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Urban Rivers Landscape Services Assessment Based on Public Perception in Mehranrood River, Tabriz, Iran

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ABSTRACT

As natural corridors, urban rivers are often under ecological pressures disturbing their environmental functions, and services over time and space. The landscape services (LS) has been accordingly introduced as an alternative method to evaluate such functions at the landscape scale. In this regard, public perceptions can seriously shape landscape changes, with potentially consistent or inconsistent implications for ecosystem sustainability over time and space. To shed light on this issue, the present study aimed to evaluate the LS of the Mehranrood River running through the city of Tabriz, Iran, from local users' perspective. For this purpose, approximately 365 questionnaires (with the Cronbach's alpha coefficient equal to 0.97) were developed based on the LS indicators and completed by the stakeholders. To analyze the results, structural equation modeling was applied. Afterward, the accuracy of the given model was checked by applying the root-mean-square error of approximation (RMSEA). The results showed that the service provision accounted for the largest number of factors. The cultural services were completely dependent on the presence of production/supply and regulation/maintenance services. The study results demonstrated that, the river had no efficient structures and functions from the stakeholders' perspective. They even believed that the ecological restoration of the Mehranrood River could deliver the potential ability to enhance its LS. Moreover, the respondents were willing to be in close contact with the river if it could be ecologically rehabilitated. Generally, ecological restoration could help boost urban resilience over time through the regeneration of ecological infrastructure, which required a transition from mechanical to ecological thought.

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INTRODUCTION

The ecosystem services (ESs) approach has been thus far utilized in various fields for many years (Aryal et al., 2022; Chen et al., 2022; Evans et al., 2022; Fang et al., 2022; McPhearson et al., 2022; Takacs & O'Brien, 2023). But it has been unsuccessful and even criticized by experts (Aschonitis et al 2016; Friess et al., 2020; Loos et al., 2023). Some negative aspects of ESs are the ecosystem commodification, the dominance of reductionism in the evaluation of ESs, the imperfect and relative evaluation of ESs, less respect for social issues, such as justice, and the fortification of the current power imbalance (Braat & De Groot, 2012; Cumming et al., 2020; Díaz et al., 2018; Melathopoulos & Stoner, 2015). Among such drawbacks, insufficient attention to stakeholders seems more considerable (Bastian et al., 2014; Sagie & Orenstein, 2022).

To moderate such criticisms, the landscape services (LS) approach was proposed

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(Termorshuizen & Opdam, 2009; Vallés-Planells et al., 2014; Wu, 2013). Unlike the ecosystem services approach, the LS one takes account of individuals' perspectives on structures as significant factors.

The LS approach has been the output of novel attitudes to landscapes since the beginning of the 21st century. It was thus respected in international agendas such as the European Landscape Convention of the Council of Europe in 2000 and the Convention for the Safeguarding of the Intangible Cultural Heritage in 2003 (Smeets & Deacon, 2016). As landscapes represent the cultural identity and diversity of people with regard to nature in the context of time (Dan et al., 2021), they have turned into one of the most fundamental axes of sustainable development, and subsequently, human well-being (Dossche et al., 2022; Peng et al., 2021). Landscapes can be also described as socio-ecological and spatial systems that offer a wide range of services (Butler et al., 2021; Opdam, 2019). Hence, they are valuable thanks to their economic, socio-cultural, and environmental functions (Gulickx et al, 2013). The close relationship between people and landscapes similarly conveys the fact that individuals' attitudes play a critical role in the LS (Opdam, 2020).

As well, the LS are based on the complicated relationships between the spatial patterns of landscape elements, processes, and people who are the main driving forces of the landscape changes (Dong et al., 2022). Therefore, the emphasis by the LS on these capabilities provides a better opportunity for integrated research, using different sciences and levels of knowledge. The LS also seek to secure the socio-economic and spiritual benefits of society by basing it on ecosystem values (Keller & Backhaus, 2020).

In this sense, a city can be a kind of disturbed ecosystem in which natural ecosystems face a myriad of disturbances (Renaud et al, 2010), thus providing the ecosystem values, and consequently, the resulting benefits pose serious challenges to society. To deal with these challenges, dual attitudes are often formed based on the nature of thought. Accordingly, the first attitude is built on a scientific and systematic viewpoint toward a subject and the second one is founded on society's perceptions of the challenges. Most of the existing literature is associated with the first axis. The ecosystem services approach also keeps to this framework, while the LS approach has an inherent tendency to the second axis due to the stakeholders' attention but it does not negate the first view either (van der Sluis et al, 2019). Therefore, examining the local community's perceptions of the nature of the LS provided by the existing ecosystems in a city, is assumed as a key issue to improve environmental conditions (Ghazoul et al., 2019; Tudorie et al., 2020),, followed by providing socio-economic and psychological benefits. In this regard, urban rivers are among the most vital ecosystems that are severely disrupted. At the same time, they have the ability to provide extensive ecosystem services if they return to their normal conditions (De Bell et al, 2020). Such rivers in Iran are also facing serious challenges due to the dominance of governance thinking over the environment and purely mechanical and engineering perspectives on the management of urban ecosystems. The outcome has been inadequate attention to the diverse, and especially, the ecological functions of such ecosystems. Mehranrood as an urban river rolling through the city of Tabriz, Iran, is one of these ecosystems. Despite its vital role in the city, this river is more of a canal than a natural river. Given these characteristics with an emphasis on the second attitude, there is a need to know about the stakeholders' perspective of such a natural ecosystem. Therefore, the main objective of the present study was to examine people's perceptions in relation to the LS of the current functions offered by the Mehranrood River. For this purpose, there was an attempt to carry out an evaluation in the framework of the LS in the city of Tabriz in order to establish a platform for achieving a more desirable quality of urban rivers.

Theoretical Foundations: Given the vital role of natural ecosystems in the quality of human life, there are various approaches to ecosystem studies such as landscape ecology, the ecosystem services approach and the LS (Opdam, 2020; Zhou et al, 2020), which have recently emerged.

Here, landscapes as platforms for human interactions with the environment and their result can form the basis of planning and design. Therefore, as a broad concept, landscapes include structural and functional elements that can play a decisive role in ecosystem sustainability, whether natural or man-made. For this reason, the European Union has recognized landscapes and provided a legal framework for the implementation of the European Landscape Convention of the Council of Europe in this union (Déjeant-Pons, 2006).

Considering the drawbacks of the ecosystem services approach, the LS one has been proposed as a link between landscape ecology and sustainable development, which also provides a good concept for applying landscape ecology knowledge in planning (Termorshuizen and Opdam, 2009). There are also different definitions of the LS. In general, such services have been defined as a set of services and goods that are directly or indirectly provided to meet human needs (Gulickx et al 2013; Vallés-Planells et al, 2014).

Based on the existing literature, the LS are classified into three main groups, i.e., production/supply, sociocultural, and regulation/maintenance services (Vallés-Planells et al, 2014) (Table 1). In the framework of this approach, the main dimension incorporates multiple axes, and each axis also contains diverse indicators that consist of a relatively comprehensive range of services and goods provided by landscapes. There is also a similarity between the LS and the ecosystem services approach, and an ambiguity arises as whether the term the LS can replace the ecosystem services or not. A review of the thematic literature also shows that although the concepts of the ecosystem services and the LS somewhat overlap, they are not the same. The discrepancy between the LS and the ecosystem services is mainly attributed to the fact that the ecosystem services deal with the structures and functions within an ecosystem, while the LS consider a broad framework and cover all existing structures, functions, and processes (Bastian et al, 2014). On the other hand, addressing the importance of stakeholders in the LS is another prominent difference between these two approaches.

After examining the historical development of the concept of the LS, Fang et al. (2015) defined the landscape service capability-flow-demand (LSCFD) framework, reflected on such services within three frameworks of LS capacity (LSC), LS flow (LSF) and LS demand (LSD), and concluded that the LSCFD conceptual framework could provide a way to replace the sustainable landscape development (LSS) with current techniques (Fang et al, 2015). In this regard, Mele and Poli (2015) established a methodological framework for surveying, mapping, and landscape assessment, known as the multidimensional complex systems. They also found

Table 1. LS dimensions

LS	
Production/Supply Services	• Production of healthy food (water and animal/plant source foods) • Production of materials (living and non-living) • Energy production (renewable and non-renewable) • Estimation of citizens' daily needs (related to work and life, mobility, and human needs)
Sociocultural services	• Health (mental and physical) • Pleasure-seeking (passive, active, and aesthetic) • Social flourishing (place identity, interaction, and sense of continuity) • Self-actualization (conscious and confused) • Security (life and money) • Values (material, spiritual, historical, and cultural heritage)
Regulation/ maintenance services	• Waste regulations (dry and wet) • Flow-related criteria (water and soil) • Physical environment regulation (atmosphere, lithosphere, and hydrosphere)

The LS dimensions (the LS classification according to the Common International Classification of Ecosystem Services) (Haines-Young and Potschin 2010).

the geographic information with the help of the geographic information system (GIS) and the analytic hierarchy process (AHP) to develop the LS maps and define some possible scenarios. Generally, they stated that recognizing the LS could be a supportive factor in the decision-making process related to sustainable management and planning (Mele & Poli, 2015). As well, Duarte et al. (2018) in a meta-analysis of the LS evaluated the effects of the landscape criteria on some services such as pollination, pest control, water quality, etc. and confirmed that considering landscape structure in evaluating the LS was of utmost importance and could strengthen the economic system for managing and decision-making purposes. Therefore, land managers needed to exploit their approach to adapt and maintain services according to focal services to build confidence (Duarte et al, 2018). In this line, Zhou et al. (2020) examined residents' preferences for cultural LS and reflected on the improved quality of cultural LS in their lives and their place of residence beyond housing. Willemen et al. (2012) also believed that social needs and landscape structure could play a key role in service delivery. Due to the constantly changing needs and multi-functional features of landscapes, the relationship between services and needs at different levels of space and the interaction between land management systems and needs, could lead to the LS dynamism. Accordingly, it is necessary to specifically reflect on the dynamics of the LS in decisions (Willemen, et al, 2012). In Heinz Renetzeder et al. (2015) investigating the role of the LS in restoration, the relationship between the potential of the LS and the actual services provided in landscapes was evaluated, and it was concluded that the capacity of space to produce services was much greater than those being currently presented.

As well, Fargerholm et al. (2019) explored the relationship between the LS at the local scale and participatory spatial planning, and concluded that, in situations wherein access to data was difficult, the method of evaluating location-oriented LS based on local participation could have a significant role in promoting the quality of spatial planning, on the one hand, and serve the interests of the local community (Fargerholm et al, 2019), on the other hand Zhou et al. (2020) similarly shed light on market price, conditional valuation, and value transfer methods for the LS and settled that when the conditional valuation was economic, it could produce much different results than other methods. In this way, values were quite sensitive to the rarity of services, and the study scale and the level of stakeholders' participation could provide a good platform for planning (Zhou et al, 2020). Keller and Backhaus (2020) also considered the role of the LS in landscape policy formulation and introduced it as a cross-disciplinary issue, enabling stakeholders to take better steps to make the best use of the LS.

Of note, landscapes are constantly changing according to human activities, while these variations occur without planning and research in many cases, inducing landscape disruption and inefficient use of special services, particularly in urban environments. Mehranrood is among many urban rivers as a natural element and an ecological corridor facing many challenges, most importantly, increasing pollution, destructed river landscape, separation from its surrounding area, loss of ecological functions, encroachment, social issues, and the like. This is while the river naturally has a wide range of functions, which has been deprived of these natural and divine services due to the mechanical thinking to deal with this urban river, and as a problem for the city, which seeks to manage it with hard engineering.

No attention to natural functions as well as the rule of hard thinking instead of soft ecological philosophy in the field of urban management for many years has caused natural resources and urban management face many problems. As a step toward improving the current situation, the services provided by this river can be evaluated in the form of the LS. Therefore, the main purpose of this study was to evaluate the urban LS of the Mehranrood River running through the city of Tabriz, Iran, from the local stakeholders' perception and analyze the services provided by this landscape. Accordingly, the LS were considered in their three main axes and a preliminary research model was initially developed (Figure 1).

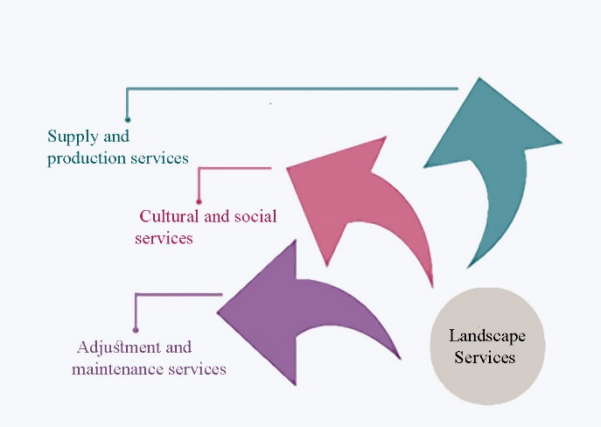

Fig. 1. The LS main model (the basic structural equation modeling: SEM)
(Source: Authors)

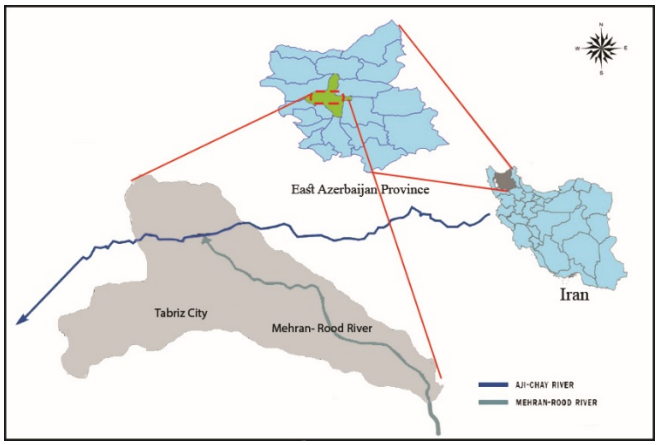

Fig. 2. The geographic location of East Azerbaijan Province and the city of Tabriz

MATERIAL & METHODS

The city of Tabriz is located on the eastern edge of the Tabriz plain and at the end of two rivers, Achi Chai and Mehranrood, at the foot of the Aoun Ibn Ali Mountain with the latitude 3807929 and longitude 4628859. The Mehranrood River originates from the Sahand slopes and steps on the arena of Tabriz with an east-west orientation. This river also enters the neighborhoods of Baghmisheh, Bilan Kooh, and the like in the eastern part of the city, leaves the neighborhood of Chosudozan in the west, and flows into the lands of Payab. Finally, in the northwest of the city, it joins Achi Chai.

This research was based on the LS approach, adopting three main axes of production/ supply, sociocultural, and regulation/maintenance services, each one with some sub-branches developed on the conceptual model and the indicators presented in the Introduction section (Table 1) of the research axes. To collect the data, a questionnaire was developed using the Likert-type scale based on the actual and the potential ability of the region and the main axes of the services. The sample size was also calculated using the Cochran formula with reference to the population of the city of Tabriz. First, 20 questionnaires were distributed, and then the results were analyzed. According to the problems occurring during this stage, the questionnaire was modified, and finally, 364 questionnaires were distributed among the people living in the

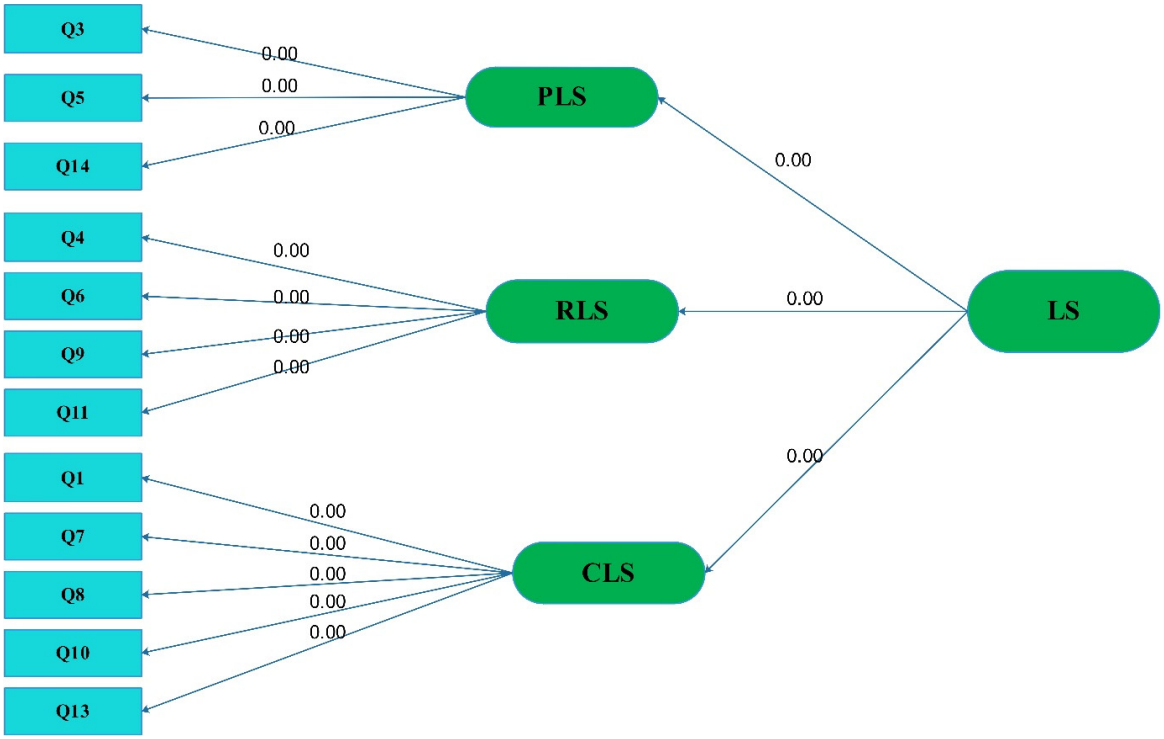

Fig. 3. Theoretical model (PLS= Production/Supply Services, RLS= Regulation/ maintenance services and CLS= Sociocultural services)
(Source: Authors)

city of Tabriz (around the river). After the initial review, the Cronbach's alpha coefficient of the questionnaire was calculated using the SPSS Statistics software by 0.97.

To analyze the questionnaires in detail and to investigate the causal relationships between the hidden research variables, the SEM was used and modeling was provided using LISREL. Before modeling, data preparation was also performed by deleting the outliers using the linear regression. For modeling in LISREL, first, a theoretical model was prepared, and then, the modeling was done in the software environment based on the theoretical model (Figure 3).

The SEM as a statistical technique allows for the systematic analysis of multivariate data to measure theoretical structures or hidden variables and show their relationships. It is also based on statistical techniques such as correlation, regression, and analysis of variance (ANOVA). This technique has the ability to model all regression equations simultaneously, whose underlying hypothesis is that the measured variable produces a definite covariance structure with a continuous multivariate normal distribution. Accordingly, LISREL analyses are performed using covariance and covariance matrix.

RESULTS AND DISCUSSION

Out of 364 questionnaires completed, 62% of the cases were from male respondents and the rest (38%) were from females. Of the total number of people who answered the questionnaire items, 97% cases were living in the city of Tabriz and only 3% of them were residing in other cities (Table 2).

Table 3 shows the results of the Pearson's (r) correlation coefficients, indicating the degree of linear relationship between the quantitatively measured variables. Accordingly, the direction of the relationship of all variables was positive and the strongest relationship was observed

Table 2. Descriptive information of respondents by percentage

Age	**Less than 18 years**	**18 to 24 years**	**25 to 44 years**	**45 to 65 years**	**Over 65 years**
	5	20	60	12	3
Education level	**High school**	**Diploma and post-diploma**	**Bachelor**	**Master's and Ph.D.**	
Working status	**Employed**	**student**	**Student or soldier**	**housewife**	**Retired**
	14	47	28	11	
Frequent traffic along the river	**everyday**	**Several times a week**	**How many times a month**	**How many times a year**	
	30	21	24	25	

Table 3. The Pearson's r results

Correlations					
		Production and Supply Services	Adjustment and Maintenance Services	Cultural and Social Services	Landscape Services
Production and Supply Services	Pearson Correlation	1	.904**	.852**	.81**
	Sig. (2-tailed)		.000	.000	.000
	N	360	360	360	
Adjustment and Maintenance Services	Pearson Correlation	.904**	1	.895**	.80**
	Sig. (2-tailed)	.000		.000	.000
	N	360	360	360	
Cultural and Social Services	Pearson Correlation	.852**	.895**	1	.92**
	Sig. (2-tailed)	.000	.000		.000
	N	360	360	360	
Landscape services	Pearson Correlation	.81**	.80**	.92**	
	Sig. (2-tailed)	.000	.000	.000	1
	N	360	360	360	

**. Correlation is significant at the 0.01 level (2-tailed).

between the production/supply and regulation/maintenance services. In other relationships, the Pearson's r value was more than 0.8, suggesting a strong relationship between the three dimensions of the LS. In addition, the Pearson's r value in terms of all three relationships of the services and the LS was generally higher than 0.8 and the strongest relationship associated with the sociocultural services was 0.92. The confidence level for this test was 99% ($p<0.01$), shown as ** on the Pearson's r value.

After making initial corrections to the raw data in the SPSS environment, the initial model was drawn and the calculations were performed based on the theoretical model in LISREL. The final model was then obtained by making some further corrections. With reference to the base model (Table 4), the root mean square error of approximation (RMSEA) or the second root of

Table 4. The model fit indices

Indicators	Optimal amount	Result	Interpretation
Ch-square		60.73	
P value	0.05 P	0.00013	Optimal fit
RMSEA	0.08 RMSEA	0.061	Optimal fit
Degrees of freedom (df)		26	
Ch-square/df	1<Indicators>5	2.32	Optimal fit

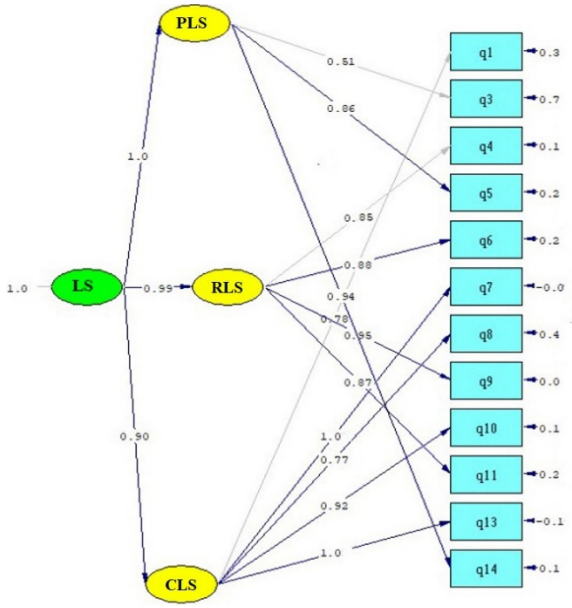

Fig. 4. The standard model (PLS= Production/Supply Services, RLS= Regulation/ maintenance services and CLS= Sociocultural services)

the results of the approximation error as one of the most important evaluation indicators of the model was approximately 0.061, which indicated a good fit of the model. Moreover, the value obtained from dividing the Chi-squared distribution by the degree of freedom was 2.33, which was acceptable due to being in the range of 1 to 5, and consequently the accuracy of the model was confirmed.

Based on the modeling performed in LISREL (Figure 4), the standard model was that the effect of the production/supply, regulation/maintenance, and sociocultural services on the LS was equal to 100%, 99%, and 90% for the production/supply, regulation/maintenance, and sociocultural services, respectively. With regard to the production/supply services, according to the standard model, public participation was the most effective factor. The given factors were also related to increasing green space and climate change in the regulation/maintenance services, and educational, recreational, and sports services in the sociocultural ones.

Considering the two standard models and t-statistic, the validity and reliability of the variables are presented in Table 5. As the t-statistic was higher than the absolute value of 1.98 for all relationships, the significance of the model was realized.

As water infrastructure in any city, urban rivers can be the source of many services, if there is sustainable management in line with their ecological system. Accordingly, many countries are to restore rivers naturally. The famous successful examples can be thus found in the Manzanares River in the city of Madrid, Spain, as well as the Bronx River in New York and the Los Angeles

Table 5. Checking the validity and reliability of the study variables

Variable	Intended options	Standard value	T value	Reliability	
				Cronbach Alpha	Cronbach's alpha after standardized
Production and Supply Services	Produce healthy food	0.51		0.78	0.8
	Material production and energy production	0.86	11.17		
	Estimating the daily needs of citizens	0.94	11.54		
Adjustment and Maintenance Services	Flow rules		0.85	0.95	0.95
	Setting the physical environment	26.19	0.88		
	Setting the physical environment	41.12	0.98		
	Flow rules	24.04	0.87		
Cultural and Social Services	Pleasure		0.78	0.94	0.95
	Health & Safety	21.51	1		
	Pleasure	31.77	0.77		
	Social flourishing and values	18.95	0.92		
	Self-actualization and health	22.07	1		

River, Los Angeles, the United States, and the like. The worst case scenario is the Manzanares River, which had become an underground canal, and the Bronx River in New York, which had turned practically into a sewer. Considering the local management model and efforts, these rivers were finally reconditioned as successful urban projects in the world (Perini & Sabbion, 2017).

In this study, according to the views of Vallés-Planells et al. (2014) the LS in the Mehranrood River area were discussed in three main dimensions, viz. the production/supply, regulation/maintenance, and sociocultural services. Before examining the results of these three axes based on the services, by looking at the t-statistic, almost all the axes had a high significance, but in the section related to the safety of the river routes and the existence of sports facilities in the routes around the river, this value with 41.12 and 31.77, respectively, showed the highest t-statistic. According to the answers given to the questionnaires and the results obtained, it was concluded that the existing routes along the river did not create a sense of security in citizens and this factor had led them not to make use of the limited sports facilities available there. In such circumstances, in respect of the river floods throughout history, resolving safety in service delivery was one of the most important issues to be considered, as confirmed by the model results. Some issues such as health concerns, climate change effects, beauty, along with recreational and educational activities were in the next significant ranks. The results of this study were thus examined separately for each service as follows:

a) Production/Supply Services**:** The model fit results demonstrated that the production/supply services, in addition to their 100% role in the LS, had a significant and direct relationship with the production/supply and regulation/maintenance services, so much attention and planning in the field of services, especially in urban areas, were required. Facing the problems of insufficient space for productive discussions could also have an effective role city improvements and residents' welfare. The most important factor in the production/supply services was related to increasing green space around the river, which could be done with public participation, according to the results in Table 5 and the people's willingness to participate, if the public was strengthened and informed. The acceptance of this issue by the public and the measures taken for this purpose to improve the situation could also produce many favorable results. Given the high capability of providing urban river production/supply services, investing in such services

along with meeting the needs of residents could greatly contribute to the well-being of the river and consequently the city at a larger scale. This was an issue raised by Wohl et al. (2005) assuming that river life continuity was its natural feature and rivers needed to be returned to them according to their context characteristics. To achieve this goal and prevent floods, it was also essential to reflect on the effects of modern flood management strategies.

b) Regulation/Maintenance Services: The regulation/maintenance services, like the production/supply ones, could have a high impact. In this category of services, the priority could be often given to issues related to improving the environment, and at the same time, promoting the living conditions of the city's residents in order to enhance the environment. The factor loading of the questionnaire items for the regulation/maintenance services was above 0.85, indicating the importance and the high power of the relationship between the influential factors in this section. Achieving regulation/maintenance services also required more detailed scientific studies in the field of energy flows (i.e., water flow, air, etc.) and then careful policy-making and planning. Therefore, research in the field of the LS could be used as a background and basis for further measures to improve urban rivers. Accordingly, Mele and Poli (2015) had considered the recognition of the LS as a supporter in the decision-making process related to sustainable management and planning, but not paying attention to one part, because it could have irreparable consequences and entail an additional economic burden for officials. As Stürck et al. (2014) pointed out, flood control could be one of the most important regulation/maintenance services and the main effective factor was land use. In addition, regulation capacity could be boosted upon the enhancement of restoration measures (Hainz-Renetzeder et al., 2015).

c) Sociocultural Services: The sociocultural services were directly correlated with the community and its people and were still of great importance despite their little impact as compared with production/supply and regulation/maintenance services on the LS, especially in urban areas. The results established that people were willing to use such services if they had been provided appropriately. In Zhoua et al., (2018) service preferences such as sports and recreation had been estimated more in rural areas. In the present study, in the case of creating a suitable atmosphere in urban areas, the city dwellers had a very high tendency to utilize such services so that the existence of facilities and recreational services had the greatest effect on the sociocultural services. The synergy between the production/supply, regulation/maintenance, and sociocultural services had been similarly proven in different studies (Nowak & Grunewald, 2018).

The compact growth of cities not only disturbs the ecological structures, but also imposes numerous restrictions on the further development of urban ecosystems (Shackleton et al., 2021). The study results have thus indicated that landscape disservices undoubtedly emerge in public perceptions (Brown et al., 2020). In consequence, the inquiry of such perceptions toward the LS paves the ground for further interventions in landscapes regarding the predetermined targets, such as the restoration and reclamation of ecological structures alongside other natural considerations. In terms of implications, the LS encompasses a wide range of benefits. In this respect, the improvement of the LS affords not only the ecological functions, such as stormwater management (Gao et al., 2018), but also contributes to enhanced human well-being, e.g., perfection in the sense of place and social cohesion (Xie et al., 2020). On the contrary, the disservices of landscapes can have diverse negative impacts, including social disorder (Jennings & Bamkole, 2019). As a final point, the LS is location-oriented, thus such evaluation processes make it possible to present appropriate, practical measures to different areas with disservices. Moreover, it can act as a supporter of urban decision-makers to address sustainable urban management and planning. Once this issue merges with the analysis of public perceptions and benefits from participatory processes, it can strengthen the strategies and policies regarding sustainable urban management. Doing so required to conduct new research in various geographical areas and rely on participatory methods. Obviously, this could add to the richness of executive programs while serving the interests of different local stakeholders.

CONCLUSION

In conclusion, natural ecosystems in urban areas provide a wide variety of services. Considering the dominance of hard over soft engineering, the ability to provide such services has been taken away from these ecosystems. Mehranrood is also one of these rivers facing many challenges. A survey from the perspective of the LS shows that people rightly believe that the river has more capabilities to provide the LS than the existing conditions. People's views also indicate the concept of citizenship in the sociocultural services based on the production/supply and regulation/maintenance services of the river. For this reason, if the production/supply and regulation/maintenance services of the river are expanded, the sociocultural services will be boosted accordingly. However, the main point is that the production/supply and regulation/maintenance services of the river should be restored and regained its proper functions. Based on this, they can undertake ecological restoration of rivers. Therefore, it seems that the strategic patterns of urban river management should be reviewed. On the other hand, it is suggested to possibly provide accurate river restoration strategies and then rehabilitate urban rivers based on restoration patterns along with the location-oriented studies of the LS.

The study outcomes established that landscape disservices could emerge in public perceptions and the LS was location-oriented, so it could act as a supporter of urban decision-makers to reflect on sustainable urban management and planning. Every time this issue was associated with the analysis of public perceptions and benefited from participatory processes, it could enhance the formulation of urban strategies and policies. The relationship between the LS, public participation, and strategic planning in urban contexts could be thus the subject of further investigation.

DECLARATIONS

Availability of data and material

Data and materials are not available online.

COMPETING INTERESTS

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

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