routes, facilities, and products of water spaces can be carried out[31]. With design methods such as collage, scene reintroduce, as well as metaphorical and abstract approaches, multi-propose local projects and public-participated special activities can be planned to strengthen human-scale recreational experience in water environment, and to guide public’s CES perception. In addition, by improving the value of nature education of landscape elements through graphic-text signage, dynamic tour guides, and training with multimedia, an interpretation system about water system ecological process, native animal and plant habits, and folk customs can be established[32], which provides both tourists and locals with landscape perception and experience from multiple perspectives, as well as with rich aesthetic inspiration in art, folklore, and buildings.

5 Conclusions

The rural settlements all over the water network in Jiangnan region illustrate their symbiosis and co-prosperity with water. However, the blind urbanization has changed the traditions in land use and lifestyle, as well as people’s nostalgia. Enjoying a typical historical water network in China, Suzhou, from the enhancing

水、人与人之间的关系。本研究立足于CES视角，引入IPA模型，通过测度居民CES感知差异与居民选择偏好，明晰不同类型水域空间CES的供需关系及要素匹配水平，进而提出提升苏州水域空间CES有效供给的规划策略。

此外，值得说明的是，考虑到现阶段研究区旅游开发水平、主要服务人群以及个体社会背景，研究仅选取了较为熟悉样本场地的本地居民参与评价。鉴于游客势必成为未来乡村水域空间的重要服务人群，因此不同群体的CES共识挖掘等内容有待进一步探索。**LAF**

residents' well-beings, needs to re-examine the relationship between people and the rural, the water, and the others. In view of CES, this research introduces IPA models to evaluate local residents' CES perception and preference, identifies CES demand–supply relations and status, and then puts forward the planning strategies for improving the supply of water space CES in Suzhou.

It is worth noting that given the current tourism development level of the study area, the major user groups, and the respondents' demographic backgrounds, this research screened out the locals who are familiar with the sample sites in the evaluation. In view of the fact that tourists are bound to become a major user group of rural water spaces in the future, further research efforts are expected, for example, to study the CES consensus among different groups. **LAF**

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