Supplementary information

S1 Questionnaire design and processing

The final result of the SolVES model is mainly determined by the environmental background values and people's perception of the local area. Among them, people's level of understanding of the local area is obtained through questionnaire surveys.

When designing the questionnaire, the relevant indicators of cultural services to be evaluated were included in the scope of the questionnaire, presented in simple and easy-to-understand questions, so that local residents could better understand them when conducting the survey. The questionnaire includes various aspects such as entertainment, aesthetics, learning, cultural atmosphere, economic development level, sustainable development level, living environment, and people's sense of happiness.

People's perception of the local area is closely related to the actual natural and economic conditions of the area, as well as their own conditions. In order to make the data of the questionnaire more convincing and scientific, we added surveys on the age, gender, and education level of the participants when designing the questionnaire. Age is divided into six stages, namely under 18 years old, 18 to 30 years old, 31 to 40 years old, 41 to 50 years old, 51 to 60 years old and over 60 years old. The level of education is divided into five levels, namely junior high school and below, high school and secondary school, junior college, undergraduate, master's degree and above. After the questionnaire design was completed, we first conducted a trial survey, selecting some people in Qingdao to investigate their level of awareness and satisfaction with the local area. A total of 103 people were selected for the survey, with different ages, genders, and educational levels. Through the trial survey, we have revised the questionnaire based on some suggestions from the respondents regarding the questionnaire questions, in order to make it understandable to people of all ages and educational levels, while also maximizing the content of the questionnaire to express what we want to investigate. The questionnaire is attached in supplementary information S2.

After determining the content of the questionnaire, we set the survey location and route for the questionnaire. Due to China's national conditions, it is impossible to distribute questionnaires to each household by email or obtain survey results from various groups through online surveys. Ultimately, we decided to obtain survey results through manual field surveys. The questionnaire survey was conducted in July 2020 and July 2021, with a duration of approximately 10 days each. The first survey was conducted in July 2020, with a team of six people renting cars to travel from Qingdao to investigate various cities and county centers in the Shandong Peninsula Blue Economic Zone, as well as villages along the way. The route starts from Qingdao, passes through Rizhao, Weifang, Dongying, Binzhou, Yantai and Weihai, and finally returns directly to Qingdao from Weihai. Each location is for one day, and some locations can stay for up to two days due to weather and task volume. 836 questionnaires were distributed, and 783 valid questionnaires were received. Due to the

consideration that different people may have different understandings and perceptions of the same issue, in order to ensure the validity of the questionnaire, we will survey at least 3 people in each location, who must be local or long-term residents who have a clear understanding of the local situation. At the same time, we tried to involve people of all ages. For local residents who have a deep understanding of the local area, we used interviews to record the problems reported by the masses and the actual situation in the local area. We collected the coordinates and elevation of the survey location using GPS for each questionnaire, in order to obtain accurate location information during later data processing. The second questionnaire survey was launched in July 2021, and the survey site was also the entire Shandong Peninsula Blue Economic Zone. In order to improve efficiency more effectively, the investigation team was divided into two groups. One group went to remote areas with the vehicle to conduct investigations, while the other group mainly conducted investigations in relatively densely populated cities and towns. A total of 1,677 questionnaires were distributed for the second time, and 1,598 valid questionnaires were received. After two questionnaire surveys, a clear understanding of the study area has been obtained.

The answers to the questionnaire questions are mostly designed as lowest, low, medium, high, and highest. We assign scores from 1 to 5 in order from lowest to highest, and we process all the questionnaires using this method. According to the location of each questionnaire, the processed questionnaire points were digitized in ArcGIS, so that each point was distributed on the map, and each point had attribute information such as numerical score, longitude and latitude coordinates, name, number of questionnaires, elevation, and so on. The SolVES model is based on geographic database call data for calculation. Therefore, firstly, users need to load the digitized point feature data, statistical survey data, and environmental feature data into the same geographic database, and then load the geographic database into the specified folder of the SolVES model to complete data preparation. According to the created geospatial database, the entertainment value and aesthetic value of the model itself can be evaluated based on the model's operation manual and principles. The result ranges from 0 to 10, with 0 representing a low value for the location and 10 representing a very high value for the location.

S2 Questionnaire used to investigate cultural services

Hello:

We are graduate students from Shaanxi Normal University. We are studying the social value of the regional ecosystem services. Please choose the answers that apply to you. We are very grateful to you for your help!

1. Sex：

A. Man   B. Woman

2. Age：

A. Under 18 years old   B. 18—30 years old   C. 31—40 years old

D. 41—50 years old   E. 51—60 years old   F. More than 60 years old

3. Level of education：

A. Junior high school and below   B. High school and secondary school

C. College specialist D. Bachelor's degree   E. Master's or doctorate degree

4. Local aesthetic value (including natural scenery and cultural landscape)：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

5. The richness of local biological resources：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

6. Local cultural atmosphere and cultural heritage：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

7. Local economy：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

8. The extent to which local resources are over-exploited：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

9. Your perceptions of the local historical background：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

10. Your perceptions of the local living environment, such as water, air quality, soil fertility and so on：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

11. The degree of local recreation (parks, cinemas, playgrounds, etc.)：

A. Lowest   B. Low   C. Medium   D. High   E. Highest

12. Living in the local area, your happiness level is：

A. Lowest   B. Low   C. Medium   D. High   E. Highest