Environ Monit Assess (2019) 191: 138
https://doi.org/10.1007/s10661-019-7284-8

Management effectiveness and conservation prioritizing the protected areas using RAPPAM methodology (case study: Khuzestan province)

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Received: 17 May 2018 / Accepted: 29 January 2019 / Published online: 7 February 2019

Abstract In the world today, where the industrialization of countries is still on the increase, protecting habitats and wildlife will be possible only in protected areas. That is why maintaining species' diversity and preventing the destruction of habitats in protected areas has been of great interest. Rapid Assessment and Prioritization of Protected Area Management methodology is one of the most common methods of management effectiveness assessment and is used as a tool for managers and decision-makers of protected areas. Recently, the biodiversity and sustainability of wildlife populations, as well as preserving the integrity of protected areas in the Khuzestan province, have been at risk due to several factors; therefore, the evaluation of management effectiveness in these areas is necessary. The studied areas in this research are protected areas in Khuzestan province, with a history of more than 5 years of management. The results of this study show that Dez, a protected area with the highest points in the planning (38.5), has the highest score in management effectiveness (128.78). Also, Shimbar, a protected area with the lowest score (11), has the lowest score of management effectiveness (64.66) among the other areas. The overall management level of the protected areas in the Khuzestan province is at the low-intermediate managerial level compared to the global average. Therefore, it is necessary to change the policies and management of these areas.

Keywords PA management · Effectiveness · Iran · RAPPAM · Conservation · Monitoring

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Introduction

Protected areas are the most important tools of biodiversity conservation and ecosystem services (Scharlemann et al. 2010). Principles of conservation planning take place to identify species in need of immediate protection and to minimize loss of biodiversity (Tali et al. 2015). Despite inadequate funding and management processes, there are indications that protected areas are helping to biodiversity conservation and community health (Leverington et al. 2010). They are not immune to loss of habitat and biodiversity (Craigie et al. 2010; Laurance et al. 2012; Geldmann et al. 2013), or increasing anthropogenic pressures (Geldmann et al. 2014), all of which result in the development of a global network with a coverage of 15.4% of the Earth's protected areas (Juffe-Bignoli et al. 2014). Despite extensive coverage, biodiversity is still declining (Butchart et al. 2010; Tittensor

et al. 2014). The difference between the increased coverage of protected areas and the negative trend of biological diversity has led to an increase in management effectiveness of those protected areas (Coad et al. 2015). However, this increase in the size of protected areas is only one aspect of the management effectiveness of the protected areas. Having a legal framework in the area and efficient management will help stop the decline in biodiversity (Watson et al. 2014).

By identifying the most important issues in the protected areas, management effectiveness assessments can be used to improve the management of protected areas (Ervin 2003). Two decades ago, the international community of protection became critical in regard to assessing the effectiveness of protected areas in the long term (Hockings et al. 2006). Therefore, in recent years, many countries have developed a variety of methods for evaluating the effectiveness of protected areas (Hockings et al. 2010).

In 1995, the World Commission on Protected Areas (WCPA) was required to establish a review of issues related to the effectiveness of protected areas based on results from the WCPA task force to develop a general framework (Hockings et al. 2000). In order to provide a consistent approach to evaluate the effectiveness of protected area management, the WCPA framework included six elements for the main evaluation: context, planning, inputs, processes, outputs, and outcomes (Leverington 2009). The WWF rapid assessment covers all these elements. The efficiency and flexibility of this method was used for all areas of life, including all ecosystems. A total of 1595 protected areas in more than 56 countries were evaluated by the Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) methodology until 2009 (Leverington 2009). The primary aim of writing this rapid assessment is to obtain a tool for assessing the management effectiveness of protected areas in a country or region (WWF 2003).

In 2010, a report entitled "Assessing management effectiveness of protected areas" was released by the University of Queensland in Australia, WWF, WCMC, UNEP, Europe Federation, and BN in Europe. In this study, RAPPAM is mentioned as one of the international and valid methods of assessing the management effectiveness of protected areas (Hockings et al. 2010). It is one of several ongoing efforts to develop a specific assessment tool that is compatible with the WCPA framework; it is also one of the most common methods of management effectiveness in the world (Leverington et al. 2010). In recent years, various studies have been carried out on the management effectiveness of protected areas. Mendonça (2010), in a study of management models in China and South Africa, concluded that the management of protected areas is influenced by that country's government. In a study of management effectiveness of protected areas by the RAPPAM methodology, Lu et al. (2012) concluded that the lack of a comprehensive management program, as well as insufficient financial and human resources, affects the reduction of management effectiveness of protected areas in Taiwan and that, to improve the management effectiveness in that country, the strengthening of management planning has to become a priority. In a study that looked into increasing the environmental effectiveness of protected areas in Thailand, Satumanatpan et al. (2014) offered strategies for biodiversity conservation and sustainable use of protected areas' resources of the country. In a study on the effectiveness of management in protected areas in Indonesia, Brun et al. (2015) offered solutions to manage these areas effectively; observation and the prevention of constructing buildings were some of the solutions that could be relied on to protect the protected areas. In a study on the management of offshore protected areas, Addison et al. (2015) noted that the assessment of management effectiveness is in its infancy. They came to the conclusion that, even when the results of long-term monitoring are available, the management organizations do not use evaluation of management effectiveness to assess the quantity conditions. They also stated that, in many management organizations, it is used to assess the quality conditions and the results are interpreted using expert judgment. In marine protected areas, a management effectiveness study in South Eastern Brazil, Araújo and Bernard (2016) used the RAPPAM methodology and announced that increasing the number of employees is their top priority for the next year.

Located in South West Asia, Iran covers 1,648,195 km^2 of the region and is known as an arid and semi-arid country. Iran has about 10,000 flora of vascular plants, of which approximately 20% are local (Mirkarimi 2007). The number of different species of vertebrate animals of this country is 1072, but around 600 species of saltwater fish from the Persian Gulf and Oman should be added to this number (Zehzad et al. 2002). Khuzestan province is in the south-western

region of Iran and has been one of the most valuable areas of the country due to its different habitats and diversity of species (Nabavi et al. 2010). The protection of the natural environment through management programs in different countries is different (Portman and Nathan 2015). In Iran, less attention has been paid to protected areas without forest cover. In recent years, Khuzestan province has been subject to serious damage due to climatic conditions and mismanagement. This study has talked about the effective management and conservation priority of protected areas in Khuzestan province, and the results of this study can be used to eliminate the shortcomings and deficiencies in management systems.

Method

Study area

Khuzestan province is located in south-western Iran (Fig. 1). Khuzestan province has different ecosystems. From the forest habitats of the margin of the river to the unique protected forests of Daz and Karkheh that are the major habitat for Persian fallow deer (*Dama dama mesopotamica*), the endangered species (Nabavi et al. 2010), are mentioned.

Khuzestan county comprises about 677.499 ha that 328.926 ha of which are protected areas (Gitashenasi 2007). Table 1 shows the features of the studied protected areas.

Assessment tool

Five pillars of RAPPAM methodology are shown in Table 2. RAPPAM methodology is regulated based on questionnaire processes. Questions of the methodology questionnaire are discussed using a participatory workshop (Carranza et al. 2014). The workshops are formed with the participation of managers of the protected areas, staff from the areas, experts, professors and professionals, and members of the local communities living in the areas (Simões et al. 2010). Because the opinion polls and participation in the working group were not possible for all of the population, the required sample was determined by Morgan's formula (Kerjcie and Morgan 1970). In this study, from a statistical community, finally a total of 74 people were determined and interviewed based on Morgan's formula. Each question in the questionnaire had four options (no, mostly no, yes, mostly yes) with 5, 3, 1, and 0 points (Carranza et al. 2014).

Comparing degrees of biological importance, socio-economic importance, and vulnerability

In the biological importance of protected areas, some items including rare species, threatened species or endangered species, biodiversity, indigenous species, existence of key species, ecosystems greatness, and extent of changes were examined. In the socio-economic importance of protected areas, the employment for local communities, the local population dependence for living, existence of religious and ideological indicators, plant and animal species having important economic, cultural, and social values, recreational value, scientific and educational values, etc. are examined. In the vulnerability of protected areas, items examined included the following: implementation of law in the region, monitoring illegal activities, the general disorder or instability at a time, the traditional and religious uses inconsistent with the aims of the region, existence of marketing value for resources in the area, convenient access to the area for illegal activities, to provide and maintain work personnel, manager being under pressure for incorrect operation, etc. (Simões et al. 2010).

Based on the results obtained from the questions provided, each protected area has a series of numerical indicators, namely biological importance, socio-economic importance, and vulnerability. These indicators can be compared widely to determine the relation between each of them. This analysis can also help to identify areas with high or low score, and provides an indicator to determine the level of importance and vulnerability (WWF 2003). In the following, it should be noted that ten questions are given per questionnaire, and 5 is the maximum score possible for each question. The final score for each questionnaire of biological importance, socio-economic importance, and vulnerability is recorded from 0 to 50 by a numerical index.

Management effectiveness

The analysis of management effectiveness covers four divisions of effective management that contains planning, inputs, processes, and outputs (Carranza et al. 2014). Planning included objective, legal

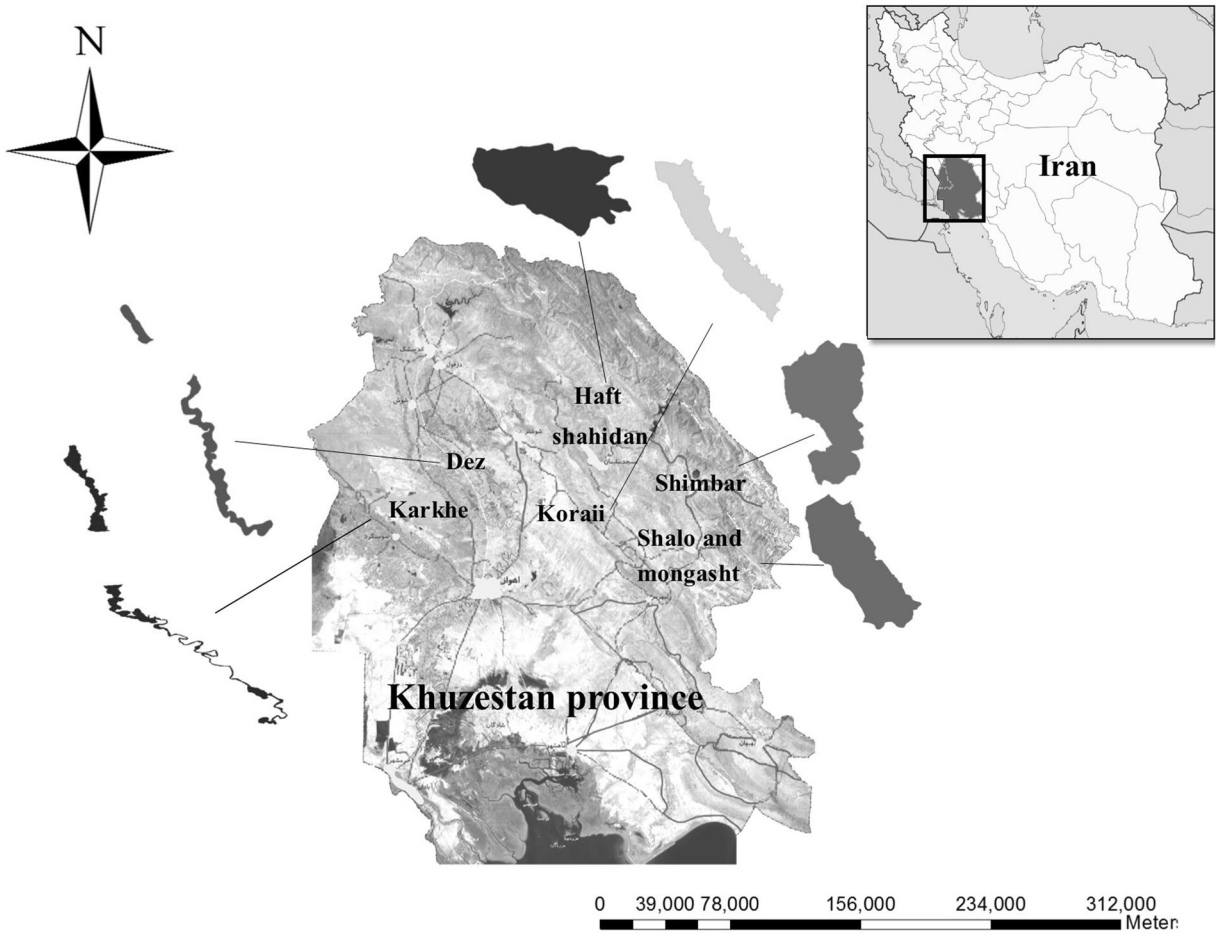

Fig. 1 The locations and coverage of the studied protected areas

security, site design, and planning. Inputs included staffing, communication and information, infrastructure, and finances. Processes included management planning, management decision-making, research, monitoring, and evaluation. The results of this questionnaire for management effectiveness of protected areas are recorded as between 0 and 300, which can be a comparison between the effects of management in large-scale and systemic weaknesses (WWF 2003).

Table 1 Features of the studied protected areas

The dominant fauna	Size (ha)	Year of establishment	The dominant flora	The dominant fauna
Dez	18,711	1967	*Populus euphratica*	*Dama dama mesopotamica*
Karkhe	8600	1970	*Tamarix* sp.	*Dama dama mesopotamica*
Shalo and Mongasht	12,992	1999	*Quercus branti*	*Ursus arctos*
Shimbar	54,139	1999	Wetland: *Vitex pseudo* Mountainous: *Quercus branti*	*Sciurus anomalus*
Koraii	39,420	1997	*Zizyphus mauritiana*	*Ovis orientalis*
Haft Shahidan	9609	2001	*Zizyphus mauritiana*	*Canis aureus*, *Canis lupus*

Albodvirej (1994a, b); Nabavi et al. (2010); Department of Environment, Islamic Republic of Iran, Khuzestan Provincial Office (2015)

Table 2 Assessment elements in WWF's rapid assessment questionnaire

Context	Inputs	Management outputs	PA design and planning	Management processes
Threats	Staff	Threat prevention	PA objectives	Management planning
Biological importance	Communication and information	Site restoration	Legal security	Management practices
Socio-economic importance	Infrastructure	Wildlife management	Site design and planning	Research, monitoring, and evaluation
Vulnerability	Finances	Community outreach Visitor management	PA system design	
		Infrastructure outputs		
		Planning outputs		
		Monitoring		
		Training		
		Research		

Simões et al. (2010)

Conservation priority protected area

Comparing the values of biological importance with vulnerability for each protected area can figure out which one of the protected areas is in the highest risk and needs more support. Some information can help the prioritization and the planned support, especially for protected areas (WWF 2003).

Results

The RAPPAM methodology questionnaire was analyzed by the relevant committees of the questionnaire methodology upon completion. The results of the analysis are given in Figs. 1, 2, 3, 4, 5, and 6. Figure 2 shows the scores for biological importance, socio-economic importance, and vulnerability of studied protected areas.

Figure 2 shows that Karkhe protected area within the study area has the highest biological importance and Koraii protected area has the most points of socio-economic importance and vulnerability among other areas

Figure 3 shows the average score for planning of protected areas. According to this figure, the Koraii protected area has the most points of planning among other areas and Haft Shahidan protected area has the lowest point of planning among other areas.

Figure 4 shows the average score for inputs of protected areas. In this section, Karkhe protected area has the most points of inputs and Haft Shahidan protected area has the lowest point among other protected areas.

Figure 5 shows the average score for processes of protected areas. In this section, Koraii protected area has the most points of processes and Shimbar protected area has the lowest point among the other protected areas.

Figure 6 shows the score for outputs of protected areas. In this section, Dez protected area has the most points of outputs and Haft Shahidan protected area has the lowest point among the other protected areas.

Figure 7 shows the overall management effectiveness of studied protected areas. According to this figure, Dez protected area has the most points of overall management effectiveness and Shimbar protected area has the lowest point of overall management effectiveness among the other protected areas.

Figure 8 shows the assessment of the conservation priority of studied protected areas. As seen in this figure, Koraii and Shalo and Monghasht are at the highest level of the chart and the Haft Shahidan protected area is at the bottom level of this chart. Same as this chart, in the chart of assessment of areas with respect to socio-economic priority (Fig. 9), Koraii and Shalo and Monghasht are at the highest level of the chart.

Discussion

Despite the fact that the extent of the protected areas will cover 17% of the world's surface by 2020, biodiversity continues to decline (Coad et al. 2015). This is the

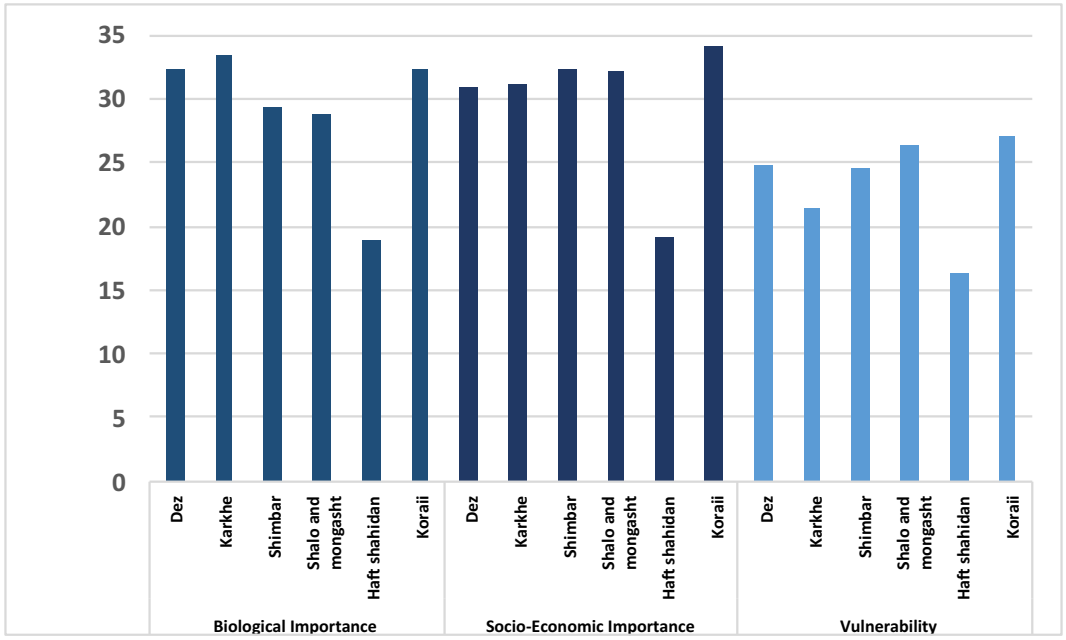

Fig. 2 Scores for biological importance, socio-economic importance, and vulnerability of PAs

reason why the protected area is considered one of the most important indexes in fast assessing the biological importance of protected areas. Rare species live in protected areas of Khuzestan province. If they are not protected well, soon they will disappear, and this protection will be possible in protected areas with effective management of these areas (Nabavi et al. 2010).

The results of the questionnaire, scoring the biological importance of protected areas in Khuzestan province (Fig. 2), show that Karkhe protected area within the study area has the highest biological importance. However, biodiversity is at an appropriate level in studied protected areas. One of the main problems for biodiversity conservation is that the habitats of rare species stand outside of the protected area (Batsukh and Belokurov 2005). In the studied areas, due to improper boundaries of lands, there are lands which are rich in biodiversity and stand outside the protected areas.

The results of the questionnaire, which shows the scores of the socio-economic importance of protected areas in Khuzestan province, showed that the Koraii protected area has the most points of socio-economic importance among other areas. In many protected areas of Khuzestan province, there is no proper social and economic information, as well as national parks of Romania (Stanciu and Steindlegger 2006).

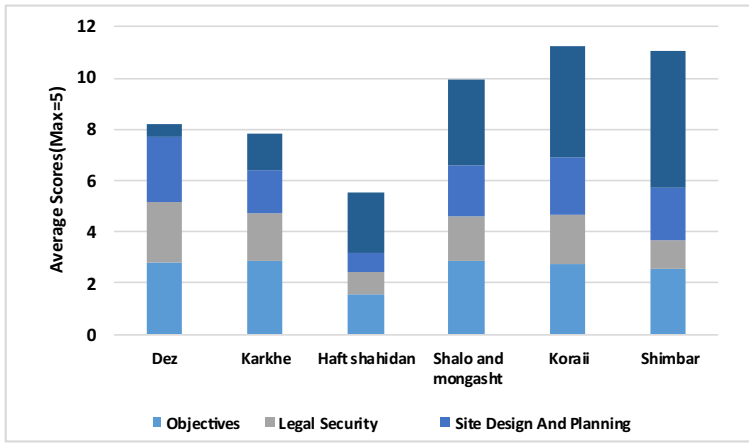

Fig. 3 Average score for planning of PAs

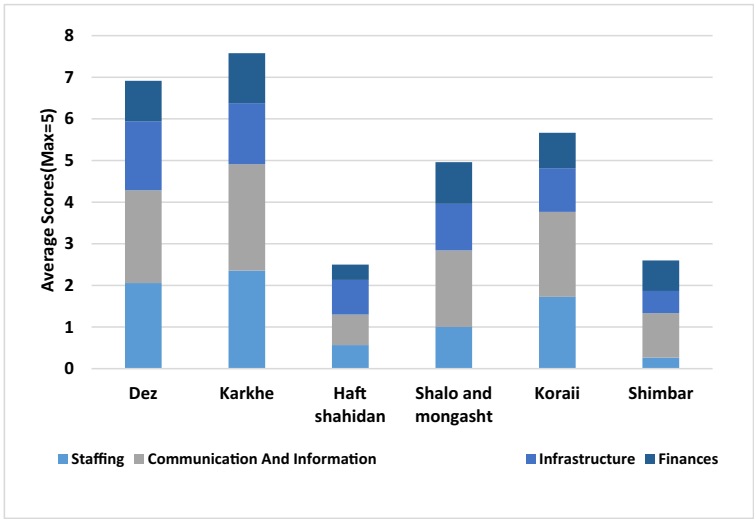

Fig. 4 Average score for inputs of PAs

In reviewing the results of the vulnerability questionnaire, the highest score was given to the Koraii protected area due to the recruitment and retention of staff and the availability of the area for illegal activities, which have the greatest impact on the vulnerability of the region. The guards of the protected areas of Khuzestan to total area do not follow prescribed standards of the world (Department of Environment Islamic Republic of Iran, khuzestan Provincial Office 2015). As in Bhutan (Tshering 2003), the attraction and retention of staff are important factors that affect the vulnerability of the region and, according to vulnerability studies in Brazil, about 69% of the country has a high vulnerability (Simões et al. 2010).

In Fig. 3, the average points of the planning questionnaire are provided. This graph shows that the Dez protected area has the highest score, while the Haft Shahidan protected area has the lowest score in the planning questionnaire. In Haft Shahidan protected area, factors such as a lack of national society's support for all regional aims, lack of staff and financial support, and lack of zoning in have influenced the reduction of the area's score in the field of planning. However, in several countries, including South Africa, other factors have influenced the low score, such as lack of a clear understanding of goals, actions, and policies of the protected area by the employees, which is concerning for managers (Goodman 2003). This factor is serious and influential in the management processes of the protected areas in this study. In addition to financial constraints, there is no comprehensive management plan for the majority of protected areas in the Khuzestan province and annual management schedules are used to manage them. In Romania, there was no management plan;

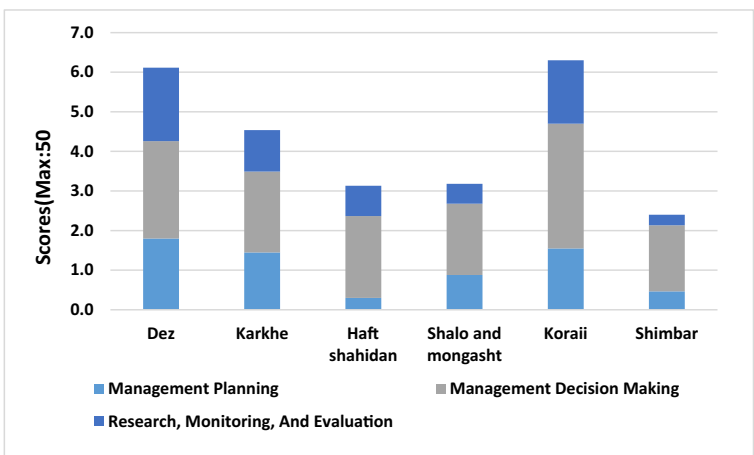

Fig. 5 Average score for processes of PAs

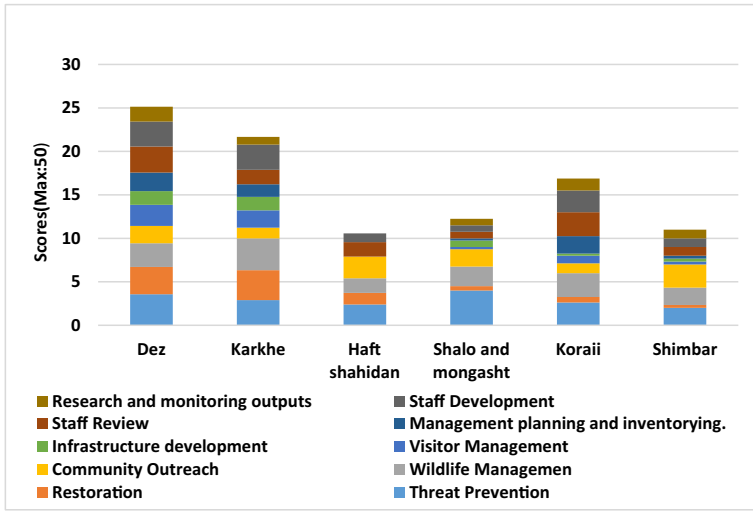

Fig. 6 Score for outputs of PAs

instead, an annual program was used for most parks until 2006. The annual plan included steps to run a protected area, which had priority at that time and, instead of focusing on the main aims of management, state resource constraints were considered (Stanciu and Steindlegger 2006). Generally, the (planning) questionnaire got the highest score in RAPPAM methodology in Russia (Tyrlyshkin et al. 2003), Turkey (Kurdoğlu and Çokçaliskan 2011), China and under study areas in Khuzestan province.

Figure 4 shows the mean scores of the input questionnaires. According to this graph, Karkhe was a protected area with a high score in the communication and information, while the employee section has the highest score in the entrance part. The Shimbar protected area, due to the lack of rangers (four rangers in 54,139 ha) and staff (one expert), has the lowest score among the protected areas in this study. Lack of staff and lack of funding and not providing facilities and equipment are some of the main causes of poor management of areas at a global level (Leverington et al. 2010). Five factors, namely budget, human resources, social relations, communication, and inventory of resource, are the factors that influence the management effectiveness in four countries of Bhutan, China, Russia, and South Africa (Ervin 2003), as well as the Khojir National Park (Mehdi et al. 2013) in Iran.

A good correlation exists between the success of training the staff in protected areas and human resources raising awareness about protected areas and the overall effectiveness of it (Lockwood et al. 2012). Similar studies in Romania show, in most of the cases when considering the number of staff and facilities, staff do not have the appropriate capacity to implement rules and, in some

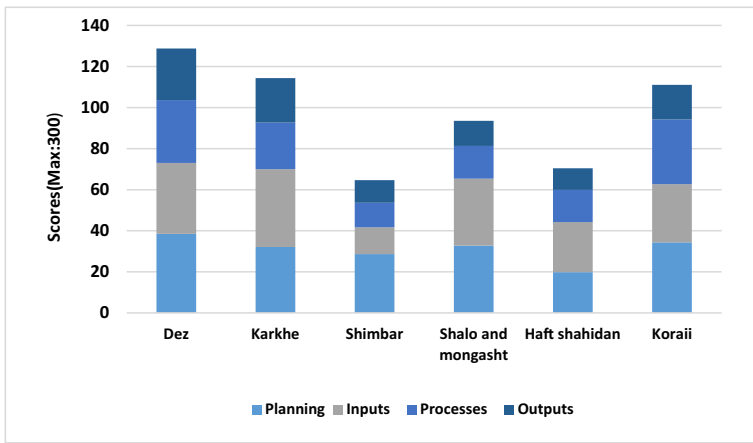

Fig. 7 Overall management effectiveness of PAs

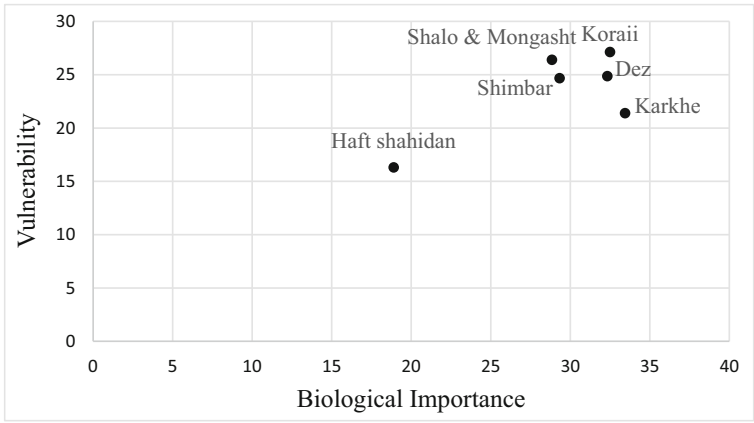

Fig. 8 Assessment of the conservation priority of areas

cases, there are no suitable conditions or permanent education available for staff (Stanciu and Steindlegger 2006). Generally, in addition to the high quality of education of the employees in protected areas, motivating young professionals to work in these areas and attracting them in all countries, and not just a few countries, is a priority (Bruner et al. 2001).

Unfortunately, one of the difficulties of successful managing is the lack of communication among local communities (Lockwood et al. 2012). One of the reasons for the need to increase staff capacity in Romania is to achieve adequate communication levels with the local communities in order to reduce and prevent potential conflicts for land rights, etc. Fortunately, this index in the Khuzestan province areas has the highest rating in the input section, as well as China (Li et al. 2003) and Brazil (Simões et al. 2010).

Figure 5 shows the mean scores of the processes questionnaire. In general, according to the graph, the Kerayi protected area has the highest score. Studies show that good analysis, monitoring, and evaluation system are closely related to the conservation of biodiversity in a protected area. Unfortunately, very few protected areas have presented a report on the comprehensive monitoring and evaluation programs (Lockwood et al. 2012). In Iran, as well as Romania (Stanciu and Steindlegger 2006), there is no evaluation system for evaluating employee performance based on results that contribute to achieving the goals and objectives of the protected areas.

Output indicates the level of management, achieving goals and control of the pressure and threats by the management of the protected areas over 2 years (Lu et al. 2012). Based on Fig. 6, the protected area of Dez has the highest score in this sector. The strongest output in the studied protected areas is threat prevention (detection and strengthening rule). However, in Bhutan (Tshering 2003), threat prevention has been one of the

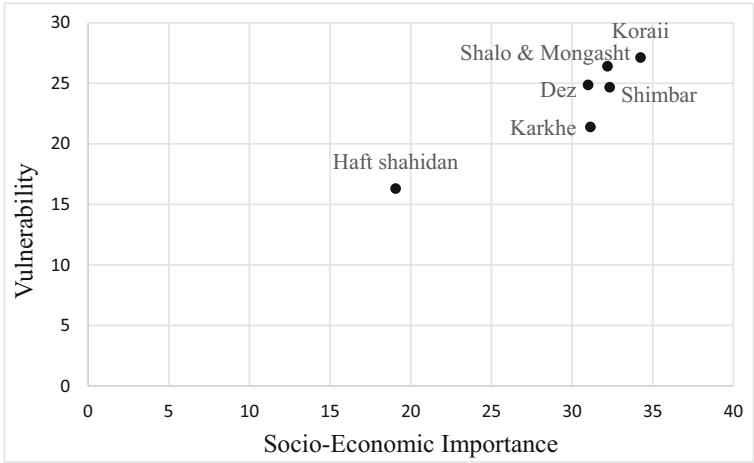

Fig. 9 Assessment of areas with respect to socio-economic priority

weakest parts of the country outputs. After the threat prevention, wildlife management has a higher rating than the other outputs to protect, in order not only to increase the size of the wild population, but also to maintain biodiversity and, thus, maintain wildlife populations at sustainable levels (Arha and Emmerich 2011). However, a part of the wildlife management in the Dez protected area and the Karkhe protected area is protecting Persian fellow deer trapped in captivity. Taking care of the species in terms of genetics and population helps to protect the threatened species (Connolly and Cree 2008). Unlike China (Li et al. 2003), the weakest outputs of the Dez protected area are the infrastructure development and, as with China (Li et al. 2003) and Brazil (Li et al. 2003), output monitoring and research. One of the main problems with protected areas is the monitoring and research, which is not needed for the region, and research conducted at the level of theory and not being applied.

Convention on biological diversity recognized education and community development as a key instrument for the conservation of biodiversity (Jiménez et al. 2015). In protected areas of Khuzestan province, unlike China (Li et al. 2003), Brazil (Simões et al. 2010), and Cambodia (Lacerda et al. 2004), education and community development program has not been in a very good state and it requires more comprehensive and practical applications in this field especially for local communities around protected areas.

Management effectiveness of protected areas' total score can be achieved of design questionnaire, input questionnaire, inventory of management outputs, and inventory of processes of management (WWF 2003). From a strategic management perspective, it is important to understand the relationships between these variables (Goodman 2003). Evaluation of the management effectiveness of the protected areas is a method of evaluating their performance (Carranza et al. 2014). Based on Fig. 7, of the four sectors that influence the effectiveness of management, Dez protected area, with the highest score at planning (38.5), has the best score in management effectiveness (128.78). Shimbar protected area, with the lowest score in inputs (11), has the lowest score in management effectiveness (64.66).

Output is management effectiveness quality index (Li et al. 2003), which has the lowest score (97.50) among the variables, influencing the management effectiveness. The highest score of the index among the studied regions belongs to Dez protected area with points of 25.14. That shows the direct relationship of this part to the region's top-level management effectiveness among the studied areas.

According to studies regarding the history of protected areas and their relationship with management effectiveness of the protected areas, old protected areas, due to more time and effort, have slightly higher scores than newer business areas, and managing them is more developed (Lockwood et al. 2012). Dez protected area has 49 years history of management and the highest efficiency in management output among other areas of study. It has had some success in recent years in breeding Persian fallow deer, and being placed at the highest level of management effectiveness in protected areas of Khuzestan province regions is not unexpected. The protected area being in good condition in the planning and processes sectors implied that there was no difference between the goals and actions taken (Lu et al. 2012) and earning most of the points in planning and appropriate score in the processes. Of course, a high level of management in Dez protected area indicates better management of this area compared to other areas of the province, and to get to the appropriate level of management, more effort and a more significant schedule will be required.

Shimbar protected area with 17 years of experience of management has been in the lowest level of management effectiveness in the protected areas of Khuzestan province. The border of this region has drastically changed after the recent dam building, and some parts of the area have gone under water, or have been destroyed in order to build roads leading to the dam. However, this is not the only factor in the low area management effectiveness and other factors, such as lack of energy, deforestation, and land use change, cause this effectiveness. In this area, the lowest was dedicated to the staff score at the entrance and in management processes to research, evaluation, and monitoring; in the planning section and the legal security; and in the output section to tourism management, infrastructure development, and planning management. As in studies in Brazil (Simões et al. 2010) and China (Li et al. 2003), employees, monitoring and evaluation and research, and planning management were the factors that had the lowest score and reduced the management effectiveness of these areas.

When comparing the biological importance of the studied protected areas with vulnerability (Fig. 8), this shows that the protected areas of Koraii, Shalo and

Mongasht, Dez, Shimbar, and Karkhe are in the higher levels of conservation priority, compared to the Haft Shahidan protected area. Haft Shahidan protected area in terms of biological significance and vulnerability lies in the lower grades. Comparing the vulnerability and socio-economic importance of the studied protected areas (Fig. 9) shows that the protected areas of Koraii, Shalo and Mongasht, Dez, Shimbar, and Karkhe are at a higher degree of risk than the Haft Shahidan protected area.

Conclusions

Due to the crisis in the protected areas of the Khuzestan province, analyzing the conservation management effectiveness and protection prioritization of areas was specifically considered and required to identify weaknesses in the management of the protected areas and identify high-risk areas, which also helps managers to allocate resources. Results of the study show that Dez protected area has the highest, while the Shimbar protected area has the lowest score on the management effectiveness, and Koraii, Shimbar, Shalo and Mongasht, Karkhe, and Dez protected areas are at a higher risk and higher conservative and economical prioritization than other protected areas in Khuzestan province. Generally, obtaining a minimum of 64 points and the maximum 128 points and comparing it with the concession period provided by the used methodology (0–300) reveals that protected areas in Khuzestan province are in a low-average level in terms of management in methodology ranking. Therefore, general changes seem necessary in attitude and management of these areas; standing at low-average levels is one of the factors that caused most of the studied areas to be high-risk areas and have high conservative socio-economic prioritization. The lack of an efficient management plan and the state budget deficit for protected areas, difficulties attracting and retaining staff, and the primacy of economic issues on environmental issues in Iran, which is a growing country, have caused a reduction in the management effectiveness level of the protected areas in the country, especially in Khuzestan province. However, in recent years, studies have been under consideration to improve the management of protected areas.

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