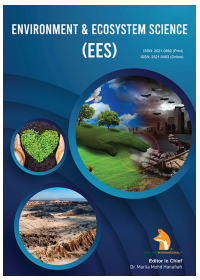
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2521-0882 (Print)
ISSN: 2521-0483 (Online)
CODEN: EESND2

Environment & Ecosystem Science (EES)

DOI: http://doi.org/10.26480/ees.02.2021.121.128



RESEARCH ARTICLE

AN ATTEMPT TO IDENTIFY CULTURAL ECOSYSTEM SERVICES AND RELATED LAND USE TYPES IN RURAL AREAS UNDER URBANIZATION

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ARTICLE DETAILS

Article History:

Received 08 August 2021
Accepted 10 September 2021
Available online 25 September 2021

ABSTRACT

Cultural Ecosystem Services (CES) play an important role in socio-natural ecosystems. Assessment of CES in rural areas is crucial for development planning and decision-making. However, assessment of CES at the local scale and, in particular, rural areas remain under-researched. In order to reveal the importance of different kinds of CES and the related land uses perceived by the rural residents, a simplified tick-scoring method was developed and tested in a case study of four villages in Shandong Province, China. This method poses CES questions and seeks answers about corresponding land use types in a questionnaire form that is accessible and useful to village residents. Furthermore, the important categories of CES and related land use types were identified and ranked based on the questionnaire. The results showed that ecological culture and aesthetic services ranked in the top two of twelve CES categories, while scenic spots/mountains, forests, and lakes/rivers/reservoirs scored for multiple CES and attained higher than average CES scores. Overall, the simplified method is practical to understand the perspectives of rural residents on the important CES and related landscapes. The established approach shed lights on CES assessment and management improvement at local scale of rural areas under different socio-environmental contexts in China and elsewhere.

KEYWORDS

China, cultural ecosystem services, ecosystem services, land use, rural area.

1. INTRODUCTION

Cultural Ecosystem Services (CES) refers to the non-material benefits derived from the ecosystem, such as, for example, spiritual growth and wellbeing, development of cognition and reflection, and entertainment and aesthetic experiences (Costanza et al., 1997; MEA, 2005; TEEB, 2011). The already established field of ecosystem services has, within its broader remit, defined, classified and assessed Cultural Ecosystem Services (e.g. de Groot et al., 2012; Chan et al., 2012; CICES, 2013; Costanza et al., 2017). As a crucial component of ecosystem services, non-material CES play an important role within more material forms of ecosystem services. For example, farmland and forest ecosystems provide not only food, climate and hydrological regulation services, but also leisure and entertainment opportunities (Dong et al., 2014, Gordon et al., 2010). CES can provide opportunities for both economic and non-economic development and growth.

CES research has been conducted at a range of scales. At the global scale, Everard et al. (2010) have estimated the CES value of coastal dunes, while Guo et al. (2010) have analyzed the impact of human activity on ecosystem services and biodiversity. At the regional scale, Van Jaarsveld et al. (2005) have explored the relationship between ecosystem services and human well-being in southern Africa and Vilà et al. (2009) have conducted a cross group evaluation of CES across Europe. Within the broader field of ecosystem services scholarship and practice, however, CES evaluation remains small and its practical applications remain limited (Costanza et al., 2017).

As the transition zone between the urban and the wild, rural areas and, in particular, villages, harbor a variety of important cultural ecosystem services of inspirational, aesthetic, recreational and ecotourism value (Jones-Walters, 2008; O'Farrell et al., 2010). The CES provided by rural landscapes play an indispensable role in maintaining cultural diversity and endemism, the promotion and continuation of ethnic and other traditional cultures, the alleviation of pressures associated with modern life, and opportunities for rest, recreation and physical and mental rehabilitation through contact with nature (Ma, 2007; Bugalho et al., 2011; Fischer et al., 2012; Hartel et al., 2014).

Quick Response Code	Access this article online	
	Website: www. environecosystem.com	DOI: 10.26480/ees.02.2021.121.128

Cite the Article: Xuehui Sun, Kun Zhang, Xiaozheng Zhang, Renqing Wang, Jian Liu, Shuping Zhang (2021). An Attempt to Identify Cultural Ecosystem Services and Related Land Use Types in Rural Areas Under Urbanization. *Environment & Ecosystem Science, 5(2): 121-128.*

However, due to rapid urbanization and industrialization, land use has changed, and rural ecosystems and CES face numerous challenges to their existence and quality (Foley et al., 2005; Gordon et al., 2010; Padilla et al., 2010). The importance of some land use types, such as forests, has already been demonstrated (Van Oudenhoven and De Groot, 2012; Dong et al., 2014), but less attention has been paid to identifying the importance of land use types within specific villages or localities. The relationship between land use type and CES within the urban landscape is also poorly understood (Haase et al., 2014). The identification of important CES and related land use types is a powerful tool in the protection of rural areas from the threats associated with rapid urbanization. Appropriate CES assessment is also a prerequisite to sustainability during the often rapid economic and social development of rural areas.

Due to increasing awareness amongst scholars and practitioners of the importance of CES, a number of assessment methods have already been developed (Hotelling, 1949; Daniel et al., 2012; Brancalion et al., 2013; Garcia-Nieto et al., 2013; López-Santiago et al., 2014; Weyland and Laterra, 2014). Taking an interdisciplinary approach, and employing a range of qualitative techniques such as storytelling (Bieling, 2014), photography (Sherren et al., 2010) and fieldwork (von Heland and Folke, 2014), quantitative methods such as statistical surveys (Langemeyer et al., 2015; Dou et al., 2019), and mixed methods such as GIS, mapping (Nahuelhual et al., 2014; Sherrouse et al., 2014; Sherrouse and Semmens, 2014) and contingent valuation methods (Mitchell and Carson, 1989), successful CES assessments have been carried out in Europe and North America, leading to improved natural resource management at regional and local scales. However, the use of such methods to assess CES at the village scale and in rural areas remains a challenge in developing countries.

Within developing countries, village scale ecosystems often consist of many land use types providing a variety of CES. Current CES assessment methods have mostly been applied within limited contexts and at relatively large scales (Feld et al., 2009; Plieninger et al., 2013; Hayashi et al., 2015). The prevailing methods, including complex mapping, GIS and/or statistical techniques, are often poorly understood by village residents and managers, thus limiting the use of these methods for community-led grass-roots sustainable development. Therefore, the development of a set of simple methods and procedures to evaluate and identify important CES and related land uses is crucial for rural communities experiencing CES degeneration or loss.

To establish a simple method and procedure to identify important CES perceived by the local residents at the village scale, an investigation of the CES and related factors has been taken in four mountainous villages of rapidly developing Shandong Province, East China. The four villages share similar natural and physical geography conditions but differ with regard to development strategies and trajectories in the context of rapid urbanization of the surrounding areas. These different development trajectories have shaped differentiated CES patterns due to changing land use and ecosystem functions. Thus, the four villages provided the ideal location to conduct a case study to establish and test a simple tick-scoring method for CES identification and assessment of rural area.

This research set out to (1) establish a comprehensive list of CES indicator categories applicable to villages in developing rural areas, (2) establish a simplified tick scoring CES assessment method and a practical procedure to identify important CES and related land uses perceived by the local residents, and (3) apply and test the method and procedure using a case study. The established approach would be easily understandable for the rural residents and practical at village scale. The CES assessment results are expected to be accessible for local managers, development planners and policy-makers. It may benefit to conservation and improvement of CES during rural development.

2. Materials and Methods

2.1 Research area

2.1.1 Natural and socio-economic backgrounds of the investigated villages

The four villages, Fanggan, Fujiazhuang, Anziwan and Huashan in Laiwu City, Shandong Province, were chosen as research sites. The four villages are adjacent to each other and located at 117°26′E, 36°26′N (Figure 1). The region experiences a warm temperate continental monsoon climate with four clearly defined seasons. Rain and hot weather coincide, the annual average temperature is 12°C, annual rainfall is 750 mm and the frost-free period lasts for 200 days. The region is predominantly mountainous and hilly, part of the Mount Tai range, with average soil thickness of 30 cm.

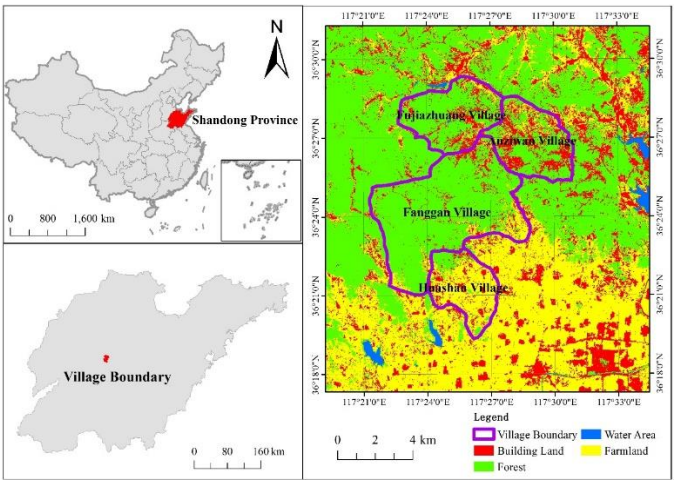

Figure 1: Geographical location and primary classification of land use for the four villages. Of these, eco-tourism in Fanggan takes advantage of high forest cover

The four villages have forest cover ranging from 40% to 95% and differentiated socio-economic backgrounds (Table 1). Since the 1990s, Fanggan has been developed its ecotourism potential, with a focus on rural ecotourism, and support services such as catering and family inns. Livestock breeding has been the main industry in Fujiazhuang, which is home to a number of family-run aquaculture factories. Anziwan continues to be dominated by crop farming, and Huashan is in a transitional phase between farming and ecotourism. Of the four villages, Fanggan is the most economically developed and ecologically sustainable, while Huashan is the most traditional and the least impacted by urbanization.

Table 1: General information of the four investigated villages

Villages	Area of village/hm^2	Forest cover	Total households	Investigated households	Dominant industries
Fanggan	1179	90	170	22	Tourism
Fujiazhuang	204	40	260	26	Livestock breeding
Anziwan	326	40	316	32	Farming
Huashan	33	90	50	16	Farming

2.1.2 The potential factors impacting ecosystem services of the investigated villages

2.1.2.1 Urbanization

In the research area, the primary impact of urbanization has been changing land use characterized by an increase in construction land for houses, road, hotels, villas and resorts. Fanggan village has also experienced population growth, particularly in summer, when people from nearby cities move to the village's hotels, villas and resorts. Both land use change and seasonal population growth can affect local CES.

2.1.2.2 Development models

In the 1970s, the four villages exhibited very similar natural, economic and social conditions. All four were mountainous, had limited farmland and were underdeveloped. However, since that time, each of the four villages has chosen a different development model to improve its economy. Fanggan village has invested in afforestation which, after 20 years of ecological restoration, led in ecotourism. Fujiazhuang village chose an industrial-agricultural route, with the breeding of livestock animals and agricultural product processing industries. Anziwan village has introduced modern agricultural technologies to develop crop farming and to increase agricultural production. Huashan village, which started out with greater forest cover and a small population, has survived by developing traditional rural fruit tree planting (Table 2). Decisions regarding these development models were made independently by each village committee. The Fanggan village committee followed a successful

ecotourism model with great awareness and foresight of the value of improved rural ecosystems.

Table 2: Economic value of ecotourism, livestock breeding and farming in the four villages (based on Ding et al., 2016)

Villages	Annual income per capita/RMB	Ecotourism /%	Farming /%	Livestock breeding /%	Others/ %
Fanggan	93,000	95%	4%	0	1%
Anziwan	6,000	0	98%	0	2%
Fujiazhuang	5,000	0	23%	73%	4%
Huashan	4,000	0	100%	0	0%

2.1.2.3 Administrative structure of the villages

The administration of each village is run independently by a village committee with a village headman. Each village committee, therefore, can choose its own path to development and has a certain level of autonomy to decide on its development plan. All village committees work under the leadership of the Xueye town government and the Laiwu municipal government (Figure 2).

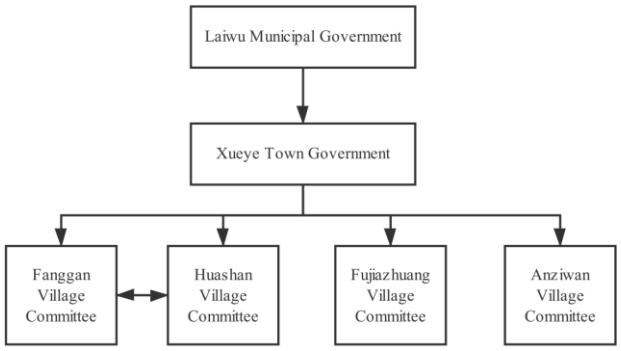

Figure 2: Management structure and communication of the four villages

2.1.2.4 Interactions and communications among the villages

There is relatively frequent communication between the village committees of the four villages during irregular meetings organized by the town government. In general, each village is independently managed by its village committee. However, Huashan village, because of its landscape resources, has joined the ecotourism framework of Fanggan village, and the two villages are jointly managed by both village committees. Therefore, Fanggan village and Huashan village have strong interactions and communication (Figure 2).

2.1.2.5 Scientific and educational services at Fanggan village

A number of institutions have recognized the scientific and educational resources that Fanggan village possesses and make use of these resources for scientific and educational services in various way. Shandong University has built a forest ecology research station, which is also used as an education base for ecology, botany, zoology, management and the arts. In addition, each year, more than 20 researchers from other universities, institutions and enterprises work at this village on agriculture, geography and sociology, and other projects.

2.2 The developed tick-scoring method for CES assessment

Based on an adapted indicator framework of CES, a questionnaire survey was designed and conducted in the four villages. Formulae were developed to analyze data from the survey and to hierarchically rank the relationship between categories of CES and related land use types.

2.2.1 The indicator framework

CES frameworks have been developed by the Millennium Ecosystem Assessment (MEA) and have been successfully utilized elsewhere (MEA, 2005; Szucs et al., 2015; Plieninger et al., 2015).

Eleven existing CES categories were integrated into an indicator framework for the four villages and, combining rural ecosystem features with local demand for CES, an additional indicator, ecological culture, were added. All indicators and their definitions are listed in Table 3. Based on the Chinese National Land Use Status Classification Standard (GB/T 21010-2007), ten land use types were used (Figure 3). To establish the relationship between different CES categories and each land use type, a binding model was established.

Table 3: Indicator framework of CES in rural areas, with definitions and references of each category

Categories of CES	Definition	References
Aesthetic	Individuals find aesthetic value in the ecosystem, reflected in support for parks, scenic drives and selection of housing locations.	MEA (2005)
Inspirational	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.	MEA (2005)
Sense of place	Ecosystems as a central pillar of "sense of place", a concept often used in relation to those characteristics that make a place special or unique, as well as to those that foster a sense of authentic human attachment and belonging.	MEA (2005)
Spiritual and religious	Many societies attach spiritual and religious values to ecosystems or their components.	MEA (2005)
Educational	Ecosystems and their components and processes provide the basis for both formal and informal education in many societies. In addition, ecosystems may influence the types of knowledge systems developed by different cultures.	MEA (2005)
Recreation and ecotourism	People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.	MEA (2005)
Cultural heritage	Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species. The diversity of ecosystems is one factor contributing to the diversity of cultures.	MEA (2005)
Cultural diversity	Different types of ecosystems and their components or processes lead to different types of culture.	Linda Szucs et al (2015)
Knowledge systems	The ecosystems and its components or different processes affect formation of knowledge systems.	Tobias Plieninger et al (2015)
Social relations	The ecosystem and its components or processes provide places or ways for social activities.	Tobias Plieninger et al (2015)
Ecological culture	The ecosystem and its components or processes facilitate formation of special local culture which reflects harmonious co-existence between local people and nature.	This research
Scientific research	The ecosystem and its components or processes provide scientific problems, experimental materials or observation sites for scientific research.	Costanza et al (1997)

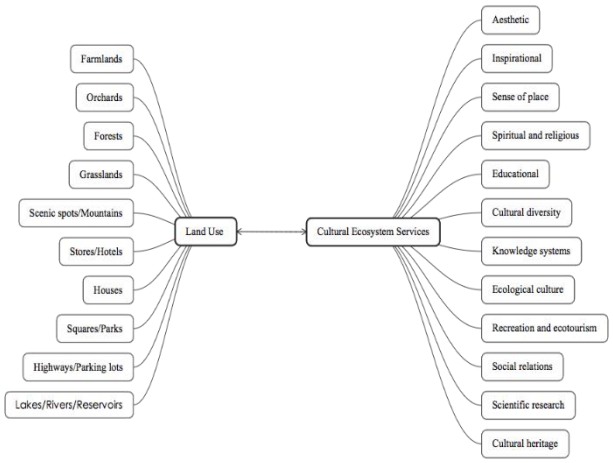

Figure 3: The binding model between CES and land use types

2.2.2 The face-to-face interview questionnaire for tick scoring

A face-to-face interview questionnaire survey was conducted in the summer of 2016. The timing of the survey affected the results as, during summertime, most students return home from university and many young men remain in the villages to engage in farming work. At other times of the year, these same young men leave the villages to work elsewhere, students are in the cities, and the villages are predominantly populated by old people and children. To avoid this left-behind effect, summer was chosen as the most appropriate time of year to conduct face-to-face research.

The research team consisted of six researchers in two groups. Prior to conducting the survey, the researchers were trained how to conduct the survey and taught how to avoid problems that might arise during the survey. Before the formal survey, a pre-survey pilot study was conducted, to highlight potential problems so these problems could be avoided during the formal survey. At various point during the survey process, researchers reported any problems they encountered and, in discussion with the research leader, sought ways to overcome these problems. Random sampling of interviewees was used, with a desire to recruit interviewees with different educational backgrounds, professions, gender and so on.

A demographic survey method was used to quantitatively assess different cultural ecosystem services categories which would be useful to policy-makers. The biggest limitation of the survey was the extent to which it was affected by interviewees' awareness and understanding of ecosystem services. Researchers sought to effectively and sufficiently communicate the concept to each interviewee in order to avoid this problem. The survey was also limited by inaccurate distribution of land use types.

2.2.3 The tick-scoring assessment of CES

A tick-scoring method, based on the Likert Scale (Langemeyer et al., 2015), was developed as a way to simplify statistical assessment. This method was then employed in the face-to-face questionnaire survey conducted in a total of 96 respondents from different households across all four villages (Supplementary Materials Part 1). Respondents' demographic details are summarized in Table 4.

Table 4: Gender, age and education distribution of the four villages

	Gender		Age			Education			
Villages	Female	Male	Under 20 y	20–60 y	Above 60 y	No schooling	Primary School	Middle School& High School	College & University &MSc
Fanggan	13	9	9	12	1	1	6	13	2
Anziwan	11	21	5	19	8	0	4	22	0
Fujiazhuang	13	13	1	18	7	0	6	25	1
Huashan	6	10	0	10	6	1	2	12	1
Total	43	53	15	59	22	2	18	72	4

In the questionnaire, participants could choose multiple land use types related to each category of CES. For example, to assess ecological culture, participants were asked, 'Which of the following places promote ecological protection, ecotourism and ecological products?' and could choose from the list of ten land use types.

The researcher read and, when necessary, explained each question and the procedure for answering it. Participants' answers were then marked on the answer sheet (see Supplementary Materials, Part 2).

A score determining the strength of the relationship between each CES category and land use types were calculated based on the percentage of participants who chose a specific land use type for each CES category, using Formula (1):

$$S = [N0/N] \times 100\% \quad (1)$$

Where:

S is the score of a CES category and its attendant land use type;

N0 is the number of participants who chose that land use type for that CES category;

N is the total number of survey participants.

The score of total CES related to a specific land use type for each village was calculated according to Formula (2):

$$SL = \left[\sum_{j=1}^{12} \frac{Nj}{N}\right] / 12 \quad (2)$$

Where:

SL is the total CES value score of all land use types;

J is the *jth* category of CES;

Nj is the number of participants who chose this land use type for a specific category of CES.

The score of specific CES for all land use types was calculated according to Formula (3):

$$SC = \left[\sum_{i=1}^{10} \frac{Ni}{N}\right] / 10 \quad (3)$$

Where:

SC is the individual CES score of the *ith* land use type;

Ni is the number of participants who chose this land use type for the specific category of CES.

The total CES score of a specific village was determined according to Formula (4):

$$ST = \left[\sum_{i=10,j=12}^{i,j} \frac{Nij}{N}\right] / [i * j] \quad (4)$$

Where:

ST is the total CES score for a specific village;

i is the number of land use types;

j is the number of CES categories;

Nij is the number of participants who chose *ith* land use type for *jth* CES.

2.2.4 Identification of important CES and related land use types

A practical workflow procedure (Figure 4) was established to

hierarchically identify the CES features of each village, and the important CES categories and land use types related to these. This was done by ranking the corresponding scores (Table 5).

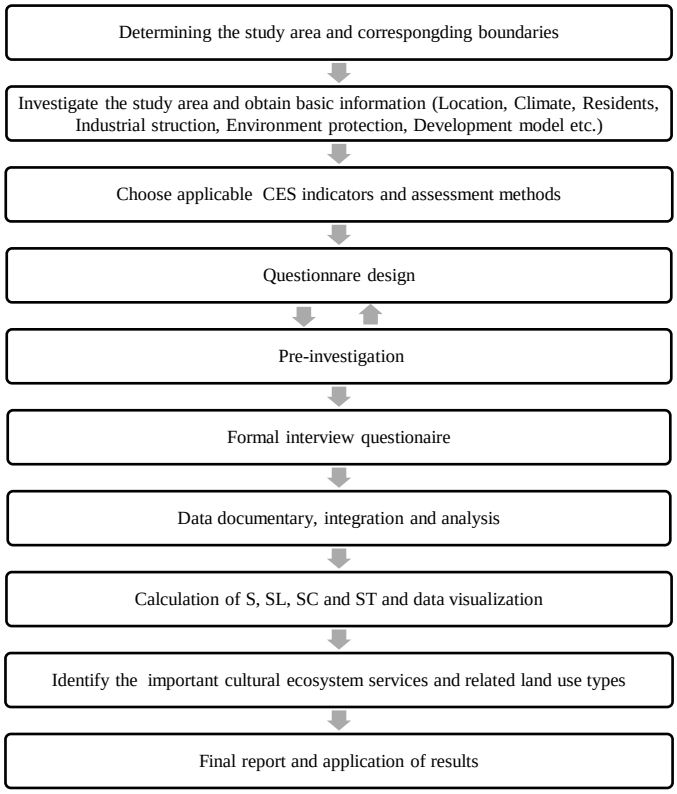

Figure 4: Workflow procedure for CES assessment and hierarchical identification

3. RESULTS

3.1 The average CES score of the investigated villages

Among the four villages, the average CES score (CES score here means CES value; the higher the score, the higher the CES value) of Fanggan, at above 0.15, was highest of all four villages (Figure 5). The other three villages scored similar to each other but considerably lower than both Fanggan and the average score for the area as a whole. Therefore, Fanggan would appear to have comparatively more CES resource advantages than the other three villages.

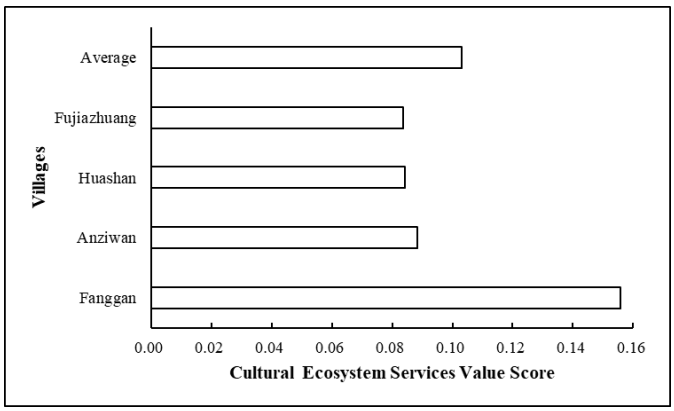

Figure 5: Average CES scores for the four villages, showing Fanggan with greater CES compared to the other villages

3.2 Identification of important categories of CES

Six categories of CES scored above 0.10 – ecological culture, aesthetic services, sense of place, social relations, inspiration, recreation and ecotourism. Among these, ecological culture and aesthetic services scored highest (>0.15), while sense of place, social relations, inspiration, recreation and ecotourism ranked third to sixth.

However, a more detailed account of each CES category in each village revealed different patterns (Figure 6). Fanggan scored relatively higher in all categories and, with the exception of spiritual and religious services, scored above 0.15 in all categories. Only six categories of CES scored above 0.10 in the other three villages. CES relating to education, cultural diversity, scientific research and knowledge systems were also present in Fanggan, but lower or entirely absent in the other villages. The aesthetic score (>0.20) of Huashan was higher than both Fujiazhuang and Anziwan.

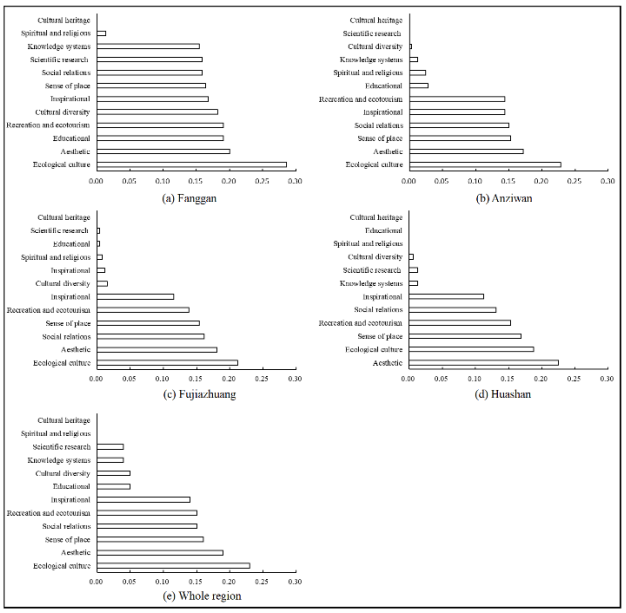

Figure 6: The full account assessment shows the average score of each category of cultural ecosystem service in each village. Both differences and similarities exist among the score patterns of the villages

3.3 Identification of important land use types associated to CES

Overall, scenic spots/mountains, forests and lakes/rivers/reservoirs had the highest average CES scores. In three of the villages, with the exception of Huashan, these three land use types also scored approximately 0.15 (Figure 7).

The score patterns of each land use type differed between villages. Scenic spots/mountains scored highest in Fanggan, Anziwan and Huashan, while lakes/rivers/reservoirs scored highest in Fujiazhuang. Only scenic spots/mountains and lakes/rivers/reservoirs scored above 0.20 in Fanggan, Anziwan and Fujiazhuang, while three land use types scored above 0.2 in Huashan.

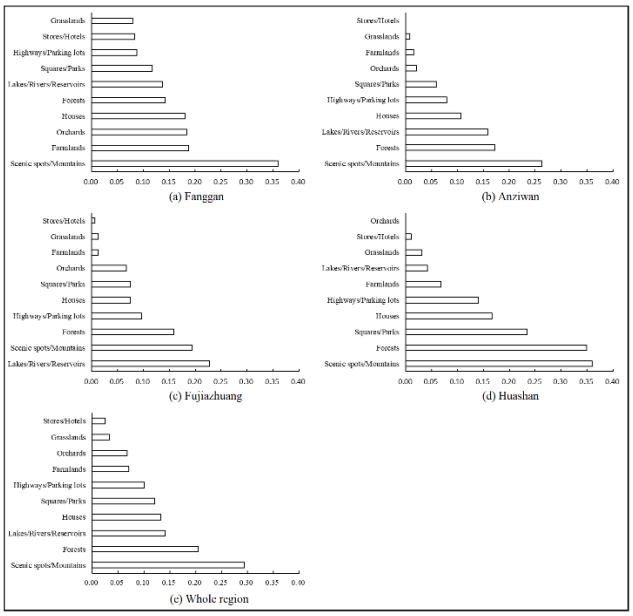

Figure 7: The scores of average CES for each specific land use type in each village and differentiated patterns for the whole area

3.4 Identification of important land use types associated to important categories of CES

Overall, the survey revealed that the land use types with the most important CES are forests, lakes/rivers/reservoirs and scenic spots/mountains. Forests scored highest for providing ecological culture and sense of place services, scenic spots/mountains scored highest for providing aesthetic, recreation and ecotourism and inspirational services, while lakes/rivers/reservoirs consistently ranked second or third for ecological culture, aesthetics, recreation and ecotourism, and inspirational services. In addition, houses proved important to sense of place and social relations, and squares/parks and highways/parking to social relations, recreation and ecotourism (Table 5).

The importance of land use types relative to each category of CES differed from village to village (Table 5). In Fanggan, farmland scored high for ecological culture, sense of place, cultural diversity and scientific research, scenic spots/mountains scored high for education, cultural diversity, knowledge systems and scientific research, and houses scored high for knowledge systems. However, in Fujiazhuang orchards scored high for ecological culture and aesthetics.

With the exception of Fanggan, no land use type scored above 0.3 for education, cultural diversity, knowledge systems and scientific research.

Table 5: Important land use types related to each category of Cultural Ecosystem Services in area as a whole and for each village were determined by ranking the scores given to each land use type. Land use types scoring above 0.3 are listed.

Categories of CES	Average	Fanggan	Anziwan	Fujiazhuang	Huashan
Ecological culture	Forests (0.69), Lakes/Rivers/Reservoirs (0.31)	Scenic spots/Mountains (0.64) Farmlands (0.59), Orchards (0.59), Forests (0.41)	Forests (0.69), Scenic spots/Mountains (0.66), Lakes/Rivers/Reservoirs (0.59)	Forests (0.92), Orchards (0.31)	Forests (0.75)
Aesthetic	Scenic spots/Mountains (0.71), Forests (0.47), Lakes/Rivers/Reservoirs (0.33)	Scenic spots/Mountains (0.64), Forests (0.32), Lakes/Rivers/Reservoirs (0.32)	Scenic spots/Mountains (0.75), Forests (0.53), Lakes/Rivers/Reservoirs (0.38)	Scenic spots/Mountains (0.69), Lakes/Rivers/Reservoirs (0.42), Orchards (0.35),	Forests (0.75), Scenic spots/Mountains (0.75)
Sense of place	Forests (0.41), Houses (0.41), Scenic spots/Mountains (0.31)	Houses (0.5) Farmlands (0.32),	Scenic spots/Mountains (0.47), Forests (0.38), Houses (0.34), Lakes/Rivers/Reservoirs (0.31)	Forests (0.5), Houses (0.35)	Forests (0.5), Scenic spots/Mountains (0.44), Houses (0.44)
Social relations	Squares/Parks (0.57), Houses (0.37), Highways/Parking lots (0.36)	Houses (0.36), Squares/Parks (0.36)	Houses (0.47), Squares/Parks (0.47) Highways/Parking lots (0.44)	Squares/Parks (0.58) Highways/Parking lots (0.54), Houses (0.46)	Squares/Parks (0.875)
Recreation and ecotourism	Scenic spots/Mountains (0.41)	Scenic spots/Mountains (0.55), Squares/Parks (0.32)	Lakes/Rivers/Reservoirs (0.44), Highways/Parking lots (0.42)	Highways/Parking lots (0.42), Lakes/Rivers/Reservoirs (0.38), Scenic spots/Mountains (0.36)	Scenic spots/Mountains (0.43), Squares/Parks (0.34)
Inspirational	Scenic spots/Mountains (0.70)	Scenic spots/Mountains (0.59), Lakes/Rivers/Reservoirs (0.32)	Scenic spots/Mountains (0.63), Forest (0.38),	Scenic spots/Mountains (0.77),	Scenic spots/Mountains (0.81), Forests (0.31),
Educational	/	Scenic spots/Mountains (0.45), Stores/Hotels (0.32)	/	/	/
Cultural diversity	/	Farmlands (0.45), Scenic spots/Mountains (0.36)	/	/	/
Knowledge systems	/	Houses (0.59) Scenic spots/Mountains (0.32),	/	/	/
Scientific research	/	Scenic spots/Mountains (0.59) Farmlands (0.36),	/	/	/
Spiritual and religious	/	/	/	/	/
Cultural heritage	/	/	/	/	/

4. Discussion

4.1 Importance of CES to the villages

Using the established tick-scoring method, CES values and components were easily profiled. Moreover, the most important CES categories and their related land use types were identified by local stakeholders. Fanggan, with its ecotourism industry, demonstrated high and diverse CES, consistent with Ding et al.'s (2016) monetary ecosystem services assessment results for these same villages. Scenic spots/mountains, forests and lakes/rivers/reservoirs provided multiple CES and showed higher average CES scores compared to other land use types. These results are similar to village scale CES assessment using other methods such as mapping and photography (Sherren et al., 2010; Nahuelhual et al., 2014; Sherrouse et al., 2014; Sherrouse and Semmens, 2014). Overall, this simplified tick-scoring method has proven practical and reliable for CES assessment and management in this region, as it allows for the effective communication of concepts and results to the public (Costanza et al., 2017) at the village scale.

Among CES categories, ecological culture and aesthetics were the most

important in the participating villages, followed, in descending order of importance, by sense of place, social relations, inspiration, recreation and ecotourism. This suggests that ecological culture and aesthetics are essential and are often more important types of CES than recreation and ecotourism, both of which have been frequently highlighted in ecosystem services assessments due to their cultural and monetary value (Costanza, 2018). It is no surprise that local residents value sense of place, social relations and inspirational services as much as, or more than, ecotourism, as these CES are closely related to wellbeing (López-Santiago et al., 2014).

Moreover, due to its well-established eco-tourism industry, Fanggan also boasts high levels of education, cultural diversity, scientific research and knowledge systems CES. This suggests that the development of ecotourism can lead to greater overall CES improvements (Ding et al., 2016). Areas of outstanding natural beauty attract not only sightseeing tourists, but also provide opportunities for academic teaching, learning and research. Active scientific research stations and other academic establishments create a stronger awareness and understanding amongst villagers of their village's CES potential. Thus, proper utilization of CES can lead to further conservation and improvements.

4.2 Importance of CES-related land uses to the villages

The identification of important CES-related land use types is essential for local sustainable development decision making and planning. Changes to land use or land cover can result in negative outcomes for habitats and biodiversity, as well as contribute to the deterioration of ecosystem services linked to human well-being (Foley et al., 2005; Schröter et al., 2005; Nelson et al., 2010; Pereira et al., 2012). This research found that, in the four villages surveyed, forests, lakes/rivers/reservoirs and scenic areas/mountains are important for ecological culture, aesthetics, recreation and ecotourism and inspirational services, but some land use types, such as farmland and houses, present higher or unique CES in some villages but not others. This suggests that the importance of certain land use types to CES may change due to the context within which development takes place. This may challenge the identification and protection of CES-related land use (Szücs et al., 2015) and suggests that ongoing and regular reviews of CES categories and land use types are necessary.

5. Conclusion

Our study has revealed that the simplified tick-scoring method can be used to identify and assess CES, and its related land use types in rural areas, the important CES and important land use types can be also identified based on the results which showed that ecological culture and aesthetic services ranked the top two among twelve CES categories, and scenic spots/mountains, forests, and lakes/rivers/reservoirs scored for multiple CES and attained higher than average CES scores. These information are very important for local managers or policy-makers to avoid local CES loss when they make plans to adjust local land use types. In addition, the simplified method, process and results of this study are easily understood by the local residents and accessible to village managers, development planners and policy-makers. Therefore, the established approach could be applied to identification, protection, improvement and utilization of CES in rural areas.

This method also sheds light on CES assessment and the identification of multiple services within the context of complex development under the effects of urbanization at the local scale. It has the potential to be even more powerful when it is integrated with objective material ES assessment. Such assessment requires a knowledge and awareness of ES, but a village scale assessment can be successful by the incorporation of more stakeholders and sectors such as experts, the tourist industry, and senior administrators from local government. Moreover, this simplified method can be adapted to CES assessment in order to support decision making processes in other rural areas of China, as well as other developing countries.

Acknowledgement

This work is supported by the National Key Technology R&D Program (No. 2013BAJ10B0403) and the Natural Science Foundation of Shandong Province, China (No. ZR2017MC013).

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