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Complexity and the Ecological Impacts of Tourism on Wetlands Ecosystem and Rural Sustainability: A Case Study of Zrebar Wetlands

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Abstract: Due to its natural and ecological qualities, rural tourism has drawn greater attention in recent decades. The development of rural tourism provides a variety of advantages that influence the environment and local resources. Therefore, this study looks at how tourism affects the sustainability of the Zrebar wetland, an urban-rural area in the west of Iran, and the wetland ecosystem. In terms of the objectives of the study and the data collection strategy utilized to achieve them, this study is descriptive analytical. The Structural Equation Modeling (SEM) created with Analysis of Moment Structures (AMoS) software and SPSS version 22 were both used for the statistical analysis. Furthermore, the probability level of (P: 0.000) is optimum to use and after that, the spatial analysis was carried out in ArcGIS using the Kriging interpolation method. The findings imply that, with a factor load of 1.13, tourism has significantly contributed to environmental degradation. In order to draw tourists to the area around Zrebar lake, there has been an increase in villa development, dispersion of the community, significant construction, and extension of farms and family gardens. A variety of both beneficial and negative effects is brought about by the growth of tourism in Marivan city, which is three kilometers from the lake. The Zrebar wetland is the most affected and the rural communities close to it suffer the most. Due to their remoteness, the villages furthest from the marsh experience less hardship. Therefore, despite its good benefits, particularly in economic growth, the increase of tourism in this area has put the ecological value and biodiversity of Zrebar wetland at threat. In the end, it can have repercussions for rural communities.

Keywords: Eco-Friendly, Sustainability, Zrebar Wetlands, Tourism, Rural Areas

Introduction

The transformation of tourism into one of the world's fastest-growing industries provided numerous reasons to pay attention to this industry (Ohajionu *et al*., 2022, Kim *et al*., 2020; Munoz *et al*., 2019; Nuchnard, 1998), On the one hand, this industry has contributed to the growth and improvement of socioeconomic conditions in tourist areas (Işik *et al*., 2020; Croes *et al*., 2020; Gulistan *et al*., 2020), on the other hand, it has had negative and undesirable effects on the local community, particularly in terms of the environmental aspect. Consequently, the issues and challenges associated with tourism and environmental sustainability have received considerable attention (Sevilla-Sevilla *et al*., 2020). Focusing solely on economic benefits from tourism activities not only fails to achieve its objectives but also exacerbates environmental problems (Han, 2021; Yu *et al*., 2020; Arrobas *et al*., 2020; Ziegler *et al*., 2019; Butler and Hall, 1998), which is why environmentally friendly tourism management is a critical component for achieving sustainable development. Tourism should be a part of the natural, cultural, and human environments in order to maintain their balance (Adedoyin *et al*., 2021; Altinay and Husain, 2005; Pomucz and Csete, 2015) because human activities have a direct impact on the region's natural resources (Dolnicar and Leisch, 2008). These effects are

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most visible in tourist areas where visitors interact with the local environment, economy, culture, and society. The negative environmental effects of tourism include air pollution, soil pollution, water pollution, traffic congestion, waste dumping, damage to historical monuments, destruction of natural plants, and destruction of wildlife (Koo *et al*., 2017; Mason, 2003; Yoon, 2002; Negaresh *et al*. 2013; Reinhold and Diara, 2000; Pomucz and Csete, 2015; Zarrabi and Islami Parikhani, 2011). Therefore, tourism activities and tourists are inextricably linked to the local host community and its natural environment. As a result, paying attention to this issue and the role of human activities for the purpose of tourism in host areas and their environments is critical. Hence, the environmental dimension of tourism and the negative effects of this industry on the environment is one of the most important topics that have been raised in this field in recent decades and have led researchers to investigate this field (Thompson and Taheri, 2020; Liang and Chan, 2018; Warren and Dinnie, 2018; Adie and Amore, 2020; Muzzo, 2013). Consequently, one of the areas of interest for researchers with a strong perspective on the relationship between humans and the environment is the environmental dimension of tourism (Mitchell and Murphy, 1991; Saarinen *et al*., 2017). In this regard, Holder believes that tourism and the environment are inextricably linked and that the relationship between socio-cultural characteristics, natural resources, and the environment is one of the essential elements for the transformation of the growth and development of tourism in the regions (Holder and Ruhanen, 2019; Hall and Page, 2014). However, the negative environmental effects of tourism in a tourism target area are determined by the environment's capacity and flexibility, the intensity of tourism activities, and the sociological characteristics of the host society (). Finally, regardless of this, the expansion of tourism in many areas has the potential to have irreversible effects on natural ecosystems (Zhuang *et al*., 2022; Ahmad *et al*., 2018a-b; Lu *et al*., 2018) The wetland ecosystem is one of the most fragile and vulnerable ecosystems in this field.

These ecosystems are examples of breathtaking natural environments that, when properly planned and managed for tourism development, can initiate or encourage development in neighboring communities, as well as aquatic and wetland ecosystems. Nonetheless, one of the most serious environmental issues identified in modern times is found in these ecosystems (He *et al*., 2022; Kirby, 2004; Hailun and Dong, 2011; Koshkam *et al*., 2014; Bego and Malltezi, 2011). Hence, their importance and value, which are known as wildlife habitat and aquatic plants, environmental quality improvement, and socio-economic value for local people (Ling *et al*., 2013; Turner *et al*., 2000), are being affected by tourists and the activities of the region's people (Diaz-Christiansen *et al*., 2016; Tavares *et al*., 2012; Dong, 2001). Because of this, they have recently developed into the most delicate and vulnerable ecosystems (Musa *et al*., 2021; Brandl *et al*., 2011; Beltrame *et al*., 2013; Lamsal *et al*., 2016). In this regard, local and regional planning and projects should place a high priority on minimizing the detrimental environmental effects caused by tourism (Usman *et al*., 2022; Jones *et al*., 2009; Wang *et al*., 2009; Liu *et al*., 2013; Narayan *et al*., 2017). In wetlands, destructive environmental effects can take the form of both physical and biological changes, such as loss of biodiversity, the introduction of invasive species, the extinction of rare species, water pollution, stress on aquatic life, and waste disposal. Physical changes in wetlands can include sediment accumulation and changes in water flow (Liu *et al*., 2022; Chandra Das, 2014; Freeland Jr, 1997; Johnston *et al*., 2001; Song *et al*., 2007; Holland *et al*., 1995; Piagentini, 2006).

Therefore, Wetlands have become an essential component of the tourism industry, particularly in developing countries, because of their uniqueness, necessitating proper and sustainable management to prevent damage to these sensitive ecosystems. This is truly the case with the Zrebar wetland ecosystem, which has undergone significant changes in recent years. These changes include, among other things, a decrease in water volume, the loss of aquatic plants, the presence of endangered species, water pollution, reed growth in and around the lake, and fires. Therefore, the environmental effects of tourism on the Zrebar wetland ecosystem and rural sustainability have been discussed in this study. Because of their close proximity and direct impact on the Zrebar wetland, the rural areas surrounding it were investigated. It is also necessary to emphasize the support of local community residents for the sustainability of wetlands and local community social participation should be considered an essential component of wetlands tourism management. Hence, in addition to evaluating the ecological capabilities of natural phenomena and studying the conditions of local communities in all dimensions, such as the capacity to develop tourism activities, financial capacity, attitude, and understanding of local communities, participation is a prerequisite for its successful implementation. Thus, these communities were investigated in order to identify the challenges that the local people and the wetland face. As a result, the overarching goal of this study is to look into the complexity and ecological effects of tourism on wetland ecosystems and rural sustainability in Zrebar wetland and its surrounding rural areas. Minor goals were established in order to achieve the main goal. In the first step, use structural equation modeling to determine the relationship between tourism and regional and ecosystem Sustainability (SEM). In the second step, it determines the spatial relationship between rural areas and their distance from the wetland, as well as the cluster or dispersion of points, using the Moran I index and hot spots in ArcGIS software.

Study Area

Zrebar wetland is located 128 km west of Marivan in Kurdistan province and is one of the province's tourist attractions. The water in the lake is sweet and comes from a variety of boiling eyes and precipitation. The lake's surface freezes completely in most winters. Longitude 46°8 and latitude 35°32 are the coordinates for this lake Iran Environment Council, 2014, 17.

The Department of Environment (DoE) of Iran officially designated Zrebar as a wildlife refuge in 2009. The semi-humid to humid climatic conditions of the area surrounding Zrebar resulted in the formation of a unique forest covering the mountains of this region, which has beautiful landscapes despite the numerous devastating consequences. Zrebar's pastures were among Iran's best and most appropriate pastures. However, due to sporadic use, its ecological balance has shifted. Zrebar was made more extensive with a spherical zone shape in the past due to the function of some faults with a northwestern-southeastern alignment and the falling of its middle part. Other natural functions of Zrebar include a sweet water wetland that provides an ideal environment for the growth of plants, and fish, and the survival of migrating and native birds and animals.

Forest Mountains, which are related to the Zagros Mountains, surround the wetland. Sweetwater wetland water is supplied by a number of springs on the bottom of the wetland, as well as climatic precipitation and numerous springs surrounding the wetland. The water level of the wetland changes as the volume of water changes throughout the year. It has a minimum depth of 6 meters and a maximum depth of 12 m. The Zrebar basin, which has a population of 70445 (more than 85% city dwellers), is divided into two subbasins: Marivan (5000 hectares) and Zrebar (10827 hectares). The volume between the minimum and maximum wetland water height figures is 19 million cubic meters and the average annual water evacuation of springs at the bottom of the wetland is 13 million cubic meters. The wetland receives approximately 54 million cubic meters of water per year, 41 million cubic meters of which come from surface runoff and the remainder from springs at the bottom of the wetland. The region's average annual precipitation is 786 millimeters. The area of the wetland changes with the seasons due to changes in water volume. The wetland medium perimeter is approximately 22 km, with a relative humidity of 58% and annual evaporation of approximately 1900 mm. The highest point in the studied area is 1895 m above sea level and is located northwest of the wetland. Therefore, according to the tourist and natural attractions that this wetland has, it attracts a large number of domestic and foreign tourists every year (Khoram and Hoshmand, 2012).

Materials and Methods

Data

We investigated the effects of tourism on the Wetlands ecosystem and rural sustainability in order to address the research and research questions. We used Cochran's formula for sample selection and local projection models for data analysis and 366 questionnaires were randomly selected from the sample villages' heads of households. The case study was chosen because the Zrebar wetland and surrounding villages are an important source of tourism in the region and have become very vulnerable in recent years.

Field Survey and Questionnaire

In terms of purpose and data collection method, we used descriptive-analytical in this study. The documentary method was used to collect information in the theoretical section and the survey method based on interviews and questionnaires were used in the field section. The statistical population of this study includes the villages of three rural districts: Khawmirabad, Zrebar, and Sarkol and several villages were chosen as a sample from a total of 93 villages in these rural areas. These villages were chosen based on their proximity to the Zrebar wetland (Fig. 1). As a result, they were divided into three clusters of villages within (0-5) km, villages within (5-10) km, and villages within (10-15) km of Zrebar wetland. Because we want to know how effective Zrerbar Wetland is in terms of tourism in various villages. In addition, four villages were chosen as samples from each of these clusters using a stratified random sampling method, for a total of 12 villages. To collect the necessary data in the field studies, a questionnaire with closed questions based on the Likert spectrum was designed. Appendix (A Table 5) contains the complete questionnaire. It was completed in the target villages through interviews and observations, which are the most important aspects of field research (Table 1).

Statistical Analysis

The statistical analysis was carried out with SPSS v. 24 and the Structural Equation Modeling (SEM) was designed with Analysis of Moment Structures (AMOS) software, which configures IBM software that has been added to the cited version of SPSS. AMOS was used to investigate the complex multivariate relationships between parameters that are typical of the ecological impacts of tourism in the Wetland under study. The model created by combining the software is depicted in Fig. 2. The AMOS allows you to specify, estimate, evaluate, and present graphical models that depict hypothetical relationships between variables. The first step was to propose an a priori conceptual model of these relationships. Environmental pollution, user changes, environmental degradation, and water resource pollution were hidden variables in this model, each with its own obvious variable, which included questionnaire questions. Following that, the model was tested, the relationships between variables were observed and a network of direct and indirect significant relationships between variables was constructed. All the variables listed above and used in SEM were tested for the linearity of direct relationships according to SEM acceptance of only linear regression. The estimated standardized regression weights (Table 2) among variables (path model coefficients) were eliminated when the regression weight for the first variable in the prediction of the second variable was significantly different from zero at p>0.05 (Arbuckle, 2011; Kruk *et al*., 2020).

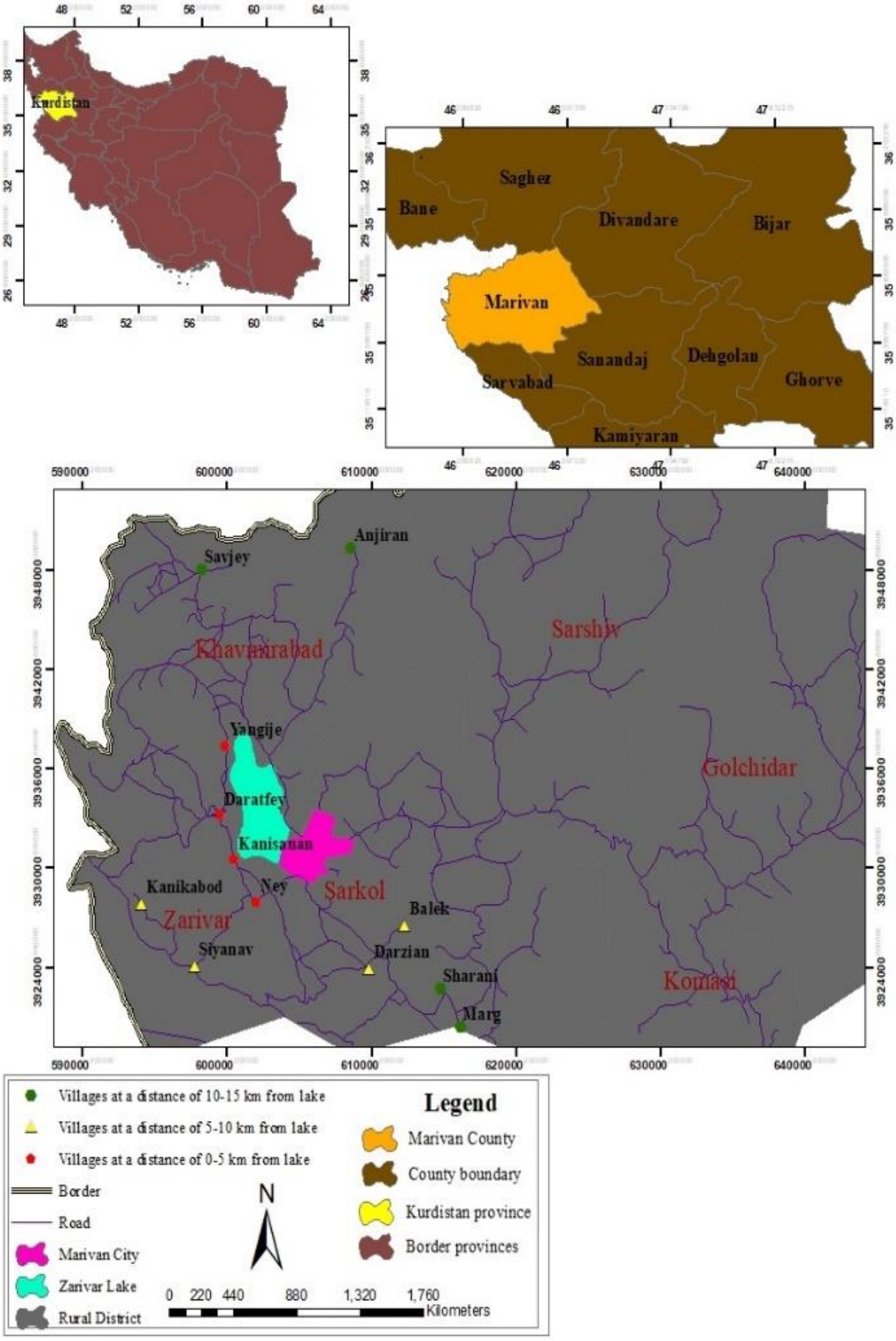

Fig. 1: Location of the case study

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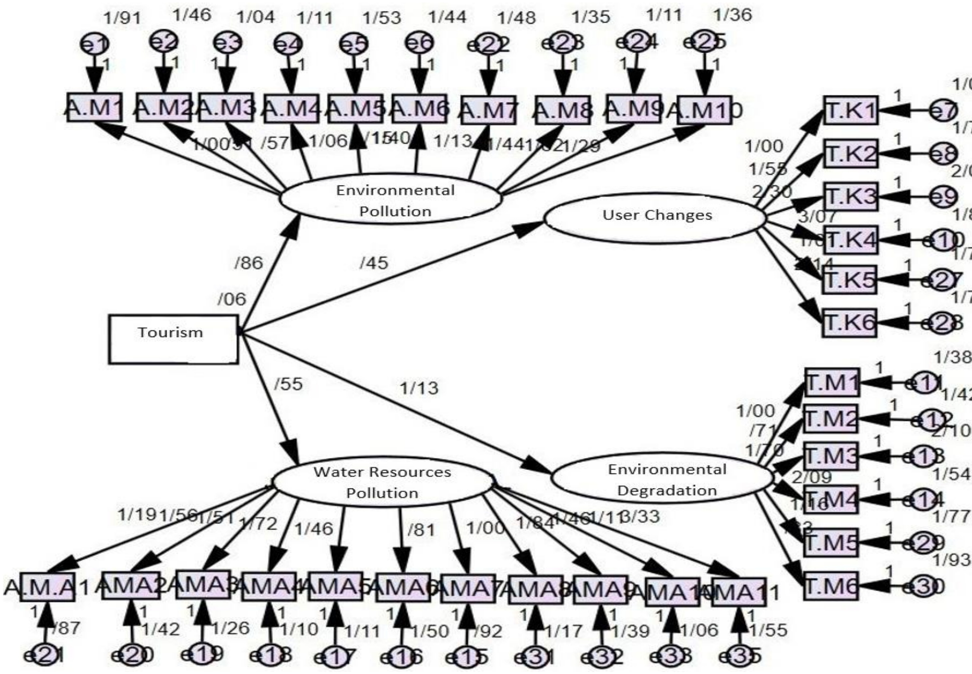

Fig. 2: The pattern of structural equations of research

Table 1: Study villages and questionnaire production among them

Number of questionnaires	The whole population	Number of households	Village name	The distance from the w
31	660	171	Kanisanan	0-5 km
43	924	244	Daratfey	
58	2560	656	Ney	
20	362	90	Yangije	
36	845	196	Siyanav	5-10 km
12	181	41	Kanikabod	
27	529	139	Balek	
23	451	112	Darzian	
26	472	113	Sharani	10-15 km
18	365	89	Marg	
47	1152	280	Savji	
25	455	111	Anjiran	
366	8956	2242	12	Total

Table 2: Results of confirmatory factor analysis (construct validity)

Sig	Sig number	Standard error	Non-standard estimates	The relationship between variables		
***	4/209	/205	/863	Environmental pollution	<-	Tourism
/003	2/983	/151	/449	User changes	<-	Tourism
***	6/510	/174	1/132	Environmental degradation	<-	Tourism
***	3/886	/142	/552	Pollution of water resources	<-	Tourism
***	3/841	/283	/811	Construction without a plan	<-	Environmental degradation
***	3/743	/191	/713	Expand family farms and gardens	<-	Environmental degradation
***	5/263	/322	1/696	Land fragmentation	<-	Environmental degradation
***	5/810	/360	2/090	Increasing the process of villa construction and dispersing the village	<-	Environmental degradation
***	4/658	/250	1/163	Irregular construction around Zrebar lake	<-	Environmental degradation
***	3/744	/222	/832	The occurrence of land-use problems	<-	Environmental degradation
/023	/680	/680	1/551	Destruction of natural beauty	<-	User changes
/011	/900	/900	2/296	Changing the pristine natural landscape	<-	User changes
/006	1/122	1/122	3/068	Ecological disintegration	<-	User changes
/066	1/842	/551	1/014	Damage to historical and ancient sites	<-	User changes
/011	2/558	/836	2/138	Vegetation change	<-	User changes
/033	2/137	/241	/514	Increase energy consumption	<-	Environmental pollution

Table 2: Continue

/010	2/579	/221	/571	Pollution of springs	<-	Environmental pollution
***	3/422	/311	1/064	Density and accumulation of waste and scrap	<-	Environmental pollution
/074	/716	/216	/154	Air pollution caused by over-concentration and transportation	<-	Environmental pollution
***	3/575	/391	1/397	Noise pollution caused by the density of tourists and their car traffic	<-	Environmental pollution
***	3/318	/339	1/126	Waste disposal problems	<-	Environmental pollution
***	3/637	/397	1/444	Endangering health due to inadequate waste and sewage networks	<-	Environmental pollution
***	3/883	/469	1/820	Traffic congestion	<-	Environmental pollution
***	3/529	/367	1/294	High consumption of fertilizers and chemical toxins in food production	<-	Environmental pollution
/003	3/008	/395	1/187	Lake water pollution,	<-	Pollution of water resources
/002	3/038	/513	1/558	Disposal of waste in the lake	<-	Pollution of water resources
/002	3/075	/492	1/514	Dispersal of waste on water shores, lakes, rivers, and springs	<-	Pollution of water resources
/001	3/283	/525	1/723	Permitted withdrawal of water from wetlands and wetlands	<-	Pollution of water resources
/002	3/101	/470	1/456	Damage to the wetland ecosystem	<-	Pollution of water resources
/037	2/084	/389	/811	Vegetation changes in wetland ecosystems	<-	Pollution of water resources
***	3/313	/556	1/842	Extinction of fish species due to pollution of lake water	<-	Pollution of water resources
/003	2/974	/491	1/459	Loss of water quality,	<-	Pollution of water resources
/005	2/794	/397	1/108	Boat traffic in the lake and stress transfer to animal species,	<-	Pollution of water resources
***	3/622	/920	3/334	Increase people's participation in preserving the wetland ecosystem	<-	Pollution of water resources

SEM provides three significant advantages over traditional multivariate techniques: (1) Explicit measurement error evaluation; (2) Estimation of latent (unobserved) variables via observable variables; and (3) Model testing, in which a structure can be imposed and data fit assessed. By not explicitly addressing measurement error, most multivariate techniques accidentally disregard it, whereas SEM models estimate these error variance parameters for both independent and dependent variables (Novikova *et al*., 2013).

Spatial Analysis

For the spatial analysis of this research, we used the Kriging interpolation method and Hot Spot in ARC GIS software.

In the form of spatial analysis, spatial kriging statistics were used to compare villagers' perspectives on the environmental role of tourism on Zrebar Wetland. The kriging interpolation tools are referred to as deterministic interpolation methods because it is directly based on the surrounding measured values or on specified mathematical formulas that determine the smoothness of the resulting surface. This interpolation is based on statistical models that include autocorrelation-that are the statistical relationships among the measured points. Kriging assumes that the distance or direction between sample points reflects a spatial correlation that can be used to explain variation in the surface. The Kriging tool fits a mathematical function to a specified number of points, or all points within a specified radius, to determine the output value for each location. Kriging is a multistep process; it includes exploratory statistical analysis of the data, variogram modeling, creating the surface, and (optionally) exploring a variance surface. Kriging is most appropriate when you know there is a spatially correlated distance or directional bias in the data (Dindaroğlu, 2014; Oliver and Webster, 1990).

The hotspot method was also employed to determine which villages are hot spots (those with the greatest environmental impact) and which are cold spots (lowest environmental impact). The term 'hot spot' has been used generically across disciplines to describe a region or value that is higher relative to its surroundings. Hot spot analysis calculates "Getis-Ord Gi" statistics for all features in the data. The calculated z-points show where the data are clustered high and low. This tool actually pays attention to each complication in the context of the complications that are in its neighborhood. It is interesting and important if a complication has high values, but a hot spot alone may not be statistically significant. In order for a spotting complication to be considered statistically significant, both itself and its neighbors must have high values. The local sum of a complication and its neighbors is relatively relative to the sum of the complications. When the "local sum" is unexpectedly higher than the expected local sum and the difference is so great that it cannot be attributed to an accident, the result will be a score (Rostaei and Alizadeh, 2020). The spatial autocorrelation (Moran's I) statistical toolset is also used to detect the spatial distribution of hot spots and cold spots and compare them with adjacent samples. "Moran's I " have well-established statistical properties to describe global spatial autocorrelation but have not been effective in identifying clustered spatial patterns and hotspots (Tewara *et al*., 2018). For hotspot identification, we employed the optimized hotspot analysis tool in ArcGIS10.3 to identify the environmental impacts of tourism hotspots in rural clusters.

Results

Statistical Analysis

Cronbach's alpha, which has a value of 0.871, was used to assess the questionnaire's reliability. The face validity method and the opinions of relevant experts, as well as the fact of the structure and confirmatory factor analysis, were used in this study to determine the validity of the questionnaires, Table (2).

AMOS structural equation model defines how to measure a hidden variable using several observed variables. This Model allows specifying, estimating, evaluating, and presenting graphical models to show the hypothetical relationships between the variables. On the other hand, it determines to what extent the number of variables observed for a hidden variable is affected by the desired hidden variable and to what extent it is affected by the error variable. In this model, environmental pollution, land-use change, environmental degradation, and water pollution are our hidden variables, each of which has several observed variables. According to the figure above, all factor loads are positive. As a result, all model fit indices have been evaluated at an appropriate level, which indicates a complete fit of the research model. According to Table 3, it can be said that all observed variables have positive and significant impact coefficients with their scales.

Table 4 shows the model fit indices. The goodness indicators of the model show the number 0.981, which indicates a favorable situation. In addition, Tucker fit indices show an adaptive fit of 0.931 and 0.951, respectively, for the model. The economic fit index and the economic adaptive fit index are 0.6610 and 0.771, respectively, which is more than 0.50, the root means square of the model estimation error is 0.091, which is less than 0.1 and finally, the value of chi-square normalized to the degree of freedom is 2.332. Based on the above results, the model has a good fit.

Table 3: Results of confirmatory factor analysis (construct validity)

Sig	Standard regression weight	The relationship between variables		
***	/627	Construction without a plan	<--	Environmental degradation
***	/662	Expand family farms and gardens	<--	Environmental degradation
***	/705	Land fragmentation	<--	Environmental degradation
***	/519	Increasing the process of villa construction and dispersing the village	<--	Environmental degradation
***	/832	Irregular construction around Zrebar lake	<--	Environmental degradation
***	/662	The occurrence of land-use problems	<--	Environmental degradation
***	/706	Destruction of natural beauty	<--	User changes
***	/726	Changing the pristine natural landscape	<--	User changes
***	/774	Ecological disintegration	<--	User changes
***	/839	Damage to historical and ancient sites	<--	User changes
***	/784	Vegetation change	<--	User changes
***	/675	Increase energy consumption	<--	Environmental pollution
***	/149	Pollution of springs	<--	Environmental pollution
***	/588	Density and accumulation of waste and scrap	<--	Environmental pollution
***	/616	Air pollution caused by over-concentration and transportation	<--	Environmental pollution
***	/706	Noise pollution caused by the density of tourists and their car traffic	<--	Environmental pollution
***	/526	Waste disposal problems	<--	Environmental pollution
***	/736	Endangering health due to inadequate waste and sewage networks	<--	Environmental pollution
***	/690	Traffic congestion	<--	Environmental pollution
***	/751	High consumption of fertilizers and chemical toxins in food production	<--	Environmental pollution
***	/839	Lake water pollution	<--	Pollution of water resources
***	/726	Disposal of waste in the lake	<--	Pollution of water resources
***	/668	Dispersal of waste on water shores, lakes, rivers, and springs	<--	Pollution of water resources
***	/672	Permitted withdrawal of water from wetlands and wetlands	<--	Pollution of water resources
***	/677	Damage to the wetland ecosystem	<--	Pollution of water resources
***	/715	Vegetation changes in wetland ecosystems	<--	Pollution of water resources
***	/681	Extinction of fish species due to pollution of lake water	<--	Pollution of water resources
***	/588	Loss of water quality	<--	Pollution of water resources
***	/638	Boat traffic in the lake and stress transfer to animal species	<--	Pollution of water resources
***	/721	Increase people's participation in preserving the wetland ecosystem	<--	Pollution of water resources

Table 4: Status of fitting indicators

The value of the index in the desired pattern	Indicator
67	NPAR
5450/116	CMIN
528	DF
/000	P
/981	GFI
/091	RMSEA
2/322	CMIN/DF
/931	TLI
/951	CFI
/661	PNFI
/771	PCFI

The factor loads in the model of measuring the pattern of structural equations must be greater than 0.30; if the factor is less than 0.30, it will damage the model and must be removed. Because all factor loads are greater than 0.30, the model fit indices have been evaluated at an appropriate level, indicating that the research model is completely fit. In other words, all of the current study's measures have a high correlation or covariance with their independent variable.

In summary, all the results obtained allow us to affirm that the elaborated model is correct since it adequately specifies the relationships among the variables (Fig. 3).

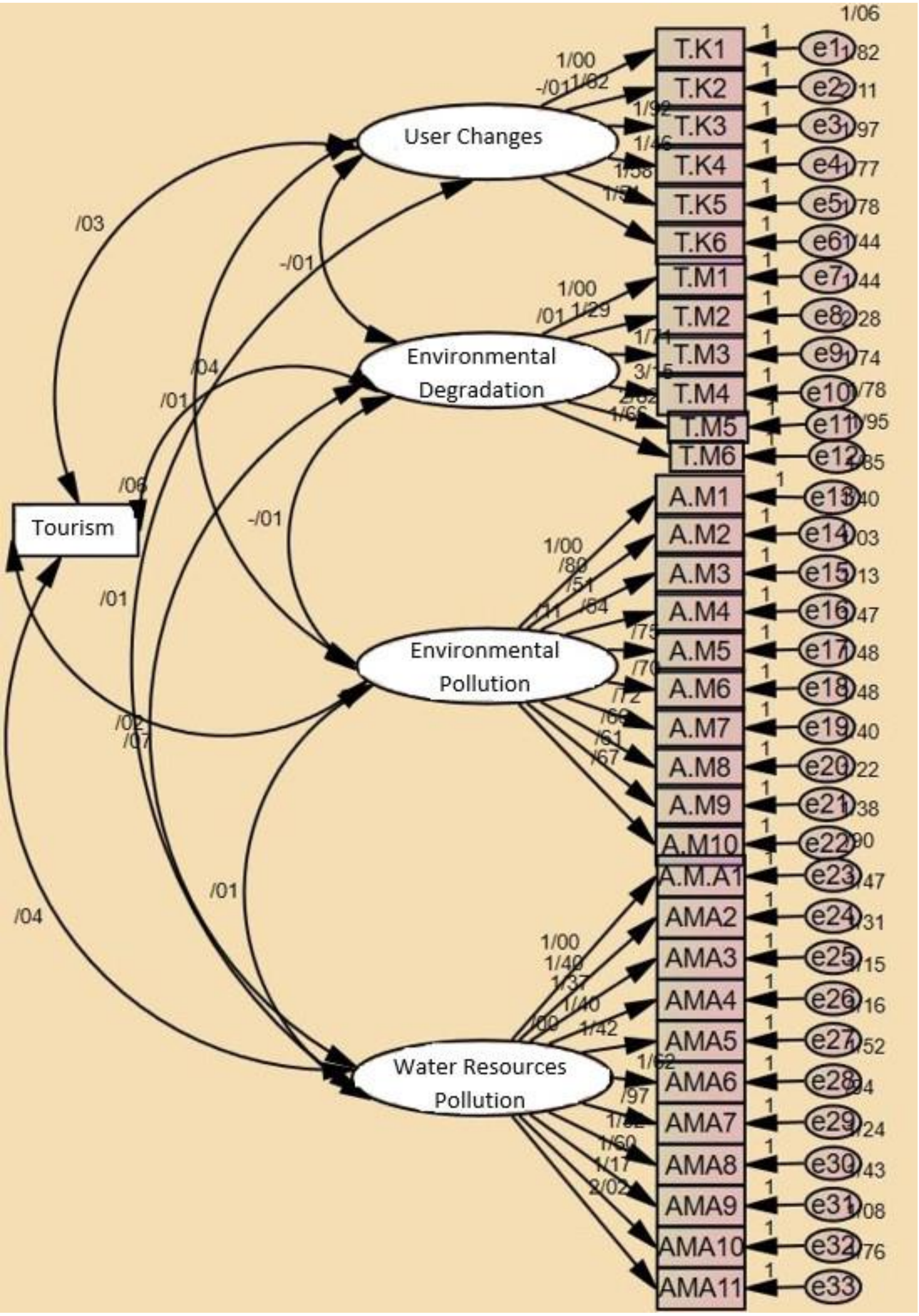

Fig. 3: Model for measuring the pattern of structural equations of research

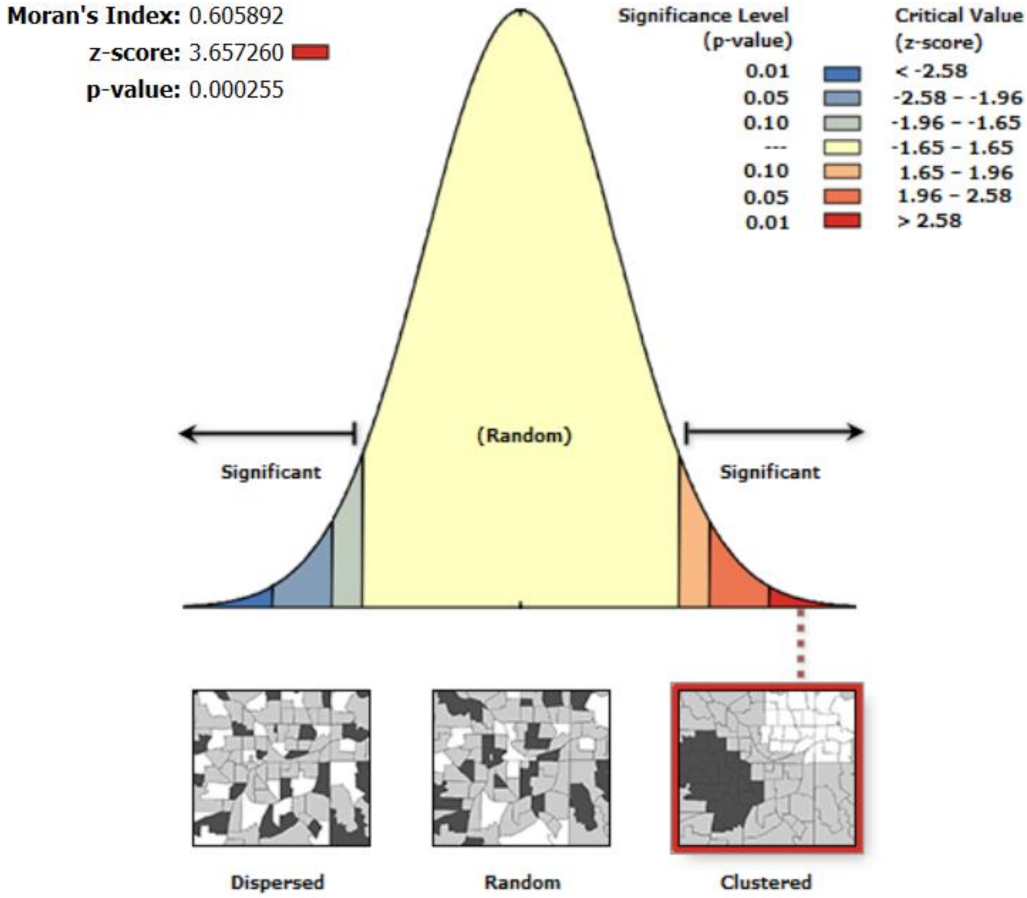

Fig. 4: Analysis of spatial autocorrelation graphic results (Moran's index)

Spatial Analysis

The graphic output of the spatial autocorrelation (Moran's I) analysis shows that the points under consideration are scattered or clustered. Moran's, I graph shows that the studied points have spatial autocorrelation. In general, if the Moran index value is close to a positive number of one (0.1), the data has spatial autocorrelation and a cluster pattern, whereas if the Moran index value is close to a negative number of one, the data is fragmented.

The table and figure show the numerical and graphical results of spatial autocorrelation of tourism effects on wetland ecosystem preservation and rural area stability in Zrebar wetland. The pattern of rural population distribution is clustered, according to the results of Moran index analysis of 0.605892, the value of Z is equal to 3.657260 with a significance level of 0.000%; thus, it can be concluded that the data have spatial autocorrelation. Accept the spatial distribution of the clusters for the analyzed data (Fig. 4).

The red spots on the maps below indicate higher amounts of Z, which are known as hot spots these areas have received more impact from tourism in the area, and the lower the Z-value, the lower the Z-value. Negative and smaller, we approach the cold spots depicted in blue on the maps, which have received the most impact from tourism in the region (Fig. 5). According to this figure, Yangje village has been most affected by tourism in terms of all environmental factors. Daratfey and Ney villages, however, are most affected by water source pollution in this area. The nearness of this village to the Zrebar wetland and the attraction of more tourists to these villages may be the cause of this and as a result, they have benefited more from tourism-related activities.

According to the results of the Kriging interpolation tool in ArcGIS software (Fig. 6), in the analysis map of tourism effects on environmental pollution in the rural areas studied, the villages of Ney, Kani Sanan, Darratafy, and Yangijeh have the most impact, the villages of Anjiran, Savoji, Siyanav, and Balk have the least impact and villages Kani kabod, Marg, Sharani and Darzian have had minimal effect.

In the analysis map of the effects of tourism on water pollution in the rural areas studied, the villages of Kani Sanan, Darratafy, and Yangijeh have the most impact, the village of Ney has a moderate upward impact, the villages

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of Darzian and Anjiran have the least impact and the villages of Siyanav, KaniKaboud, Balk, Sharani and Marg have had minimal effect.

In the analysis map of the effects of tourism on the degradation of the rural areas studied, the villages of Kani Sanan, Darra Tafy, and Yangijeh have the greatest impact, the village of Ney has a medium to high impact and the villages of Anjiran and siyanav have very little impact and the villages of KaniKaboud, marg, Sharani, Darzian, and Bulk has had minimal impact.

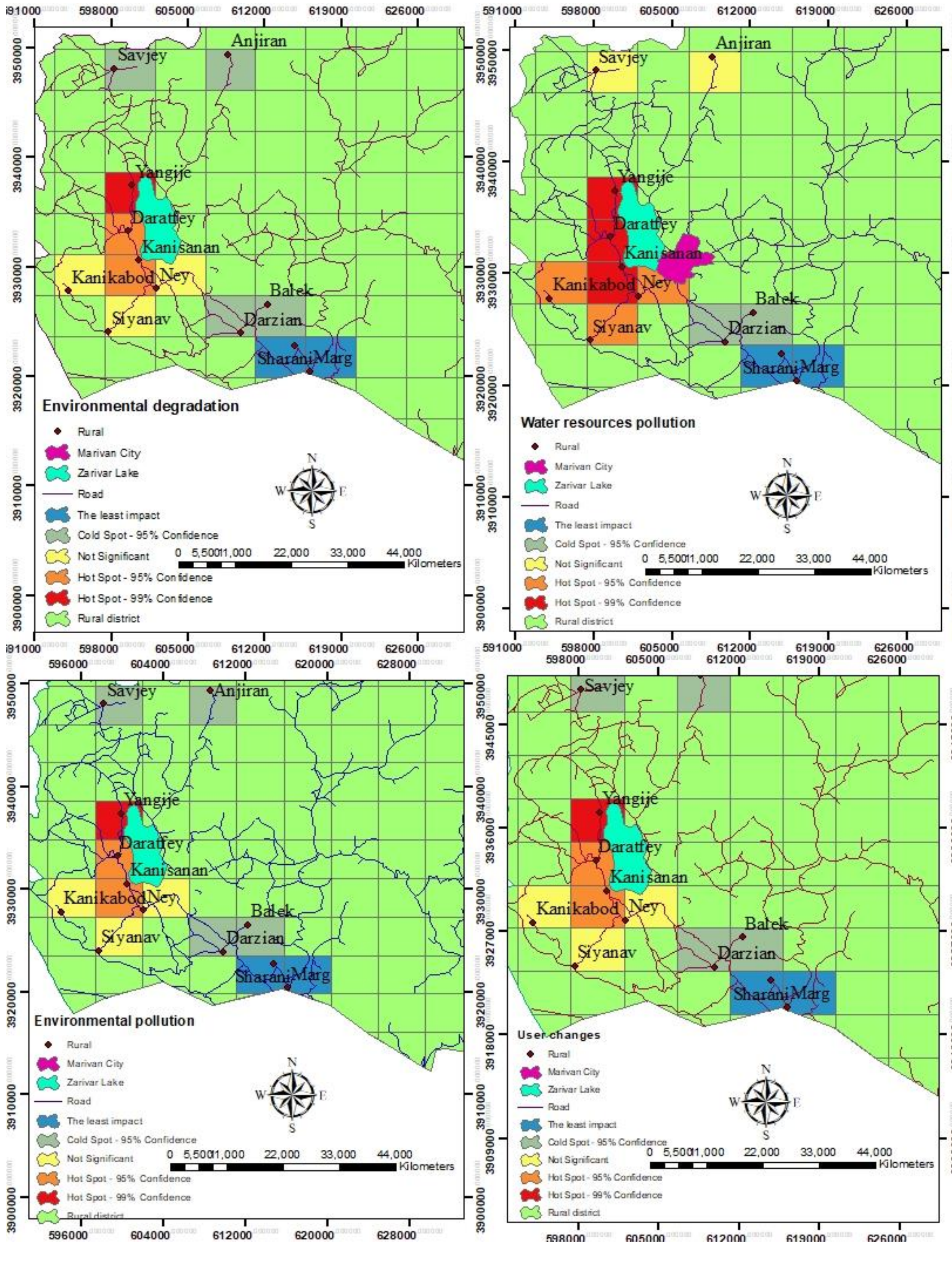

Fig. 5: Analysis of hot and cold spots of tourism effects in preserving wetland ecosystems and stability of rural areas

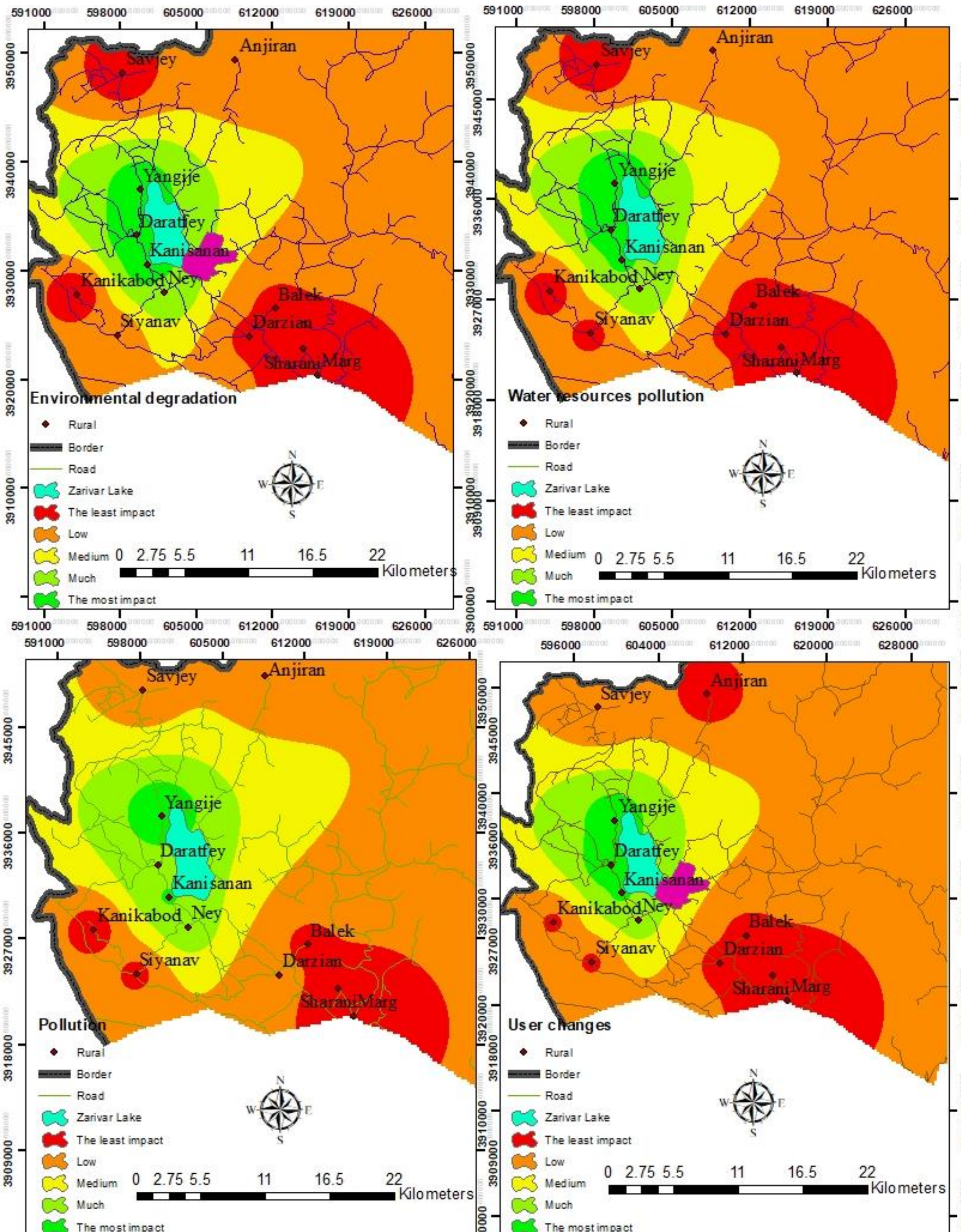

Fig. 6: Spatial analysis of tourism effects in conserving the ecosystem of Zrebar wetland by the Kriging method

In the analysis map of the effects of tourism on land-use change in the studied rural areas, the villages of Ney and Yangijeh have the most impact, the villages of Kani Sanan and Darratafy have the highest upward effect, the village of Savjey has the least impact and the villages of KaniKaboud, marg, Sharani Cyanau, Balk and Darzian. It has been minimal.

In general, villages located within a short distance (0-5 km) of the Zrebar wetland have benefited the most from the wetland due to the provision of tourist opportunities. These effects have been positive on the one hand, such as tourism in these villages and improving the economic situation and increasing population density, and negative on the other, such as environmental pollution, water quality loss, and vegetation changes in the wetland ecosystem. In these villages, there is a risk of declining health due to insufficient waste and sewage disposal networks around the wetland, water pollution in the wetland, increased construction of villas around the wetland and village dispersal, and so on. Villages in the middle (5-10 km) and far (10-15 km) distances from the wetland, on the other hand. They are significantly less affected by this problem.

Discussion

In the name of profits and social welfare, tourism development, the same as global development, has had negative impacts by ignoring the considerations and contexts that shape this industry. Therefore, it has left a misleading impression of how tourism interacts with the environment. It is assumed that the development process should transform to focus on sustaining the tourism industry in order to prevent the negative impacts of tourism related activities and that this industry requires the sustainable use of resources as well as the involvement of local communities. Wetland ecosystems and wetlands themselves are among the causes in this regard that have grown increasingly vulnerable and have suffered irreparable harm as tourism has increased.

These wetlands require a review and presentation of appropriate policies, as well as the use of their capabilities and capabilities, due to their vulnerability as a result of high tourism. It could be argued that wetland tourism highlights the natural resources found in these ecosystems.

Because of this, the current study's objective is to examine the complexity of the ecological impacts of tourism on the wetland ecosystem and the sustainability of the urban rural divide in the Zrebar wetland. The results of the AMOS structural equation model show that there is a significant relationship between tourism development and the research's hidden variables in the study area.

Tourism's most significant negative effects have been on the environment (with a factor load of 1.13). The expansion of farms and family gardens to attract tourists, the dispersal of villages and the building of more villas, the construction of impromptu structures near Zrebar lake, and other factors are all to blame for this. Most tourism-related effects have been in the dimensions of environmental pollution, which comes after the dimensions of environmental degradation (with a factor load of 0.86). Some of the causes of this include increased population density, higher energy consumption, increased garbage and waste density and accumulation, excessive modes of transportation and air pollution, excessive crowding of tourists and their vehicles and disposal issues, Waste of time, and so on. The magnitude of water resource pollution was the focus of the majority of the effects in the stage after that (with a factor load of 0.55). Garbage on the lakeshore, fish species extinction from illegal fishing, fish species extinction from lake water pollution, loss of water quality, boat traffic on the lake and fish species transfer could all be contributing factors. Additionally, there is a connection between stress and animal species, the majority of which are impacted by tourism in this region. The greatest impact on the dimensions of land-use change in the final stage was tourism (with a factor load of 0.45).

The reasons for this include vegetation changes, grassland fires, ecological disruption, the destruction of natural beauty, the alteration of original natural landscapes, and ecological destruction.

The study's concluding remarks are discussed along with the (Dokulil, 2014) findings on the effects of tourism on lakes, (Kurleto, 2013) study on the effects of tourism on environmental management and conservation of lakes in Australia and New Zealand, (Boglárka Pomucz and Csete, 2015) study on evaluating the sustainability of the Hungarian lake after the development of the tourism industry and (Hadwen *et al*., 2012) study on developing tourism. The results of the spatial analysis show that tourism research in the Zrebar wetland and the surrounding rural areas has had the most detrimental effects and outcomes. The villages located near this wetland, including Ney, Yingijeh, Kani Sanan, and Darreh Tafi, have generally had negative effects, including environmental pollution, pollution of water sources, specifically pollution of the Zrebar wetland, environmental degradation, and so forth. The effect on the villages far from the wetland has been negligible because there aren't many tourist attractions in this area. One could argue that the expansion of tourism in this area, despite its benefits, particularly in the economic sphere, has put the stability of rural areas and the ecological status of this wetland in danger.

Conclusion

The purpose of this research was to look into the effects of tourism on the Zrebar wetland ecosystem and the sustainability of the surrounding villages. Tourism, as the research indicates, has played a number of roles in environmental degradation. Aside from these instances, it has had a massive effect on pollution and water resources. These issues have made regional sustainability more difficult to achieve and have negatively affected the plant and animal ecosystem of Zrebar wetland, one of the region's most important natural attractions. Despite the obvious environmental challenges of this wetland, neither the local authorities nor the government has taken any action. Meanwhile, experts predict that if these threats are not addressed, this wetland will disappear completely in the future. Hence, its revitalization is one of many important indicators that must be implemented by local planners and policymakers.

Therefore, in order to achieve tourism development consistent with sustainable development, it is necessary to prevent indiscriminate constructions and expand family farms and gardens around the Zrebar wetland ecosystem, prevent illegal fishing and extinction of fish species, and educate and strengthen the capacity of local people, encouraged the local people to participate in maintaining the wetland ecosystem, prevent the spreading of waste around the wetland and encourage farmers not to use chemical fertilizers and pesticides, especially those who have agricultural land in the Zrebar wetland area.

Highlights

- ✓ Rural sustainability and Tourism
- ✓ Negative effects on the wetland ecosystem and rural areas by tourism
- ✓ Achieving sustainability by amending laws and implementing tourism-based sustainable development programs
- ✓ Amos structural equation method was used to measure the relationships between variables and tourism instability

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Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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Appendix A (Main Questions)

Table 5: Asks questions about the "Impacts of tourism on Wetlands ecosystem and rural sustainability" in various fields. Please rate your opinion from "totally agree "to" totally disagree" by ticking the (✓ or *) mark in front of each phrase

Dimensions	Indicators	Strongly agree	Agree	Nether agree nor disagree	Disagree	Strongly disagree
Environmental degradation	Tourism has been influential in unplanned construction in the region					
	Tourism has been influential in the expand of farms and family gardens in the region					
	Tourism has been influential in the fragmentation of land in the region					
	Tourism has been effective in increasing the construction process of villas and the dispersal of villages in the region					
	Tourism has been influential in uncontrolled (Irregular) construction around Zrebar lake in the region					
	Tourism has been effective in land use problems in the region					
User changes	Tourism has been effective in destroying the natural beauty of the region					
	Tourism has been instrumental in changing the pristine natural landscape in the region					
	Tourism has contributed to the ecological disruption in the region					
	Tourism has been instrumental in damaging historic and ancient sites in the region					
	Tourism has been effective in changing vegetation in the region					
Environmental pollution	Tourism has been effective in increasing energy consumption in the region					
	Tourism has been influential in the pollution of springs in the region					
	Tourism has been influential in the density and accumulation of waste in the region					
	Tourism has been influential in air pollution due to over-concentration and transportation in the region					
	Tourism has been effective in noise pollution caused by the density of tourists and their car traffic in the region					
	Tourism has been instrumental in waste disposal problems in the region					
	Tourism has been instrumental in endangering health due to inadequate waste and sewage disposal networks in the region					
	Tourism has been influential in traffic congestion in the region					
	Tourism has been effective in high consumption of fertilizers and chemical toxins in food production in the region					
Pollution of water resources	Tourism has been influential in lake water pollution in the region					
	Tourism has been instrumental in discharging garbage into the lake in the area					
	Tourism has had an impact on the distribution of waste on waterways, lakes, rivers and springs in the region					
	Tourism has been effective in permitting water withdrawal from wetlands in the region					
	Tourism has been effective in damaging the wetland ecosystem in the region					
	Tourism has been effective in changing the vegetation of the wetland ecosystem in the region					
	Tourism has been instrumental in the extinction of fish species due to illegal fishing in the region					
	Tourism has been instrumental in reducing water quality in the region					