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Original Article

Identification and Assessing Economic and Social Services of the Natural Ecosystems to Rural Communities

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Abstract

Purpose- Protected areas (PA) are effectively managed places dedicated to the long-term conservation of biodiversity and natural values with associated ecosystem services and cultural values. Forest and rengland ecosystems of national park provide a wide range of environmental, economic, and social services to human communities, with a variety of stakeholders. One of the beneficiaries of forest ecosystem services is the rural communities on the edge of forests. The proper and appropriate use of natural resources plays an important role in empowering local communities and affects their socio-economic status.

Design/methodology/approach- In this research, forest and rangeland ecosystem of the Kiasar National Park (KNP) was selected in Iran for assessing the social and economic natural ecosystems services to rural communities. For achieving the research goal, the Delphi questionnaire inclouding a set of indicators for natural ecosystems assessing extracted from various sources is used to identify the indicators of economic, and social services, Entropy and TOPSIS techniques to calculate their weight and prioritize, respectively. Also, GIS has been used to map the economic and social services of the natural ecosystems of KNP. In this study, 36 specialists in the field of national parks answered the Delphi questionnaire.

Findings- In this research exteracted 38 indicators including 20 social indicators and 18 economic indicators that among them, 7 economic indicators and 11 social indicators accepted and customized to assess the social and economical services of natural ecosystems. Then preparation capability map (Potential map) in four classes based on their weight and priority overplayed. The results indicated that recreational value, and interests and contributions from to rural communities protect and develop the park indicators had the highest priority in assessing the economic and social services of natural ecosystems. The KNP capability map showed that 1810.50 and 34.30 ha of the park is located in the very suitable class from an economic and social perspectives for utilization rural communities of services natural ecosystems park respectively.

Keywords: Stakeholders, Socio-economic Ecosystem Services, Multi-Criteria Decision Making, Delphi Method, Kiasar National Park.

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1. Introduction

Forest and rangeland ecosystems, as a renewable resource, are considered one of the main components of sustainable development in every country. By producing goods and services directly and indirectly, they play an important role in the economic and social development of regions, ensuring the well-being of rural communities of forest edage (Gu, 2023). In recent decades, non-timber forest and rangeland products have been recognized as an important component in reducing poverty in rural communities. Therefore, there is a need to deeply understand the role and importance of forest and rangeland services in the rural economy (Jagger et al., 2022). Forest and rangeland ecosystems and their non-timber products play a role in providing the livelihood needs of rural people, such as providing energy, food, medicine, raw materials for construction, handicrafts and the production of basic agricultural tools, producing fodder, medicinal plants, collecting firewood, medicinal plants, collecting and selling fruits, mushrooms, and mountain vegetables (De Groot et al., 2010; Chinnasamy et al., 2016). The diversification of these products can play an important role in rural development and the livelihoods of forest-fringe villagers. Because cash income from forest resource exploitation is often low-cost, such activities account for a larger share of household income in rural areas (Raihan, 2023). However, recent studies on the situation of rural households on the edge of forests, rangelands, and national parks show that their income is rarely considered in the mix of conventional rural activities, because the buying and selling of forest and rangeland products is done at the local level, and the cash income from them has been neglected and has been referred to as seemingly low-value and unimportant products (Bakkegaard et al., 2017). For this reason, there is a significant gap in our understanding of the true economic contribution of forests and rangelands, national parks, rural economic performance, and the extent of poverty and inequality in rural areas (Fisher, 2004). Therefore, there is a need to understand the ecosystem services of forests and rangelands of national parks and their role and importance in the rural economy (Li et al., 2019). Sustainable rural development is a multidimensional process that focuses on improving and enhancing the quality of life of vulnerable segments of the rural community. There are various economic strategies to improve the quality of life of villagers, one of which is the strategy of protecting and managing natural resources, which not only provides a platform for job creation, but also serves as a source of income for villagers.

National parks are one of the natural reserves which contain a variety of natural ecosystems such as forest, rangeland, etc. This natural ecosystem provided alot of ecosystem services (ES) for human communities. The importance and role of the natural ecosystems of national parks (NENP) is recognized as the best-managed areas nationally and globally in all countries (Järv et al., 2021). But today, due to the special economic and social structure of some countries, the destruction of natural ecosystems has been provided more than before (Rodríguez-Rodríguez et al., 2021). Therefore, in recent years, for protecting and supporting natural ecosystems, much attention has been paid to natural ecosystem. With making these areas, processing of reducing the level of forests and pastures has decreased and appropriate policies have been adopted to protect the country's natural resources and communities' attitudes toward national parks and protected areas have changed (Roux et al., 2020).

2. Research Theoretical Literature

Iran's national parks have many ecological, economic, social, and political values. One of the most important and effective factors that can play a role in their sustainability is monitoring, assessing and valuation of national parks ecosystem services using correct and accurate criteria. Studies have been conducted on the role of forest and rangeland ecosystem services in the economy of rural communities in Iran, some of which are mentioned below:

Malekmirzaei et al. (2017), Abdollahpour et al. (2020), and Mahmoudi (2022) studied the role of forest and rangeland by-products in the livelihoods of local communities in Zagros. The results showed that there is a positive and significant relationship between the exploitation of by products and employment creation, income generation, poverty reduction, and prevention of migration of rural communities.

In studies survaed about role of natural ecosystem services in the economy of rural communities in

abroad Iran; Angelsen et al. (2014), examined environmental income and sustainable livelihoods in 24 developing countries. They concluded in their study that 28 percent of total household income is provided by non-timber forest products. Ai et al. (2019) and Aguilar and Wen (2021), examined the socio-economic and environmental impacts of forest services in China and Myanmar, respectively. The results showed that more than 70 percent of the countries' population depends on forests to meet their daily needs. Also, 43 percent of total household income is generated through the sale of forest products. Järv et al. (2021), examined different socio-economic practices in the management of protected areas and the communities and stakeholders of five Estonian national parks. The results showed that the provision of natural ecosystem services is effective in improving local socio-economic conditions and protecting ecosystems. Kalogiannidis et al. (2022), estimated the contribution of the forestry bioeconomy to the socio-economic development of the Greek country using a questionnaire and survey of 312 experts in the f orestry and finance sectors of Greece. The results of the study showed that forests contribute to the economic development of a country through their direct and indirect impact on human livelihoods.

Also, studies have been conducted in the field of mapping the economic and social services of national natural park ecosystems to rural communities using geographic information systems (GIS), some of which are mentione: Sherrouse et al. (2011) used GIS for mapping, assessing the social values of ecosystem services (ES). Surveying results showed that social mapping ES provided a means to say social and economic values. Also, they expressed that social ecosystem services are the effective ES in the assessments of the natural ecosystems. Nemec and Raudsepp-Hearne (2013) used GIS for assessing and mapping ES. The result showed that GIS is a powerful tool for assessing and mapping ecosystem services within a landscape. Rocchinia et al. (2017), used GIS for measureing number of ecological tasks ecosystem. In this study, the most straightforward measures of spatial complexity of ecological patterns and processes available summarized in GIS. The result showed that among free and open-source options tools of assement, Gis provide chances to made new algorithms. Codato et al. (2017) evaluated ES Mapping (High-Biodiversity) using GIS in Italy and Peru regions. The results indicated GIS is a good software for assessing ecosystem services and producting map value. Also, landscape ES social mapping used asseing cultural and bioiversity parks in Italy and watershed Peru. Masoudi et al. (2021) evaluated the land-use schematization using GIS-Based MCMO[1] in the Qaleh Ganj County of Iran. The findings indicated that 30.80% of the rangeland zone and 22.9% the ecotourism zone had the highest suitability potential. GIS-based MCMO maide spontaneous and flexible method of assessing ecosystem services. Lacayoa et al. (2021) used GIS, INVEST and Ecosystem Services Web Services (ESWS) for assessing ecosystem service. The result showed that Ecosystem Services Web Services result can quickly add GIS software and overcome the key challenge of repeatability and comparative analysis. This approach also creates a new level of interoperability through data source. Siltanen et al., (2023), the economic impacts of the protected areas of the three national parks (NPs) Snæfellsjökull, Vatnajökull and Þingvellir in Iceland were evaluated. The results showed that based on data from 2087 visitors in 2019, they spent an average of $113 per day in the parks, generating an estimated total economic impact of between $30 and $99 million with 347 to 1,140 jobs created across the study sites. Krzanowski et al., (2024) examined and discussed the impact of land consolidation in rural areas using GIS (Geographic Information System) tools on the conservation and sustainable development of national parks, forests, and rural areas. The results were analyzed using a combination of maps, tables, and graphs. The results showed that service delivery decreased by 40 percent due to the implemented project. Also, Chen and Wu (2025), surveyed and assessed the supply and demand of rural recreational services in national parks in Zhejiang, China. In this study, the combined method of spatial analysis and model as MaxEnt tool played a positive role in modeling the areas that provide cultural ecosystem. Based on the research, the study area is divided into different zones to propose spatial planning. This study divided Changhong Township into four types of zones: developed recreational service zone,

1 Multiple Criteria and Multiple Objective

potential recreational service zone, recreational service requirement zone and marginal recreational service zone. The results showed that the MaxEnt model was strong in mapping the rural recreation services (RRS) supply.

A review of studies conducted on the evaluation of social and economic services of natural ecosystems of national parks to rural communities shows that, given that forests and renglands play a key role in poverty reduction strategies and economic development of rural communities, few studies has been conducted on identifying ecosystem services that affect the economy of rural communities and mapping them. Therefore, the purpose of this research is to identify and evaluate the economic, and social services of forest and rangeland ecosystems in national parks using the indicators IUCN (IUCN, 1994) and CIFOR[1] (CIFOR, 1999), SRM[2] (Mitchell, 2010) and other indicators extracted from scientific articles for rural communities, to map these services, and to map the capability map (Potential map) for providing these services to rural communities using the Geographic Information System (GIS).

3. Research Methodology

3.1 Geographical Scope of the Research

Kiasar national park (KNP) is located amonge 53°36'08" and 53°39'54" (E) longitude, and 36°10'32" and 34°9'08" (N) latitude in northern Iran (Figure 1). The KNP area is 9528/97 ha and it have 400 plant species, 37 mammals, 113 birds, 7 amphibians, 7 fish species and 6 reptilesin KNP. Also, 10 Panthera pardus, 40 Ursus thibetanus, 47 Capreolus capreolus, 47 Cervus elaphus, 150 Phasianus colchicus, 35 Ovis Orientalis vignei and 12 endemics and endangered species in the park from 2005 to 2015 (Report on the detailed plan of Kiasar national park, 2012).

The villages of Alikola, Langar, Aghouzgale, Baladeh, Tilhebban, Tilak, Svasareh and Ghaleh are located in near of the Kiasar National Park. According to the surveys carried out and the statistics obtained from the general population and housing censuses, the total population living in the population centers of the region was about to 1222 people in the form of 345 households (Report on the detailed plan of Kiasar national park, 2012).

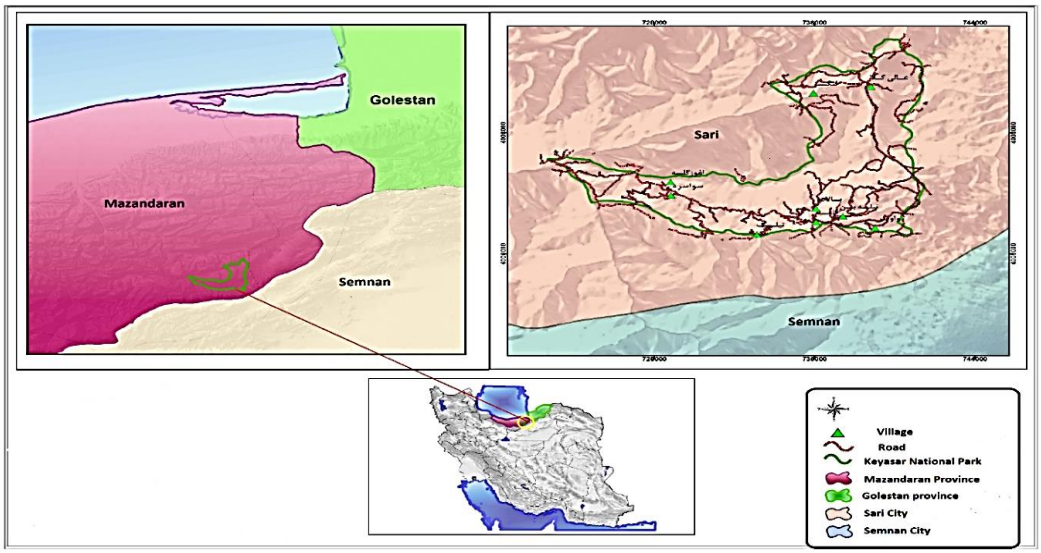


Figure 1. Area location

A lot of area of KNP is natural forest ecosystems (6672.62 he; 70.02%) and mountainous or summer rangelands (2064.80 he; 21.66%). In the KNP forest ecosystem, there are *Carpinus betulus*, *Fagus orintalis*, *Quercus persica*, *Carpinusbetulus × schuschaensis. H J. P. Winkl* forest types trees (3092.59 ha). Also, 375 plant species, 22 varieties and 28 subspecies belonging to 321 genera 73 class were identified in the rangeland ecosystem of KNP. *Veronica*,

1 Sustainable Rangeland Management

2 Criteria and Indicators for Sustainable Forest Management

Ranunculus, each *Stachys*, *Salvia,* and *Astragalus* are the most important plant species in the park in terms of species richness.

The biomass of plants of the rangeland ecosystem of KNP showed that hemicryptophytes with 136 species, therophytes with 113 species, cryptophytes with 60 species, phanerophytes with 49 Species, amphibians with 12 and epiphytes with one species have the highest abundance respectively (Report on the detailed plan of Kiasar national park, 2012).

In general, the rangeland ecosystem of KNP consists of two types: 1- Forested rangeland 2- Non-Forested rangeland;

- ***Forested rangeland includes the following species:***
  Festuca, Ovina, Bromus tementellus, Onobrychis cornuta, Astragalus sp*, Dactylis glomerata, Carpinus orientalis, Quercus macranthera, Juniperus excelsa, Juniperus Sabina.*
- ***Non- Forested rangeland ecosystem includes the following species:***
  Festuca ovina- Onobrychis cornuta, Poa sp- Lolium sp – Forbs sp, Festuca ovina- Bromus tomentellus.

3.2. Methodology

In this study, for determineing the importance of assessing indicators of economic, and social services of natural ecosystems of the national park (NEKNP) used Delphi group decision-making method. First, a set of indicators used to assess the economic, and social NEKNP services for rural communities included the IUCN indicators (IUCN, 1994) and CIFOR[1] (CIFOR, 1999), SRM[2] (Mitchell, 2010), and other indicators extracted from scientific articles have been survyed in the form of Delphi questionnaire. To score those, questionnaires were distributed among the decision-making group consisting of 36 experts in environment, tourism and ecotourism, natural resources and faculty members in four periods (steps). To comment on the importance of indicators in the assessing process. Scoring was according to the Likert scale (1: insignificance until 5: very important) (Hosseini et al, 2021). The indicator average and Standard Deviation (SD) in each step was calculated to reach a consensus among Delphi members (Powell, 2003; Hosseini et al., 2021). In the research, indicators were accepted that scored an average of three or higher than it (Choi and Sirakaya 2006). Also, validity of the questionnaire calculated based on the opinion of experts and for assesseing the internal consistency of the questionnaire questions, the questionnaire distributed among 18 experts in the first stage. Also, reliability questionnaire questions measured to Cronbach's alpha coefficient the (Momeni et al. 2006). The reliability of the questionnaire was confirmed with Cronbach's alpha coefficient ($\alpha = 0.97$).

Then, weight and prioritization of accepted indicators determineted with entropy and TOPSIS respectively models (Wang and Chang, 2007; Hwang and Yoon, 1981). In this study, for creating a capability map (Potential map) of economic, and social NEKNP services; first, the information layer of each of the indicators created, ranked and overlaid according to their weight and priority in Arc GIS 9.3. Finally, the Kiasar National Park capability map (Potential map) made, and classified into four classes, including very suitable, suitable, very unsuitable and unsuitable classes. It should also be noted that in this study, the value of some services such as recreational value, values of O^2 supply, CO_2 absorption, carbon sequestration, value wildlife, the role of the rangeland and forest ecosystem in creating employment and etc., was calculated using valuation methods and then a map of these services was prepared. In this research, Excel and Spss16 software used for questionnaire data analysis and Arc GIS 9.3 for creating layers.

4. Research Findings

In this study, 22 indicators including 7 economic and 15 social indicators accepted for assessing Kiasar National Park services for rural communities. Then they prioritized based on their final weight (Table 1). The results of Entropy and TOPSIS techniques are presented in Table 1.

1 Sustainable Rangeland Management

2 Criteria and Indicators for Sustainable Forest Management

Table 1. Weight and priority indicators of economic and social services assessing of NEKNP

Criterion	Indicator	Entropy Weight	TOPSIS	
			Relative proximity	Priority
Economic	Recreational value	0.04998	0.735436	1
	Values of O_2 supply, CO_2 absorption, carbon sequestration	0.049990	0.735184	2
	Aesthetic value (enjoyment and enjoyment of landscapes)	0.049978	0.725477	3
	Tourist productivity capacity	0.049996	0.704693	4
	Value wildlife	0.050054	0.662796	5
	Income obtained from forests and rangeland for livelihoods of local communities	0.050000	0.583045	6
	Reducing the cost of regenerative activities (ecosystem self-regulation)	0.050015	0.562023	7
Social	Interests and contributions from rural communities to protect and develop the park	0.049982	0.749904	1
	Improving the livelihood of dependent communities	0.049987	0.733644	2
	Existence of traditional buildings with historical value	0.050002	0.722421	3
	Geotouristic and ancient areas	0.049997	0.716258	4
	The contribution of the park in public culture (indigenous knowledge and local beliefs)	0.049980	0.714557	
	The number of local communities dependent on rangeland and forests	0.049984	0.679006	5
	Historical roads or bridges	0.050022	0.675682	6
	Historical tombs	0.050015	0.675368	7
	Contribute to food security in vilages	0.050010	0.674188	8
	The role of parks in promoting the social structures of local communities and customary systems	0.050013	0.596919	9
	Existence of old caves	0.050011	0.596540	10
	The role of the rangeland sector in creating employment	0.049985	0.590541	11
	The role of the forest sector in creating employment	0.049999	0.589608	12

The results obtained of TOPSIS technique in Table (1) showed that recreational value from an economic perspective and the interests and contributions from rural communities to protect and develop the park indicator from a social perspective with the highest relative proximity (final weight) were in the first priority, respectively (Table 1).

- Economic and social indicators of natural ecosystems of KNP

In this research, the information layer of economic and social indicators of NEKNP created in GIS software. Output layers showed in figures 2 (A, B) and 3 (A, B, C).

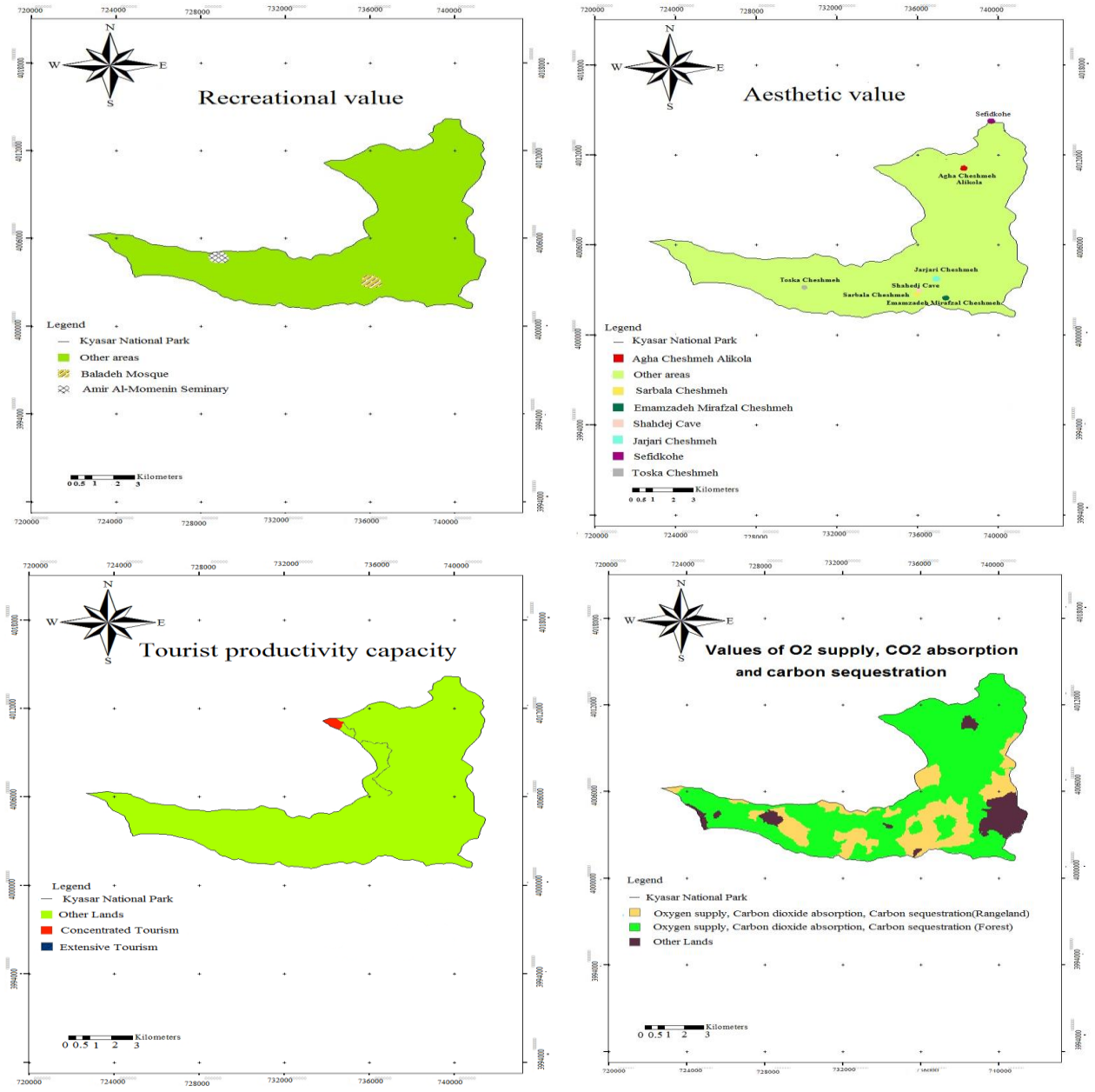


Figure 2 (A). Indicators of economic services of NEKNP assessing

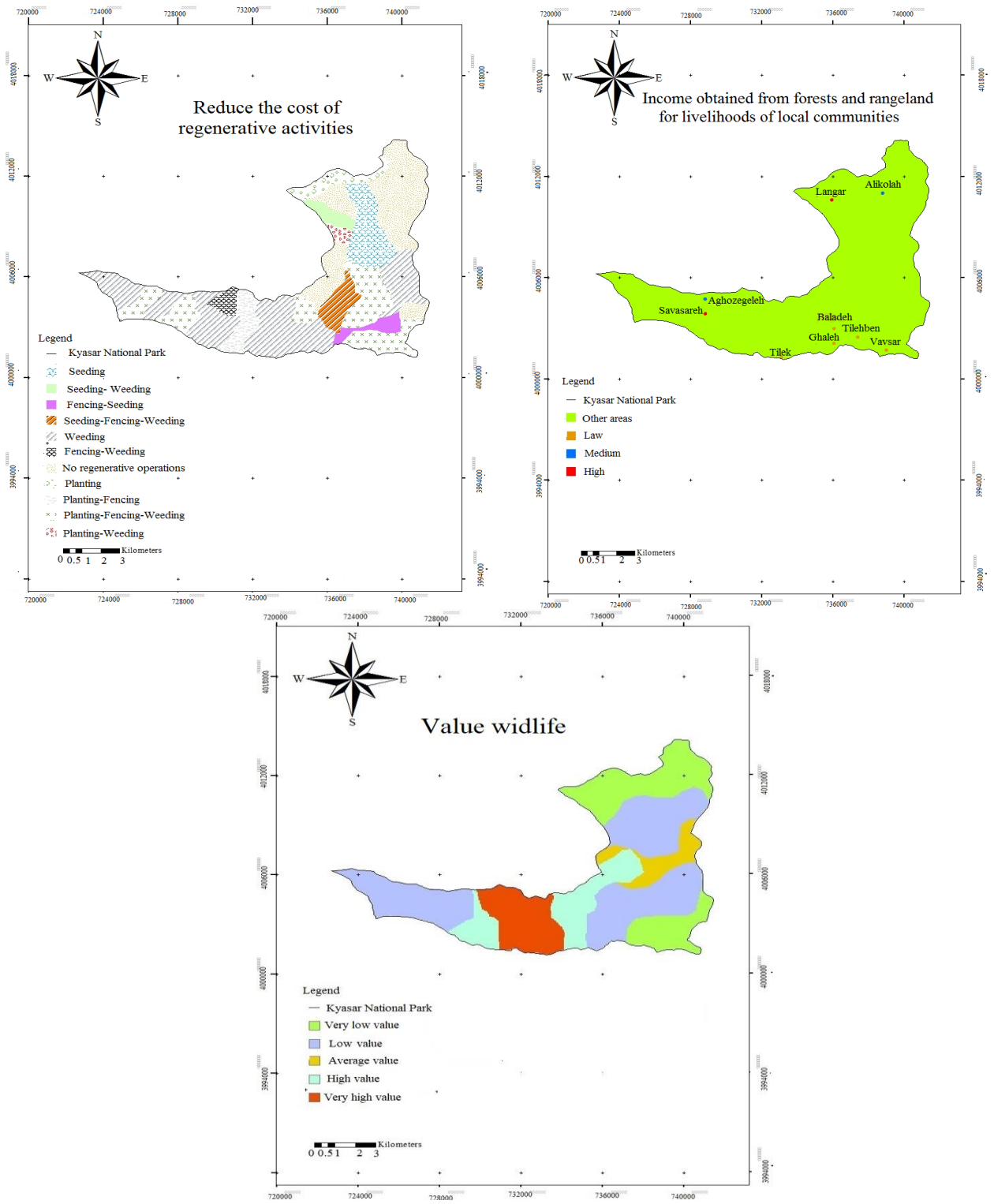


Figure 2 (B). Assessing indicators of economic services of NEKNP to rural communities

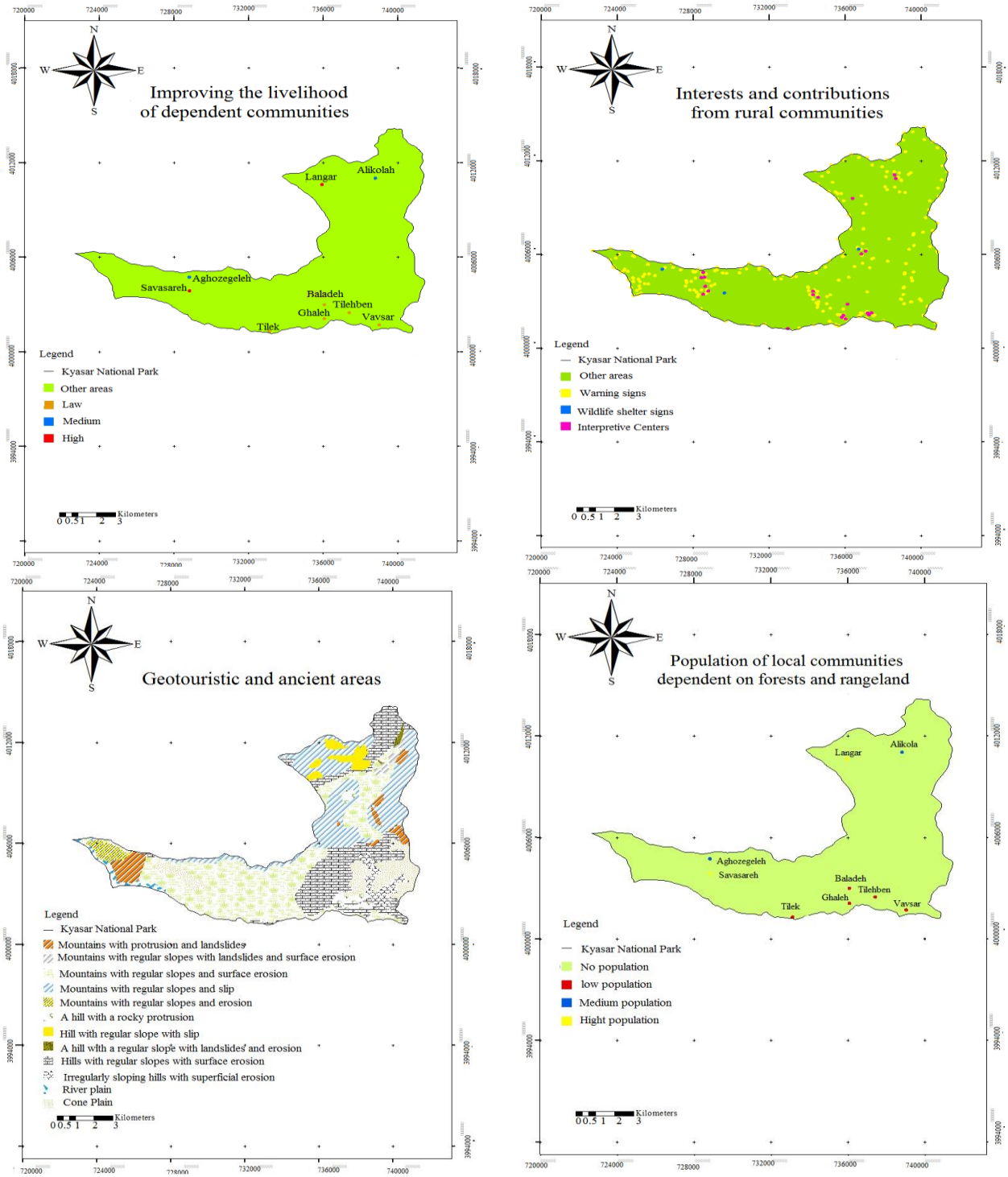


Figure 3 (A). Assessing indicators of social services NEKNP to rural communities

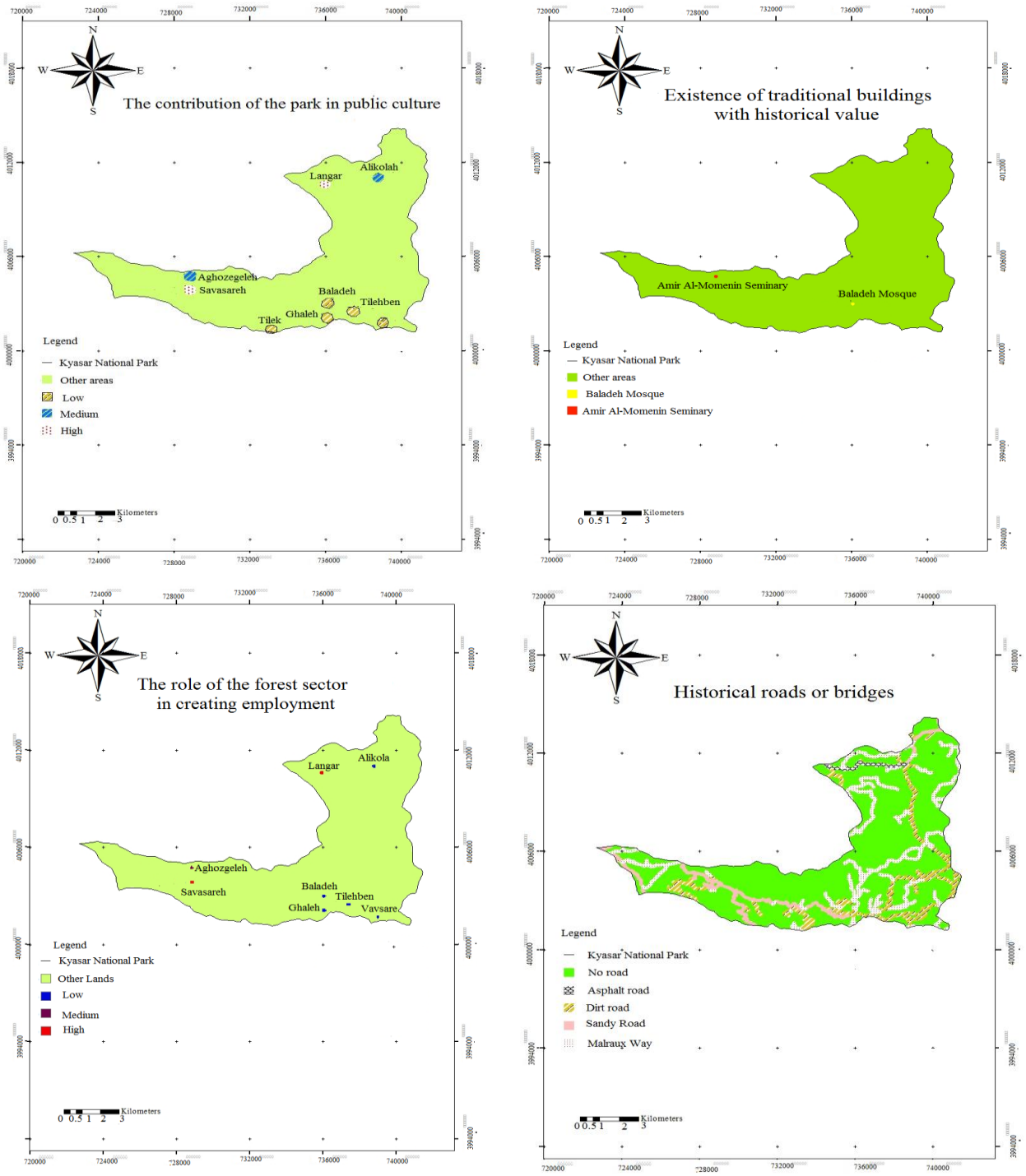


Figure 3 (B). Assessing indicators of social services NEKNP to rural communities

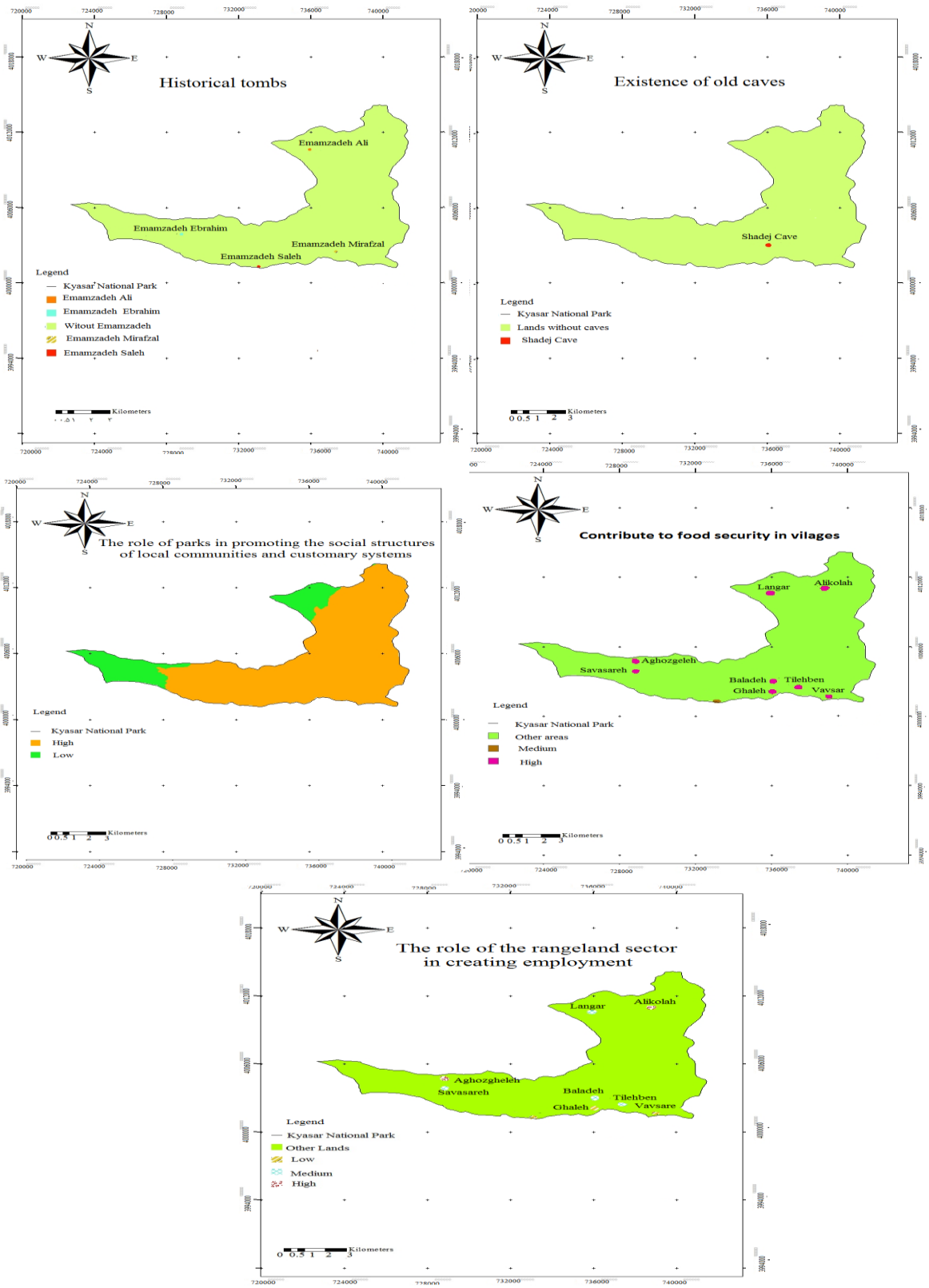


Figure 3 (C). Assessing indicators of social services NEKNP to rural communities

- Capability map (Potential map) of economic and social services of NEKNP

Capability map (Potential map) of economic and social services of NEKNP indicated at the 4 and 5 figures. The capability map was prepared in four categories: unsuitable, very unsuitable, very suitable and suitable for evaluation. The capability map indicated the frequency distribution of economic and social services of NEKNP.

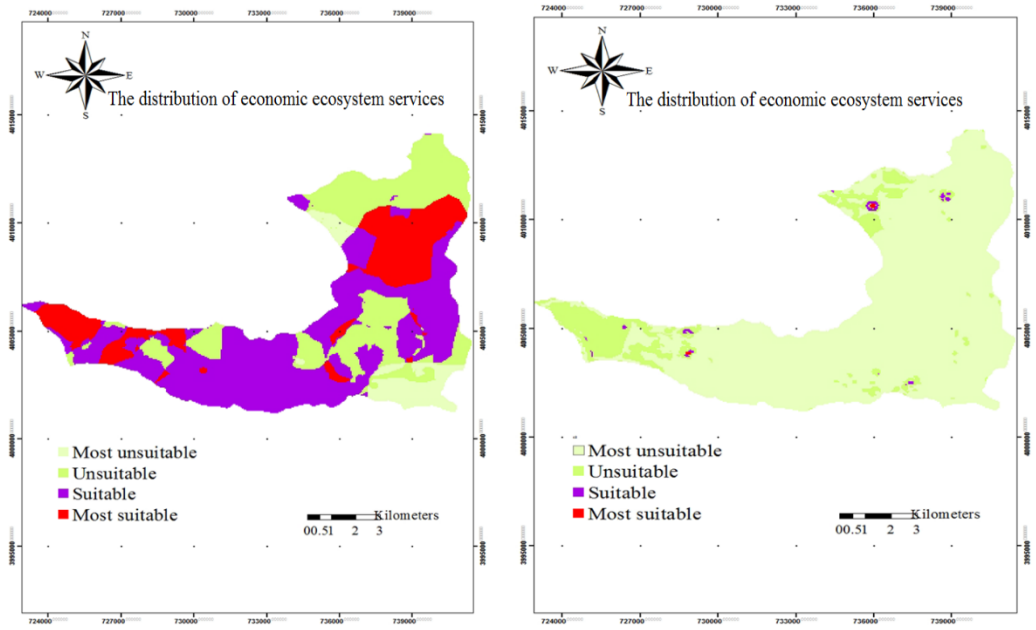
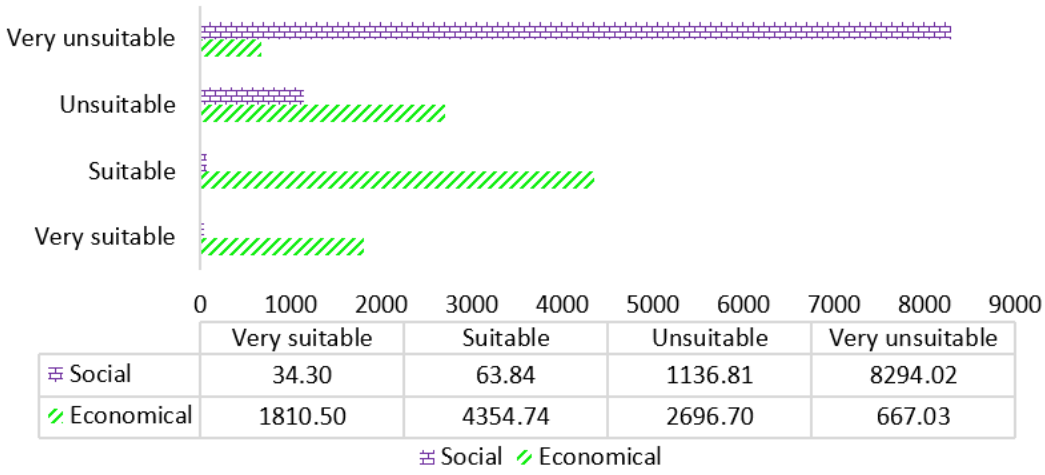


Figure 4. Assessing of social and economic ecosystem services of KNP (Capability map KNP) for rural communities

The results of assessing capability map KNP showed that from an economic perspective, 1810.50 ha park is located in the very suitable class and 34.30 ha park is located in very suitable class from a social perspective for utilization rural communities from social services of the park.



	Very suitable	Suitable	Unsuitable	Very unsuitable
Social	34.30	63.84	1136.81	8294.02
Economical	1810.50	4354.74	2696.70	667.03

Figure 5. The distribution of economic ecosystem services in the KNP for rural communities

5. Discussion and Conclusion

Today, agriculture in rural areas faces significant challenges, including production costs, food security, climate change, volatility in agricultural commodity markets, and other environmental issues and demands. Therefore, there is an urgent need to adopt innovative approaches in the agricultural and forestry sectors in order to increase the production of raw materials for food, energy, and other industrial purposes (Hosseini et al., 2021; Kalogiannidis et al., 2022).

The rural system should be considered as the most important basis for rural development to improve the situation of agriculture, which is not hidden from anyone; but from another perspective, there are also complementary solutions that can be very effective in their own right. When we talk about urban depopulation, especially in metropolitan areas, the most important solution to this problem is prevention, meaning we must be able to prevent rural migration to cities and small-town residents from migrating to large cities and metropolitan areas, and all planners know that this goal is not easily achievable. Now, rural tourism areas that are close to popular attractions such as national parks and protected areas have good potential for rural development. Forest and rangeland ecosystems of national parks and protected areas have a variety of services in this regard for the development of rural communities that need to be identified.

The Delphi method is one of the proper methods to identify indicators and criteria for assessing natural ecosystems services (Hai et al., 2009; Ludwig and Star, 2005). The results of the study identified and classified 22 indicators from the socio-economic perspective as effective indicators on the assessing of economic and social services of national park ecosystems for rural communities by specialists (Table 1). According to a specialist's viewpoint, national parks are protected areas where any harvesting or interference is prohibited. The result indicated that only seven indicators economic are suitable for assessing the natural ecosystems of national parks (NEKNP) (Table 1). This result showed that, today's societies do not see NEKNP such as forest and rangeland for harvesting wood and other production. This result indicates that from an economic perspective, the national park has an important role in preserving natural ecosystems for today's communities. In this regard, Hadadnia and Danehkar (2012) in their studies, out of 12 criteria that they identified for the assessment of protected areas, only 6 main criteria were selected for the choice of protected areas.

Among the intangible and valuable services of the forest and rangeland ecosystems of national parks is the provision of a suitable place for tourism, which is defined as the spiritual, aesthetic and recreational exploitation of nature (Sgroi, 2020). Tourism and visiting protected areas such as national parks directly and indirectly contribute to income and employment, and the expansion of this industry provides indicators of sustainable development in rural areas and is considered from various perspectives. Economically, tourism creates employment and wealth in the region. Socially, it increases vitality in society, and culturally, it also causes cultural exchange and the proximity of different cultures to each other (You et al., 2022).

Increasing tourist visits to forest areas of national parks and protected areas in developing countries, by generating income and economic justification, can play an important role in the protection of biodiversity and natural resources (Thapa et al., 2022). Therefore, in recent decades, tourism has become an important phenomenon in the economic, social and cultural fields, and new concepts have been proposed in the field of organizing and managing tourism destinations that emphasize sustainability and social responsibility. In the meantime, natural spaces such as forests have gained a special place because they play a role not only as physical spaces but also as dynamic platforms for social and economic transformations (Mäntymaa et al., 2021).

The findings indicated (Table 1) recreational value and national and universal values from an economic perspective had the first priority between other indicators for assessing natural ecosystems services for rural communities. It expressed, paying attention to these criteria in assessing the NEKNP will lead to the sustainable development of urban ecosystems. In other words, natural ecosystems are one of the main sources of landscape that attract ecotourism. The results of Hosseini et al., 2024; the Nemec and Raudsepp-Hearne (2013) and Masoudi et al. (2021) studies confirm present results.

Forest and rangeland products are the source of livelihood for many rural communities around the world, and significantly affect the livelihoods of

communities that rely on forests and rangelands. It is estimated that 1.6 billion people, or 25 percent of the world's population, rely on forests for their livelihoods, employment, income, and other livelihood needs (Soe & Yeo-Chang, 2019). Today, efforts to protect, improve, and restore forest and rangeland ecosystems in national parks with the participation of local and indigenous communities as a documented management plan are a fundamental step towards sustainable development. The success of these projects depends on the level of public participation in decision-making, implementation, and conservation. Various assessments show that projects in which people have been involved in various stages or have been designed and implemented with the different needs of rural people and stakeholders in mind have been more successful and sustainable (Mosaffaie and SalehpourJam, 2020). They introduced public participation in national park conservation projects due to the reduction of administrative costs and more effective implementation of executive projects. The most logical solution for preserving natural resources is comprehensive public participation. This will reduce administrative costs and guarantee the success and more effective implementation of the plans (Ghahari et al., 2021).

The economic benefits of protected areas have attracted increasing attention in recent years, and methodologies in this field are advancing. Numerous studies have shown that protected areas such as national parks are a powerful land-use strategy for generating multiple and direct economic benefits and conserving natural ecosystems (Siltanen et al., 2023). According to the result of Table 1, the interests and contributions from rural communities to protect and develop the park and improve the livelihood of dependent communities had the highest final weight. It showed the ability of the ecosystem to provide economic services and allowe people have a better chance of deciding on the conservation of natural ecosystems because it plays a role in their well-being. In other words, ecosystem services help the economic and social development of rural households. It is in contrast with the findings of Seidzadeh et al., 2022; Mohammadian et al. (2021); Pribadi et al. (2023).

The important purpose of assessing and mapping ecosystem services is to demonstrate the potential of natural ecosystems in providing ecosystem services. Because our ability to estimate the social and economical services of the ecosystem is low. In this study, GIS approaches and models were used for assessing and mapping ecosystem services. Our result for assessing the contribution of ES based on capability map KNP in figure 5 showed the contribution of ES is different in KNP. The results showed that the number of services varies among natural ecosystems. The ES assessment showed from an economic perspective, 4354.74 ha (45.70%) of the NEKNP are in the suitable class for using rural communities. It is constant whit study results Masoudi et al. (2021) and Krzanowski et al. (2024).

National parks not only protect natural resources, but also provide a variety of cultural ecosystem services and serve rural areas as important locations for the provision of rural recreation services (RRS). Spatial quantification of the supply and use of RRS will help ensure the protection and promotion of human health in national parks (Chen and Wu, 2025). These results indicated that the natural ecosystems of KNP have sufficient potential to provide ecosystems services such as recreational value, national and universal values and aesthetic value, etc. In this regard, Mahmoudi and Danehkar (2002), evaluated the recreational capacity for forest park planning in the forests of Lordegan of Iran using AHP and GIS. Their result showed that economic criteria have main role in assessing parks. Also, Chen and Wu, (2025), evaluated rural recreational services of Zhejiang national parks using MaxEnt software. The result showed that, national parkshave recreational service in the different zone.

The Millennium Ecosystem Assessment (MEA) has classified ecosystem services into four types, of which cultural ecosystem services (CES) are one of the important categories, defined as the non-material benefits that humans derive from ecosystems, including spiritual satisfaction, reflection, aesthetic experience, recreation, and cognitive development (Reid et al., 2005). CES can enhance human well-being and encourage environmental action (Schirpke et al., 2018) and link society, ecology, and landscape (Chan et al., 2012). While preserving the ecological and cultural characteristics of protected areas, national parks simultaneously provide opportunities for recreation and ecotourism to the public. Although the social services of national parks enable conservation and economic development, they can also lead to the

loss of forests and rangelands as they stimulate economic development (Brandt and Buckley, 2018). Because, the ecology of national parks is sensitive. The increasing demand for recreational activities is placing significant pressure on the natural ecosystems of national parks.

Figure 5 showed that 63.84 ha of the park is suitable (These areas are mostly in virgin park ecosystems) based on social indicators and 8294.02 ha of the park is most unsuitable for supplying services to rural communities. The result indicated that the ecosystem services had decreased due to human activities like population growth, construction sites, pollution, etc. This factor destroyed natural ecosystems and prevents the production of important ecosystem services. As result, the benefits and services that we receive directly or indirectly from ecosystem performance are decreased. The studies result of Costanza et al. (2014) for estimating total value of world ecosystem services and Najmizadeh and Yavari (2005) about the assessment of the environmental potential of Khabar National Park consistent with the present results.

The result experienced assessment and ecosystem mapping services can stay important of ES for humans. Based on the research findings, it is suggested that the relevant organizations consider the above indicators as important indicators in the assessing of natural ecosystems of national parks.

Indicate of the interests and contributions of rural communities to the protection and development of the park are important indicators in evaluating national parks. Therefore, it is suggested that the interests and contributions of the general public, especially indigenous people, be considered for the protection and development of national parks, and that their opinions and experiences be used in protection activities and management decisions.

- Our result showed that the natural ecosystems of national parks can provide services based on economic indicators for rural communities, it is suggested that in macro planning, the budget be considered to protect these parks.

The result indicated the assessment of natural ecosystem services by combining GIS layers and multi-attribute decision making (MCDM) data is efficient and useful because it involves the simultaneous use of weights and priority indicators and their geographic layers. GIS and Multiple Attribute Decision Making (MCDM) such as Entropy and TOPSIS models are a useful technique that contain the use of geographic layers, weights, and an aggregation function that incorporates spatial data and weights of criteria to assess areas for suitability evaluating.

- It is suggested that more advanced, more efficient and newer techniques such as ELECTER, LINMAP, artificial neural network, etc. be used simultaneously to weight and prioritize the criteria and indicators for evaluating national parks.

- Considering that reliable data for evaluating national parks is very difficult, it is suggested that reliable and high-precision terrestrial data and satellite image be used for mapping and assessing the ecosystem services.

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Authors' contributions

Sareh Hosseini: Conceptualization, Methodology, Software, Writing - Original draft, Visualization; Jafar Oladi and Hamid Amirnejad: Supervision, Conceptualization, Methodology; Reviewing, Editing, and Validation.

Conflict of interest

The authors declare no conflict of interest.

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Original Article

شناسایی و ارزیابی خدمات اقتصادی و اجتماعی اکوسیستم‌های طبیعی به جوامع روستایی

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چکیده مبسوط

۱. مقدمه

مناطق حفاظت‌شده مکان‌هایی با مدیریت مؤثر می‌باشند که به حفظ بلندمدت تنوع‌زیستی و ارزش‌های طبیعی، همراه با ارائه خدمات اکوسیستمی و ارزش‌های فرهنگی اختصاص دارند. پارک‌های ملی به‌عنوان یکی از مهم‌ترین انواع مناطق حفاظت‌شده با هدف حفظ اکوسیستم‌های طبیعی، تنوع‌زیستی، منابع ژنتیکی، چشم‌اندازهای زیباشناختی و سایر خدمات فرهنگی ایجاد می‌شوند و تحت مدیریت سازمان حفاظت محیط‌زیست قرار دارند. اکوسیستم‌های طبیعی این پارک‌ها شامل حیاتی‌ترین بستر توسعه پایدار محیط‌زیست و پدیده‌های اکولوژیک محسوب می‌شوند. اهمیت و نقش اکوسیستم‌های طبیعی پارک‌های ملی به عنوان بهترین مناطق تحت مدیریت در سطح ملی و جهانی در همه کشورها به رسمیت شناخته شده است. این اکوسیستم‌های طبیعی، طیف گسترده‌ای از خدمات زیست‌محیطی، اقتصادی و اجتماعی را به جوامع انسانی ارائه می‌دهند و ذینفعان متعددی از آن بهره‌مند می‌شوند. یکی از مهم‌ترین ذینفعان این خدمات، جوامع روستایی واقع در حاشیه اکوسیستم‌های طبیعی از قبیل جنگل‌ها و مراتع می‌باشند که نقش مهمی در توانمندسازی این جوامع و بهبود وضعیت اجتماعی-اقتصادی آن‌ها و در مقابل مشارکت اجتماعی جوامع روستایی در حفاظت از این منابع‌طبیعی می‌شود. در سال‌های اخیر جهت حفاظت و حمایت اکوسیستم‌های طبیعی توجه زیادی به پارک‌های ملی و سایر مناطق تحت حفاظت شده است. زیرا با شکل‌گیری این مناطق روند کاهش سطح جنگل‌ها و مراتع کند شده و سیاست‌های مناسبی جهت حفاظت از منابع‌طبیعی کشور اتخاذ شده است و در اثر فعالیت‌های ترویجی متصدیان امور حفاظت، انس و الفت بیشتری بین دولت‌ها و مردم این مناطق برقرار گشته و نحوه نگرش و تلقی جوامع مختلف از مفهوم و اهمیت پارک‌های ملی و مناطق حفاظت شده تغییر کرده است با این حال، عدم استفاده مناسب از این مناطق و عدم ارزیابی دقیق خدمات اکوسیستمی آنها، تهدیدی جدی برای بقای این مناطق محسوب می‌شود. از این‌رو، ارزیابی علمی خدمات اقتصادی و اجتماعی اکوسیستم‌های طبیعی با استفاده از ابزارهای نوین مانند می‌تواند گامی مؤثر در جهت مدیریت پایدار این منابع باشد.

۲. روش تحقیق

در این پژوهش، اکوسیستم‌های جنگلی و مرتعی پارک ملی کیاسر در شمال ایران به‌عنوان منطقه مطالعاتی جهت ارزیابی خدمات اقتصادی و اجتماعی اکوسیستم‌های طبیعی برای جوامع روستایی انتخاب شد. برای دستیابی به اهداف تحقیق، از پرسشنامه دلفی شامل مجموعه‌ای از شاخص‌های استخراج‌شده از منابع مختلف استفاده گردید. در این مطالعه با استفاده از نظرات ۳۶ نفر از کارشناسان و متخصصان پارک‌های ملی، شاخص‌های مهم اقتصادی و اجتماعی مرتبط بر اساس طیف لیکرت امتیازدهی شدند. سپس از روش‌های تصمیم‌گیری چندمعیار شامل تکنیک آنتروپی (Entropy) برای وزن‌دهی شاخص‌ها و تکنیک ترجیحات بر اساس شباهت به راه‌حل ایده‌آل (TOPSIS) برای اولویت‌بندی شاخص‌ها استفاده شد. در ادامه، سامانه اطلاعات جغرافیایی (GIS) برای تهیه نقشه ارزیابی خدمات اقتصادی و اجتماعی اکوسیستم‌های طبیعی پارک ملی کیاسر برای جوامع روستایی در چهار طبقه به‌کار گرفته شد.

۳. یافته‌های تحقیق

در این تحقیق، ۳۸ شاخص شامل ۲۰ شاخص اجتماعی و ۱۸ شاخص اقتصادی شناسایی شد که در نهایت ۷ شاخص اقتصادی و ۱۱ شاخص اجتماعی برای ارزیابی خدمات اکوسیستم‌های طبیعی پذیرفته و بومی‌سازی گردید. نتایج نشان داد که شاخص‌هایی مانند ارزش تفریحی، منافع و مشارکت جوامع روستایی در حفاظت و توسعه پارک بالاترین اولویت را در بین سایر شاخص‌های ارزیابی به خود اختصاص دادند. همچنین نتایج حاصل از نقشه ارزیابی خدمات اقتصادی و

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اجتماعی اکوسیستم‌های طبیعی پارک ملی کیاسر نشان داد که از جنبه اقتصادی و اجتماعی به ترتیب ۱۸۱۰/۵۰ و ۳۴/۳۰ هکتار از اکوسیستم‌های طبیعی پارک در طبقه بسیار مناسب برای بهره‌مندی جوامع روستایی از خدمات قرار دارند. این تفاوت نشان‌دهنده آن است که ظرفیت اقتصادی پارک ملی کیاسر در ارائه خدمات اکوسیستمی به‌مراتب بالاتر از ظرفیت اجتماعی آن است.

۴. بحث و نتیجه‌گیری

طبق نتایج، اکوسیستم‌های طبیعی پارک ملی کیاسر از جنبه اقتصادی سطوح بیشتری از طبقات مناسب را نسبت به جنبه اجتماعی به خود اختصاص داده است. این نشان از آن است که اکوسیستم‌های طبیعی پارک دارای ظرفیت بالایی در ارائه خدمات اقتصادی اکوسیستمی است، به‌عبارت دیگر، اکوسیستم‌های طبیعی پارک ملی کیاسر توان بالقوه بالایی در ارائه خدمات اقتصادی اکوسیستمی دارند که می‌تواند در صورت مدیریت صحیح، به رشد اقتصادی منطقه و بهبود معیشت جوامع محلی منجر شود. در مقابل، از منظر اجتماعی، به‌ویژه در زمینه‌هایی مانند مشارکت فعال جوامع روستایی در فرآیندهای حفاظت، مدیریت از اکوسیستم‌های طبیعی پارک، خلأهایی مشاهده می‌شود که نیازمند توجه و برنامه‌ریزی دقیق‌تری از سوی نهادهای ذی‌ربط است. همچنین نتایج پژوهش نشان داد استفاده از روش‌های تصمیم‌گیری چندمعیاره مانند دلفی، آنتروپی و تاپسیس در کنار ابزارهای تحلیلی مانند سامانه اطلاعات جغرافیایی، امکان تحلیل دقیق، علمی و چندبُعدی داده‌ها را فراهم می‌سازد. این ترکیب روش‌شناختی نه‌تنها موجب افزایش اعتبار و دقت نتایج ارزیابی می‌شود، بلکه می‌تواند به‌عنوان الگویی کاربردی برای ارزیابی سایر پارک‌های ملی، مناطق حفاظت‌شده و زیست‌بوم‌های حساس در سطح کشور مورد استفاده قرار گیرد. در نهایت، چنین ارزیابی‌هایی نقش کلیدی در بهبود مدیریت منابع طبیعی ایفا می‌کنند. افزون بر این، نتایج حاصل از این نوع مطالعات می‌تواند در توانمندسازی جوامع محلی، ارتقاء سطح آگاهی زیست‌محیطی، افزایش مشارکت اجتماعی، و بهبود کیفیت زندگی ساکنان مناطق پیرامونی پارک‌ها مؤثر واقع شود. بنابراین، توجه به ابعاد اجتماعی در کنار ظرفیت‌های اقتصادی، ضرورتی اجتناب‌ناپذیر در مسیر توسعه پایدار و حفاظت مؤثر از اکوسیستم‌های طبیعی به‌شمار می‌رود.

کلید واژه‌ها: ذینفعان، خدمات اقتصادی و اجتماعی اکوسیستم، تصمیم‌گیری چندمعیاره، روش دلفی، پارک ملی کیاسر.

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