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ANALYSING PRESSURES AND THREATS ON THE SOUTHERN WETLANDS OF IRAN WITH THE APPLICATION OF RAPPAM METHODOLOGY (CASE STUDY: KHUZESTAN PROVINCE)

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ABSTRACT

Wetlands are sensitive ecosystems. They provide various services to man, but have been degraded to a large extent. Wetlands are of great importance, therefore they should be evaluated and monitored periodically in a planned way. Undoubtedly, identifying threatening factors for wetlands properly and accurately, based on their importance and the extent to which they affect the wetlands, can provide the right context for preventing and fighting against these factors, and also preparing and implementing plans related to the protection of wetlands, as well as their environmental management. Khuzestan province is located in the south west of Iran and has huge wetland ecosystems in it. In this study, first the most important factors of pressure and threat for four wetlands in Khuzestan province were identified based on the Delphi method. Then, the key factors identified were scored based on RAPPAM methodology. The results showed that there are 22 major pressure and threat factors in the Shadegan wetland, 15 factors in the Hoor_Al_Azim wetland, 10 factors in the Miangaran wetland and nine factors in the Bamdezh wetland. Factors such as road construction, dam construction, hunting, fishing, the discharge of urban and industrial sewage into wetlands, and drought have placed the highest level of pressure and threat imaginable upon the wetlands of the province. Analysing and comparing the cumulative rate (CR) of pressure and threat factors, which is the sum of the means of the scores obtained from pressure or threat factors for each area of wetlands, showed that among the wetlands of Khuzestan province, Hoor_Al_Azim wetland with a pressure factor of 458.5 CR and threat of 484.5 CR, and Miangaran wetland with a pressure factor of 204.5 CR and a threat of 209.5 CR have the highest and lowest scores of threats and pressure of among the other wetlands, respectively.

Therefore, Hoor_Al_Azim wetland should receive a higher degree of attention with respect to management, or reducing or eliminating stressful factors.

Key words: Wetland, Pressure, Threat, Delphi, RAPPAM, Iran, Khuzestan Province

1. Introduction

In this century, human beings have been facing an unsolvable problem that will endanger the survival of all kinds of species in the world. Many of these problems result from developments in agriculture, shipping, transportation, tourism etc. These problems are created through the excessive use of natural

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resources and environmental pollution, to an extent to which the resources cannot replenish themselves by themselves (Pagourtzi *et al.,* 2003).

Wetlands are complex and vital ecosystems. Despite the growth of public awareness about the significance of natural environments, our real understanding of the value, importance and sensitivity of these life-giving ecosystems is very low, and wetlands have always been a victim of human wishes and desires. Drying wetlands and turning them into arable lands, establishing industries within them, unwanted wars on these lands, and so on, have made these wetlands barren (Dugan, 1990).

Based on the definition given by the Ramsar Convention, wetlands include marsh areas, pound, peat swamp and water areas, whether natural or artificial, permanent or temporary with still, flowing, fresh, brackish or saline water. Furthermore, they include marine waters where the depth of water at low tide does not exceed six meters (Seeling and Dekeyser, 2006).

Wetlands cover about six percent of the earth and provide many services such as floodwater, agricultural production, fisheries and recreation for human beings (Biswasory *et al.,* 2011).

Wetlands are very useful and valuable for humans because they are useful for the sustainability of human activities. The value of some wetlands increases with the development of human activities since some of them are used more and more along with these developmental activities (Williams and Gosselink, 2000).

Wetlands are lands that are located between terrestrial ecosystems and aquatic ecosystems, and provide many benefits and services, including controlling floods, protecting water quality and habitats for wildlife, and controlling erosion (Sugumaran *et al.,* 2004).

These ecosystems are among the most vital and important areas of the world, and have a special place because of their unique biodiversity, large volumes of biomass production, a controlling role in hydraulic systems and adjusting temperature, preventing floods and storms, controlling diseases and illnesses biologically, their role in communication and transportation, their multilateral touristic and recreational importance, their uncountable scientific research value, and their biosphere reserves (Bennett and Whitten, 2000).

According to the latest List of Wetlands, recorded in the Ramsar Convention published on the sixth of August, 2012, 162 countries have joined the convention and 2,046 wetlands with a total area of 193,443,062 ha recorded in this convention. In Iran there are 33 wetlands with 24 names and a total area of 1,486,438 ha which is equal to 0.76 percent of the area of wetlands registered in the convention. The main objective of the Ramsar Convention, which was signed by the committed countries including Iran in 1971, is to conserve and make sensible use of wetlands by taking national measures and joining in international collaborations in order to achieve sustainable development (Jones et al., 2009).

Monitoring changes of wetlands and their surrounding areas can be helpful in managing these valuable ecosystems (Ozesmi and Bauer, 2002). Over the last few decades, there has been a great rise in the awareness of the importance of wetlands (Biswasory *et al.,* 2011). Thus, wetlands need to be monitored, inspected and assessed regularly. One of the common methods of assessment employed for studying and monitoring the conditions of wetland ecosystems is the Wetland Rapid Assessment Procedure (WRAP). This procedure has been used during the last two decades, especially in the developed countries (Vance, 2009).

The Wetland Rapid Assessment Procedure is a useful tool for assessing the conditions of wetlands, identifying possible stressful factors, and determining priorities in wetlands restoration (Apfelbeck, 2005).

Until now, studies using the Wetlands Rapid Assessment Procedure have been conducted using various methods around the world, such as studies of the rapid assessment of the Estuarine wetlands in Florida (Raymond *et al.,*1997), a rapid biological assessment of wetlands using the contamination degree of vertebrates and invertebrates with toxins (Van Dam et al.,1998), a technique of rapid assessment of the health of water flows in watershed units (Clean Water Services, Watershed Management, 2000; Siobhan Fennessy *et al.,*2004), and using a common rapid assessment in the United States in the rapid assessment of Montana wetlands in order to understand the conditions of wetland resources for their reservation and reconstruction (Apfelbeck,2005).

Khuzestan province, in the south west of Iran, is one of the Iranian provinces that contains vast areas of biological resources, especially in the form of flowing waters and wetland ecosystems (Gitashenasi, 2008; Dinarvand and Assadi, 2011).

Due to the damage caused by war and the unbridled possessions of wetland ecosystems by public and private sectors, these precious ecosystems have unfortunately been subjected to a lot of stresses. Thus, in this study, the most important pressure and threat factors on the natural wetlands of Khuzestan province were identified and studied using the Delphi and RAPPAM (Rapid Assessment and Prioritization of Protected Area Management Methodology) method.

In the assumptions of the considered methodology it is mentioned that this methodology can be applicable even for a single region (WWF, 2004). RAPPAM is a credible methodology and has been used by number of countries to assess natural and protected areas.

An evaluation of threats and pressures on natural ecosystems and protected areas based on this methodology has been performed in countries such as Brazil (Simões *et al.*, 2010), Mongolia (Batsukh and Belokurov 2005), and South Africa (Goodman, 2003) Cambodia (Lacerda *et al.,* 2004), Russia (Tyrlyshkin *et al.,* 2003), Nepal (Nepali, 2006) and Montenegro (Porej and Stanišić, 2009). However, this study is the first time that the identification and study of threats and pressures on the natural wetlands of Iran have been performed based on this method.

2. Materials and Methods

This province is one of Iran's provinces that has extensive bio-resources, especially ecosystems of flowing water and ecosystems of wetlands. For example, 26/9 percent of the total area of international wetlands in Iran are located in this province, all of which are related to the Shadegan wetlands. The most important wetlands of this province include Shadegan, Hoor_Al_Azim, Bamdezh, and Miangaran.

2.1 Study area

With an area of 63633.6 km^2, Khuzestan Province is located on 29 º 57´ to 33 º 00´north of Equator and 47 º 40´ to 50 º 33´east of Greenwich in South West Iran (Gitashenasi, 2007). Its annual precipitation is 255 mm and it has an annual evaporation rate of 2044 mm. It is therefore known as one of the warm areas of Iran with vast biological resources especially in its water flow ecosystems and wetland ecosystems. For example, Shadegan wetland in Khuzestan Province accounts for 26.9% of Iranian international wetlands (Dinarvand and Assadi, 2011). The most important wetlands in the province include Shadegan, Hoor_Al_Azim, Bamdezh, and Miangaran wetlands.

Shadegan international wetland located in the north of Persian Gulf in the Khuzestan province, this wetland area was designated wildlife refuge in 1972 and was later registered as an international wetland in 1975. Level to open seas, the region has an area of about 400000 ha. The northern part of the wetland has fresh water whereas the middle and southern parts have brackish and brine water thanks to their neighboring with coastal marshes. The wetland is a perfect habitat for a great number of resident and migratory threatened birds such as marbled teal, dalmation pelican, goliath heron, Indian pond heron, jackal, common fox, Indian crested, cape hare and checkered cat snake also live in the wetland and its surroundings (Darvishsefat, 2006).

Bamdezh wetland is a fresh water wetland, located in the east of capital city of khuzestan province and provide services such as ecotourism, commercial benefits and recreation to local community. The wolf, jackal, common fox, marbled teal and Iraq babller are the important threatened species in this wetland (Behrozirad, 2008).

Hoor_Al_Azim wetland is an Iranian section of Mesopotamia great wetland in the eastern part of Khuzestan province. This wetland is a fresh water wetland and has important role to irrigation the agricultural lands and local community Livelihoods. There are many important and threatened species such as Smooth-coated otter, marbled teal, sacred ibis and Mesopotamian Softshell Turtle can be seen in this wetland (Behrozirad, 2008).

Miangaran wetland in the north of khuzestan province is a fresh water wetland. This wetland is smallest wetland in Khuzestan province. This wetland plays an important role in flood control, water supply and the drain the ground water. This wetland and its surrounding fields is overwintering site and implantation of important species such as jackal, wolf, common crane and northern shoveler (Behrozirad, 2008).

Location and extent of wetlands under study are presented in Table 1. Fig. 1 also shows the situation of wetlands under study in Iran and Khuzestan province.

Table 1. Location and extent of wetlands under study

Area (ha)	North latitude	East longitude	Wetland
400000	30° 58´ - 30° 17´	48° 50´ - 48° 17´	Shadegan Wetland
117000	41° 00´ - 31° 53´	47° 58´ - 47° 16´	Hoor_Al_Azim Wetland
2440	31° 45´ - 30° 50´	49° 47´ - 49° 45´	Miangaran Wetland
40000	31° 51´ - 31° 38´	48° 42´ - 48° 27´	Bamdezh Wetland

(Behrozirad, 2008)

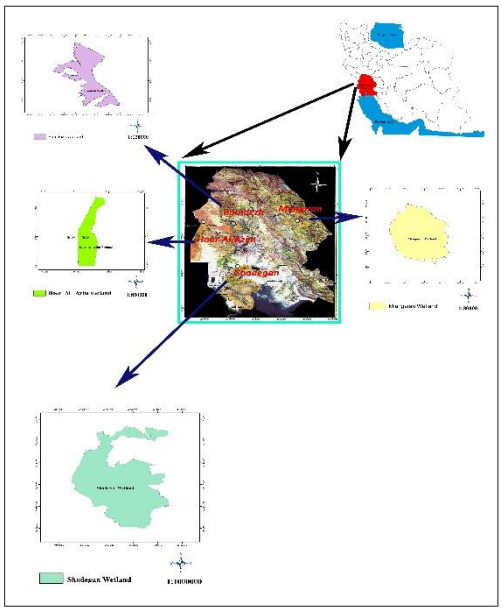

Figure 1. Situation of wetlands under study in Khuzestan province

2.2 Method

Part of the RAPPAM (Rapid Assessment and Prioritization of Protected Area Management Methodology) methodology, which was introduced in 2003 by WWF (World Wildlife Found) for rapid assessment of protected area, is used for this research (WWF, 2003). This methodology is based on the questionnaire method. In this method, first the wetlands under study were subjected to a field analysis. Then, based on reliable evidence and reports, a list of all stressful and threatening factors for wetlands was prepared. After that, the mentioned factors were screened using the Delphi method. Finally, the most important pressure and threat factors for each wetland were obtained.

The Delphi technique is a procedure for attracting attention, judgment, and consensus from a group of experts about a particular subject. It is a time consuming prediction method in which predictions from experts on multidisciplinary subjects are collected (Dalkey and Helmer, 1962).

Then, based on the methodology used, parameters of the intensity, extent and permanence of impact for each pressure and threat factor were rated by target groups. The target groups for the study included environmental researchers and experts, managers of wetlands, beneficiaries and local communities affecting and affected by the wetlands.

The RAPPAM Methodology focused more on determining the degree and magnitude of each threat and pressure (Tshering, 2003).

- **Pressures**

Pressures are forces, activities, or events that have already had a detrimental impact on the integrity of the areas. Pressures include both legal and illegal activities, and may result from direct and indirect impacts of an activity (WWF, 2003; Porej and Stanišić, 2009; Lopes Simões *et al.,* 2010; Arshad, 2011).

- **Threats**

Threats are potential or impending pressures in which a detrimental impact is likely to occur or continue to occur in the future (WWF, 2003; Porej and Stanišić, 2009; Arshad, 2011).

- **Extent**

Extent is the range across which the impact of the activity occurs. The extent of an activity should be assessed in relation to its possible occurrence. For example, the extent of fishing would be measured relative to the total fishable waterways. “Throughout” means that an activity occurs in 50 per cent or greater of its potential range, “widespread” means occurrence in between 15 and 50 per cent, “scattered” occurs in between 5 and 15 per cent, and “localized” in less than 5 per cent of its potential range (WWF, 2003; Tshering, 2003; Porej and Rajković, 2009; Arshad, 2011).

- **Impact**

Impact is the degree, either directly or indirectly, to which the pressure affects overall area resources. “Severe” impact is serious damage or loss to area resources, including soil, water, flora and/or fauna, as a direct or indirect result of an activity. “High” impact is significant damage to area resources. “Moderate” impact is damage to wetland resources that is obviously detectable, but not considered (WWF, 2003; Porej and Rajković, 2009; Lopes Simões et al., 2010).

- **Permanence**

Permanence is the period of time needed for the affected area resources to recover with or without human intermediacy. Recovery is defined as the retroflection of ecological structures, functions, and processes to levels that existed prior to the activity’s occurrence or existence as a threat. “Permanent” damage is damage to the area resource that cannot recover, either by natural processes or with human intervention, within 100 years. “Long term” damage can recover in 20 to 100 years. “Medium term” damage can recover in 5 to 20 years. “Short term” damage can recover in less than 5 years (WWF, 2003; Kus Veenvliet and Sovinc, 2009).

Pressure and threat factors were rated based on RAPPAM methodology according the table 2.

Table 2. Scoring for pressures and threats module

Extent	Impact	Permanence
Throughout = 4	Severe = 4	Permanent = 4
Widespread = 3	High = 3	Long term = 3
Scattered = 2	Moderate = 2	Medium term = 2
Localized = 1	Mild = 1	Short term = 1

(WWF, 2003؛ Lopes Simões *et al.*, 2010)

The extent, impact and durability of each pressure or threat factor was scored based on Table 2. Then, the scores obtained from the extent, impact and durability of the factors were multiplied by each other, and the final score for each factor of pressure or threat was obtained. Each threat or pressure factor can have a score from one to 64. Then, the cumulative rate (CR) of the pressure or threat was obtained for each wetland under study. The cumulative rates of threats and pressure are the sums of the scores' means obtained from all the pressure or threat factors of any wetland (WWF, 2003).

3. Results and Discussion

In this study, the most important threat and pressure factors on wetlands in Khuzestan province were identified using the Delphi method. Finally, 27, 16, 11 and 10 pressure and threat factors were identified for Shadegan, Hoor_ Al_Azim, Bamdezh and Miangaran wetlands, respectively. The important pressure and threat factors on Khuzestan wetlands shown in table 3.

Table 3. The important pressure and threat factors on Khuzestan wetlands

Shadegan Wetland	Hoor_Al_Azim Wetland
• Entering the urban sewage • Establish the commercial port • Establish the petrochemical complex • Conversion of land use • Hunting • Collection of Plants • Establish the Roads • Establish the thermal power plant • Drought • Establish the Fishing Jetty • Establish the Industrial town • Establish the Steel manufacturing • Soils cut and fill • Establish the Aquaculture plan • Entering the Agricultural drains • Dam building • Discharge the ballast water • Breaking the old oil pipe • Entering the Industries sewage • Conflagration • Establish the upper lands irrigation and drainage plans • Establish the Rail ways	• Entering the urban sewage • Dam building • Establish the Roads • Conversion of land use • Immethodical use of water resources • Hunting • Collection of Plants • Entering the Agricultural drains • Erosion in upper lands • Drought • Conflagration • Oil and Gas exploration and operation • Invasive alien species • Water quality changes • Establish the frontier dike
Miangaran Wetland	**Bamdezh Wetland**
• Entering the urban sewage • Dam building • Proprietorship problems • Conversion of land use • Immethodical use of water resources • Hunting • Collection of Plants • Establish the Roads • Drought • Erosion in upper lands	• Immethodical use of water resources • Entering the urban sewage • Dam building • Conversion of land use • Hunting • Collection of Plants • Invasive alien species • Drought • Erosion in upper lands

After specifying the most important factors of pressure and threat affecting the wetlands of the province, the factors were rated using the RAPPAM methodology in various expert sessions. The results of the average scores of the pressure and threat factors obtained from the questionnaires are shown in figures 2-5. Furthermore, diagrams of the cumulative degree of pressure and threat, as well as a comparative diagram of the cumulative degree of the important factors of pressure and threat on the wetlands under study are provided in figures 6 and 7.

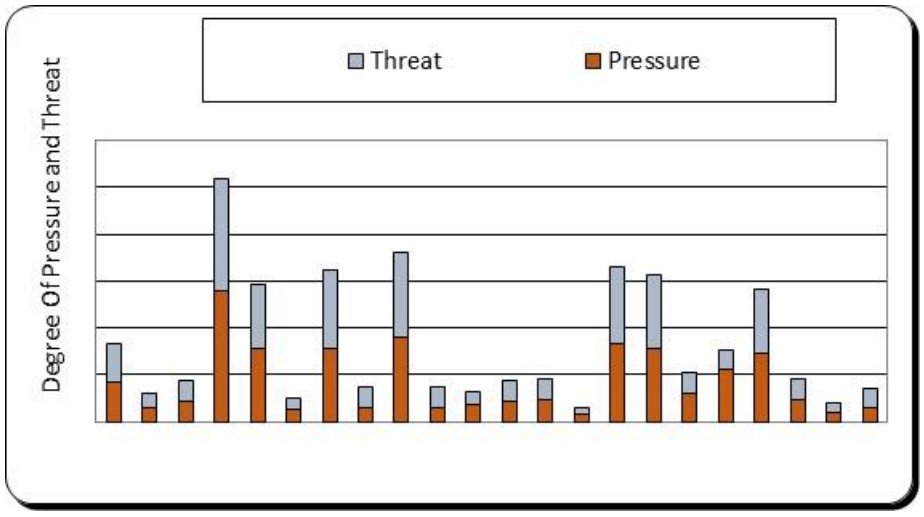

Figure 2. Average degree of pressures and threats in Shadegan wetland

Wetlands have been described as the kidneys of the landscape because of their function in the hydrological and chemical cycles. Furthermore, they have been described as biological supermarkets since they support rich biodiversity and food cycles. Now, about 50 percent of the wetlands of the world have been destroyed (Olarewaju *et al.,* 2014).

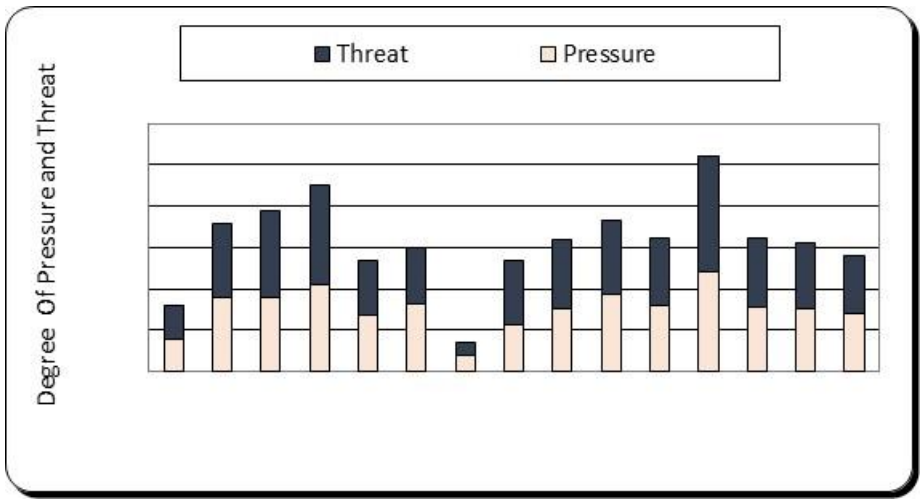

Figure 3. Average degree of pressures and threats in Hoor_Al_Azim wetland

Wetlands are a valuable part of our cultural and natural heritage. They are important resources for human interests and activities, as well as habitats that support a rich diversity of animal and plant life (Biswasroy *et al.,*2011).

Many wetlands have been lost as a result of pollution or drying. These sites are places that receive surface water and water flowing off watershed that carries nutrients, minerals, and organic and even toxic materials, and wetlands transfer these materials to the open waters around them. The construction of buildings, roads, dams and promenades, taking water from water resources, drying wetlands and turning them into arable lands, introducing indigenous species, excavating trenches, drainage, digging, and so on are part of the development plans that undoubtedly affect wetlands (Allan, 2004).

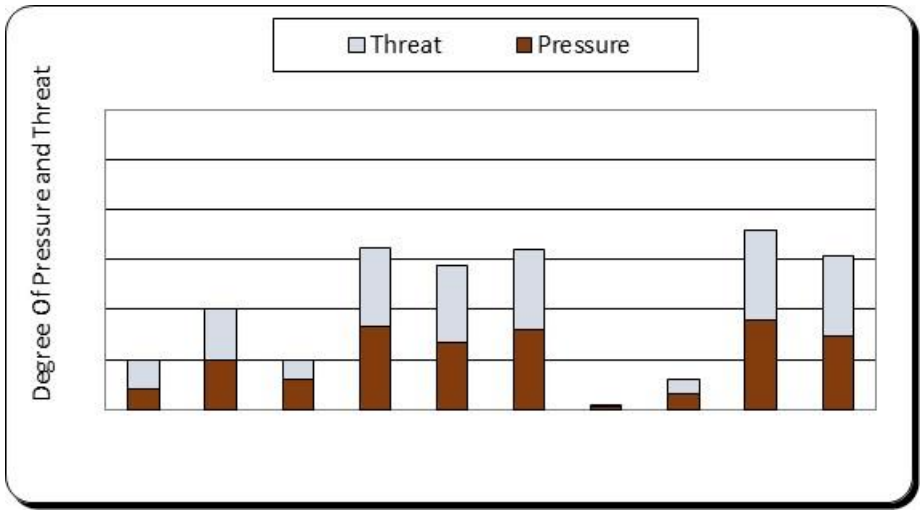

Figure 4. Average degree of pressures and threats in Miangaran wetland

The Shadegan wetlands are among the largest international Iranian wetlands that stretch from the Khor_e_Musa estuaries in the south to the Persian Gulf in the north. In the present study, 22 causes or activities were identified as the main pressure and threat factors for these wetlands and were rated based on the RAPPAM methodology. The results suggest that vast changes in the land use of wetlands to residential and agricultural, erosion and the breaking of pipe lines used for transferring oil and petroleum products in wetlands, illegal and out-of-season hunting, and drought had the highest scores of threat and pressure for these wetlands.

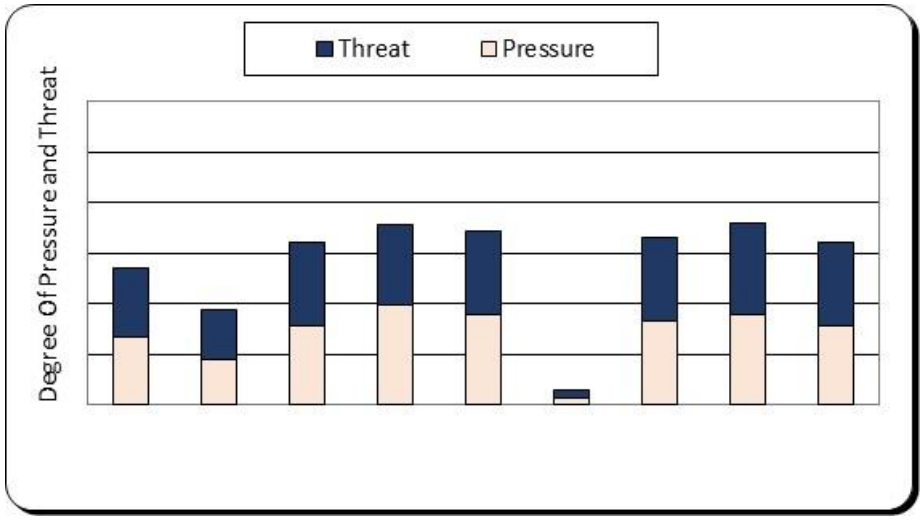

Figure 5. Average degree of pressures and threats in Bamdezh wetland

Due to the abundance of oil and gas related installations and industries in Khuzestan province and their large distribution over the northern and southern part of this province over the years, the Shadegan wetland have been used as a north-south corridor for laying oil and gas pipelines. Unfortunately, due to the age and exhaustion of the lines in question, frequent failures occur in them that not only lead to the leakage of a great deal of oil and other petroleum products into the wetlands, but also result in occasional firings.

Due to the rapid development of Shadegan city and its surrounding villages, with residential areas being located in the proximity of Shadegan wetland, there have been lots of changes in the land uses of wetlands, something which is drastically increasing. Moreover, because of the extension of the residential

uses and traditional context of the local communities, vast areas of the wetlands have been occupied for agricultural and livestock uses. Furthermore, in recent years, vast areas of the wetlands have been captured by public institutions and military-security agencies. Similar studies indicate that in Slovenia, Cambodia and Southern Africa, the most important pressure and threat factors for protected areas are associated with land use changes. (Kus Veenvliet and Sovinc, 2009; Goodman, 2003; Lacerda *et al.,* 2004). This indicates the high demand on the part of human societies to possess the wetland areas. The southern part of the wetlands, which ends in the Khor_e_Musa estuaries, is severely affected by the pollution entering from the petrochemical industries active in the area.

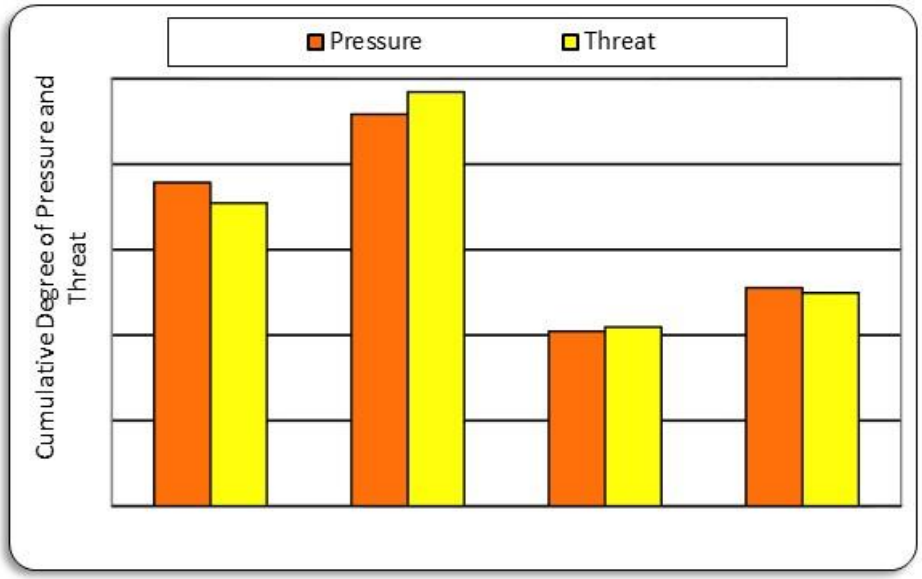

Figure 6. Cumulative pressures and threats on studied wetlands

The Hoor_Al_Azim wetland, which are in fact the Iranian part of the large Mesopotamian wetlands, is located in the western extreme of Khuzestan province. This is also considered the water border between Iran and Iraq, and is located on vast oil tables. Thus, during recent years there has been extensive damage and invasions in the wetland as a result of measures taken to discover and utilize these oil tables. According to the study on the Hoor_Al_Azim wetland, 15 threat and pressure factors were identified and analysed.

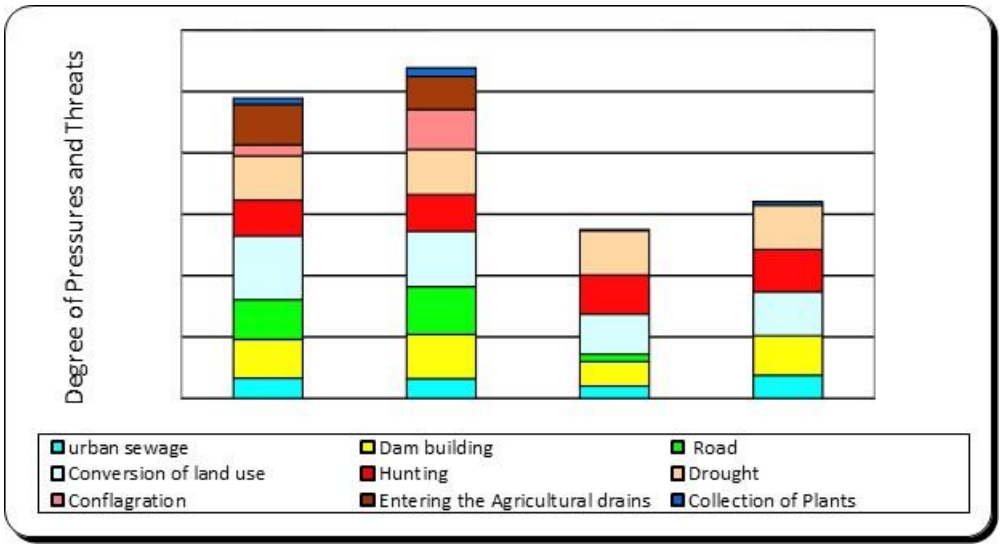

Figure 7. Comparing cumulative pressures and threats factors on studied wetlands

The following factors had the highest scores as the most important threat and pressure factors on the wetland considered: dam construction, an extreme decrease in incoming water feeding the wetland, overfishing, the drainage of agricultural sewage, and the construction of access roads for oil discoveries, which has led to a fragmentation of the ecosystem and drastic changes in the quality of the wetland' water as a result of pollutants. Regardless of the strategic and economic significance of oil, due to a lack of attention from managers and officials in the oil industry of the country to the importance and values of this wetland, irreparable damage has unfortunately been caused to the resources in the area. The construction of access roads, residential camps, oil discovery and exploitation operations all over the wetland, drying large amounts of the wetland for access and exploitation purposes, and so on are among the most important stresses exerted on the Hoor_Al_Azim wetland by oil formations. According to the results of studies performed using the method in Bhutan and Brazil, road construction and fragmentation of ecosystems pose the highest level of threats to natural areas (Tshering, 2003; Lopes Simões *et al.,* 2010).

In addition to of whether showers, which have a small share of the water supply in the wetland, the major sources supplying water for the wetland are rivers, such as the Karkheh River on the Iranian side. Recently, the construction of dikes and large dams over freshwater inlets of the Hoor_Al_Azim wetland has led to a drastic reduction in biological water rights for the wetland. Moreover, the recent drought has also doubled the impact of the construction of water structures over rivers ending in the wetland. The overfishing and utilization of unusual fishing methods, such as toxins, electro shockers and explosives, such as dynamite which has been used more since the collapse of the Iraqi government, are also other threat and pressure factors influencing the wetland. It should be mentioned that fishing with explosives is also seen. Another stressful factor is the drainage from agriculture and human sewage from the cities of Hoveizeh, Susangerd and Bostan into the wetland. This factor considerably affects the wetland because of the high salinity of the underground waters and soil in the area. Similar studies performed in Russia also show pollutions in natural environments as the most important pressure factor for natural ecosystems (Tyrlyshkin *et al.,* 2003).

Like other wetlands of Khuzeshtan province, the Bamdezh wetland have been affected by a wide range of human and natural factors. This wetland is located in the north west of Ahwaz city, which is of importance to the area because of its contribution to the control of floods, and the supply of surface waters and forage. A total of nine pressure and threat factors have been identified and investigated for this area of wetlands. The most important threat and pressure factors on this area of wetlands are the changing use of the wetlands to agricultural and residential, drought, the accumulation of sediments in the wetland, the reduction in the area and depth of the wetland, the of hunting birds and aquatic organisms living in the wetland ecosystem, the overutilization of water resources, and the drastic reduction in the wetland' water supplies. The strategic position of the wetland among the surrounding villages, the rapid development of rural areas and the uncontrolled possessions of lands have led to a considerable reduction in the area of the wetland.

The uncontrolled overutilization of the wetland' water for agriculture and aquaculture, the construction of dams and several dikes over the wetland water inlets, and recent droughts are some of the other factors influencing the depth and area of the wetland. The excessive hunting of birds is also another pressure and threat factor influencing the Bamdezh wetland; this is not easy to prevent and control for supervisor agencies because of the scope of the area and the number of communities residing in the area. In addition, in recent years, the construction of aquaculture ponds has led to the introduction of new aquatic species to the Bamdezh wetland, which can change the number of indigenous aquatic organisms in the long term.

The Miangaran wetland in the north of Khuzestan province are located on the hillside of the heights facing Izeh city. This wetland is the fourth widest wetland in the province and are important because of their role in controlling floods and hosting migratory birds during the cold months of the year. According to the results of the studies conducted, the most important pressure and threat factors for the Miangaran wetland are drought, the reduction of depth caused by the entrance of sediments produced from severe soil erosion in the upstream of the watershed, and bird hunting, especially in seasons when hunting is

banned. Drought and a discernable decrease in rainfall in the watershed ending in the Miangaran wetland have also resulted in a drastic reduction in the scope and depth of the wetland, as well as an increase in the concentration of water chemical factors such as salinity. Since the natives of the area own a large number of hunting rifles and they practice illegal bird hunting, this area of wetland has lost its status as a safe residing place or refuge for migratory and indigenous birds that used to regenerate in the area. For countries such as Brazil, Nepal, Cambodia, Romania, Mongolia and China, illegal hunting and fishing is also the most important threat and pressure factor for protected ecosystems. (Lopes Simões *et al.,* 2010; Lacerda *et al.,* 2004; Stanciu and Steindlegger, 2006; Nepali, 2006; Li *et al.,* 2003; Batsukh and Belokurov, 2005).

Furthermore, according to Figure 7, illegal hunting and fishing, dam construction in the upstream watershed, drought, sanitation and land use change can be seen in all wetlands of the province, while road construction and discharge of agricultural drainage in the Miangaran, Hoor_Al_Azim and Shadegan wetlands are observed.

4. Conclusion

This study reveals that land use changes and encroachments on the wetlands, drought, the violation of water rights by constructing dikes, unprofessional exploitations, and uncontrolled manipulations by public companies, especially those associated with the discovery and utilization of oil, are threatening the lives of the southern wetlands in Iran. Analysing and comparing the cumulative rate of pressure and threat that is the sum of the scores' means obtained from the pressure and threat factors for each area of wetlands showed that Hoor_Al_Azim wetland with 458.5 pressure CR and with 484.5 threat CR faced the highest degree of stressful factors and human activities. Furthermore, the Miangaran wetland, with 204.5 pressure CR and 209.5 threat CR, are in a better conditions than other wetlands of the province. This study also shows that Hoor_Al_Azim wetland and Shadegan wetland, among other wetlands of the province, due to having higher scores of threat and pressure, should receive a higher degree of importance for the management and protection or elimination of stressful factors.

Documents and information obtained in this study show that if serious actions to eliminate or reduce the pressures and threats on theses valuable ecosystems are not taken, there will undoubtedly be extensive changes and irreversible damage in the wetlands of the Khuzestan province.

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Appendix

Sample of pressures and threats questionnaire

Pressures and Threats

Pressures:

☐ **Has** ☐ **Has not been a pressure in the last 5 years**

In the past years this activity has:	The overall severity of this pressure over the past 5 years has been:		
	Extent	**Impact**	**Permanence**
O Increased sharply	O Throughout (> 50%)	O Sever	O Permanent (> 100 years)
O Increased slightly	O Widespread (15 - 50%)	O High	O Long term (20 - 100 years)
O Remained constant	O Scattered (5 – 15 %)	O Moderate	O Medium term (5 - 20 years)
O Decreased slightly	O Localized (< 5%)	O Mild	O Short term(< 5 years)
O Decreased sharply			

Threats:

☐ **Will** ☐ **Will not be a threat in the next 5 years**

The probability of the threat occurring is	☐ The overall severity of this threat over the next 5 years is likely to be:		
	Extent	**Impact**	**Permanence**
O Very high	O Throughout (> 50%)	O Sever	O Permanent (> 100 years)
O High	O Widespread (15 - 50%)	O High	O Long term (20 - 100 years)
O Medium	O Scattered (5 – 15 %)	O Moderate	O Medium term (5 - 20 years)
O Low	O Localized (< 5%)	O Mild	O Short term (< 5 years)
O Very low			

(WWF, 2003; Porej and Stanišić, 2009; Kus Veenvliet and Sovinc, 2009)