In the Name of God

Vulnerability Assessment of Iran Ramsar Sites Concepts and Methodology

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Preface

Assessing the vulnerability levels of wetland ecosystems and their components can be used as an effective tool to prioritize conservation programs, formulate and reinforce policies and programs, develop management strategies, budget and identify the needs and information deficiencies. In this regard, the Conservation of Iranian Wetlands Project has developed an approach to assess the vulnerability of Ramsar sites in Iran in its 2017 work plan. This booklet provides an approach based on the available information, documents and the knowledge of national, provincial and local experts and does not require specific laboratory conditions and tools. This booklet will guide the reader from the theory of vulnerability assessment to practical steps towards its implementation and, by providing a framework for assessing Ramsar vulnerabilities in Iran's sites, it describes the implementation process. For more information, please visit the website at «http://www.wetlandsproject.ir»

Special acknowledgment is due to Dr David Ness, Adjunct Associate Professor, University of South Australia (UniSA) and chair of Ecological Development Union International Inc. (EDUI), and his UniSA colleagues, Dr. Chan Panditharatne, Dr Harpinder Sandhu, Dr Ke Xing and Prof Ying Zhu, who have been eagerly cooperating with us since the early writing of this booklet.

Khuran Straits, Hormozgan

Photo: Neda Pazukinejad

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Hamun Wetland, Sistan & Baluchestan

Photo: Ali Mohajeran

Conservation of Iranian Wetlands Project

CIWP is a joint initiative between GEF, UNDP and the Iranian government (led by the Department of Environment), which was initiated in 2005. CIWP aim is to systematically remove or substantially mitigate the threats to sustain Iran's wetland ecosystems. CIWP has started the implantation of the activities in three important wetlands of the country as demonstration sites and is making an effort to disseminate the achieved experiences to the other country's wetlands by presenting a managerial system and providing legal tools for implementation of the system.

In the along with the establishment of the ecosystem approach and the development of a management plan for the country's wetlands, attention to monitoring and evaluation as an instrument for protecting the inventory and value of wetlands, an understanding of the existing conditions and the rational use of them through management planning processes is inevitable. Especially in recent decades, the destruction of coastal buffer systems, and due to the negative effects of human activities and severe climate changes, have increased the vulnerability of wetlands and have significant environmental, economic and social consequences for local communities and wetlands residents.

Based on this, the preparation and development of a Ramsar vulnerability assessment guide for Iran's sites in the 2017 work plan was considered by the Conservation of Iranian Wetlands Office.

Lake Urmia, West Azerbaijan

Photo: Ali Mohajeran

Iran Ramsar Sites

Wetland habitats are one of the most important natural ecosystems on the earth that have long played a substantial role in development of the surrounding societies.

Ramsar Convention- the oldest international treaty with the subject of world nature conservation - was endorsed in Ramsar City of Iran for the purpose of protecting wetlands valuable ecosystems. By emphasizing on the wetlands' role in supplying the needs of human societies, the convention has set wetland biodiversity conservation as its main objective. Since the beginning Iran has played the main role in formation of Ramsar Convention and by the time the convention officially came into force, Iran was one of the first 7 countries, who joined the Convention as a contracting party.

Table 1. Ramsar Convention: The oldest international treaty on the conservation of nature

Year and place of signature	1971 - Ramsar City, Iran
Types of wetlands defined in the Ramsar convention	42 types
Types of wetlands in Iran	41 types
The number of Iranian wetlands of international importance	105 wetlands
The number of Iranian wetlands registered in Ramsar Convention	35 wetlands in the form of 24 titles
Area of Iranian wetlands registered in Ramsar Convention	1486438 hectares

IRANIAN RAMSAR SITES

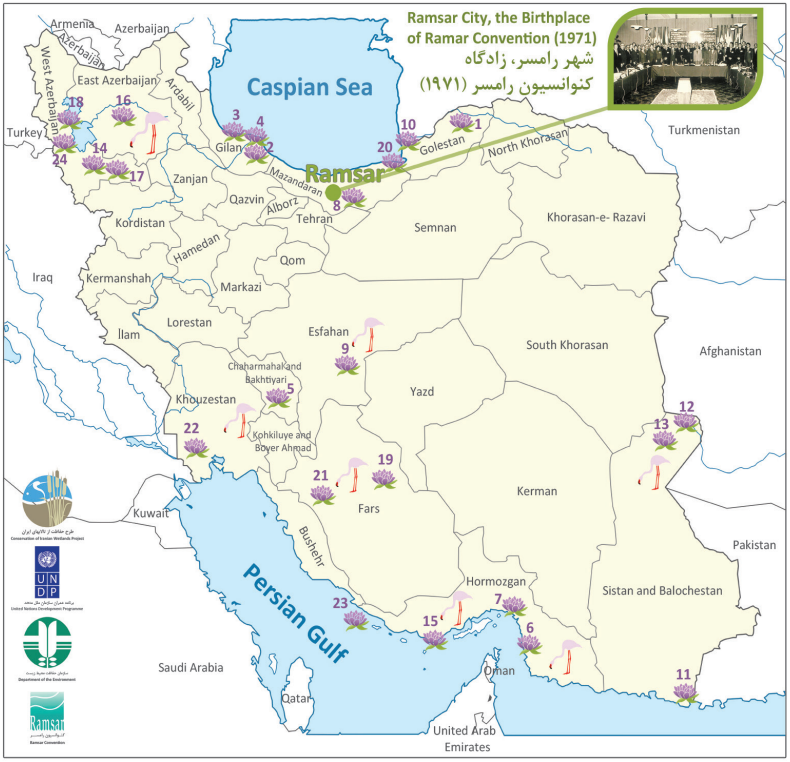


Fig 1. The map and list of Iranian wetlands that have been registered as Ramsar site in the Ramsar Convention

List of Ramsar Sites
رامسر سایت های ایران

Alagol, Ulmagol and Ajigol Lakes (1)	مجموعه آلاگل، آلماگل و آجی گل (۱)
Amirkelayeh Lake (2)	تالاب امیرکلایه (۲)
Anzali Mordab (Talab) complex (3)	تالاب انزلی (۳)
Bujagh National Park (4)	پارک ملی بوجاق (۴)
Choghakhor Wetland (5)	تالاب چغاخور (۵)
Deltas of Rud-e-Gaz and Rud-e-Hara (6)	دلتای رود گز و رود هرا (۶)
Deltas of Rud-e-Shur, Rud-e-Shirin and Rud-e-Minab (7)	دلتای رود شور شیرین میناب (۷)
Fereydoon Kenar, Ezbaran& Sorkh Ruds Ab-Bandans (8)	آب بندان های فریدونکنار، ازباران، سرخه رود (۸)
Gavkhouni Lake and marshes of the lower ZaindehRud (9)	تالاب گاوخونی و تالاب های پایین دست زاینده رود (۹)
Gomishan Lagoon (10)	تالاب گمیشان (۱۰)
Govater Bay and Hur-e-Bahu (11)	خلیج گواتر و هور باهو (۱۱)
Hamun-e-puzak, south end (12)	هامون پوزک (۱۲)
Hamun-e-Saberi & Hamlm-e-Helmand (13)	هامون صابری و هیرمند (۱۳)
Kanibarazan Wetland (14)	تالاب کانی برازان (۱۴)
Khuran Straits (15)	خور خوران (۱۵)
Lake Gori (16)	تالاب گوریگل (۱۶)
Lake Kobi (17)	دریاچه قوپی (۱۷)
Lake Urmia (18)	دریاچه ارومیه (۱۸)
Lake Parishan & Dasht-e-Arjan (19)	تالاب پریشان و دشت ارژن (۱۹)
Miankaleh Peninsula, Gorgan Bay and Lapoo-Zaghmarz Ab-bandan (20)	شبه جزیره میانکاله، خلیج گرگان و آب بندان لپوزاغمرز (۲۰)
Neyriz Lake & Kamjan Marshes (21)	تالاب های نیریز و کمجان (۲۱)
Shadegan Marshes & Mudflats of Khor-al Amaya & khor Musa (22)	تالاب شادگان، خور الامیه و خور موسی (۲۲)
Sheedvar Island (23)	جزیره شیدور (۲۳)
Shurgol, Yadegarlu & Dorgeh Sangi Lakes (24)	تالاب های شورگل، یادگارلو و درگه سنگی (۲۴)

Anzali Wetland, Gilan

Photo: Reza Mostafavi

Vulnerability assessments; introduction and expression of the problem

Wetlands provide livelihood for millions of people and they are the controllers of many crises such as water degradation, flood, storms, erosion and decomposition of carbon. These valuable ecosystems throughout the world have long been subject to destruction due to human activities and climate changes. And many of their remaining habitats also suffer from instability, destruction of coastal buffer systems, due to the negative effects of human activities and severe climate changes which increased the vulnerability of wetlands, and has significant environmental, economic and social consequences for local communities and residents of that area. Therefore, the identification of threats is essential in order to understand the conditions of wetland ecosystems, assess the vulnerability level and resilience of their dependent communities in order to develop effective management strategies. In terms of vulnerability, various definitions are provided but in general, it can be deduced that vulnerability is a dynamic and multidimensional concept.

The vulnerability consists of two dimensions; the external dimension emphasizes on the risk and the internal dimension on the coping disability and the low capacity for rebuilding. Vulnerability can be described as the ability to set up a system by three aspects of vulnerability (exposure, sensitivity, and adaptive capacity) to mixing and external forces. In fact, the concept of vulnerability is a function of three elements of exposure, sensitivity and adaptability. Therefore, vulnerability can be attributed to the sensitivity of a system that is susceptible to exposure to environmental and social changes due to lack of capacity for compatibility. Based on this, understanding the vulnerability and the interactions between the various structures and processes that lead to vulnerability is useful in providing a better understanding of the system. Vulnerability

assessment provides information they need to prioritize management and conservation plans for species and habitats. The vulnerability assessment of ecosystems can be solutions to reduce the level of vulnerability by reducing threats, technical solutions and adaptation to limit the negative outcomes of threats. This booklet provides an approach for assessing the vulnerability of Ramsar sites in Iran.

In this approach, a number of key components of wetland systems, endangered habitats, species and local communities associated with them are identified and after defining the indicators affecting them through quantitative and qualitative processes, taking into account expert opinions of managers, experts, and local communities, will measure the vulnerability level of Ramsar sites.

Goals

- To be aware of the current situation of Ramsar sites in Iran and their changes over the past 25 years
- Determination of sensitivity, resilience and capacity of wetlands adaptation to various pressures and tensions.
- Investigating the economic and social impacts of wetlands damage on livelihood and those of local communities affiliated with them
- Understanding the vulnerability of Ramsar sites by focusing on major and endangered habitats, key variables and commercially important ones
- Vulnerability assessment of Iranian Ramsar sites at three levels of biodiversity, habitats and local communities
- Assessing the impact of threats on wetlands and providing suggestions and solutions for effective adaptation
- Monitoring and management consistent; determining the steps necessary to ensure that the desired results are achieved
- Providing management advice, and increasing measures to reduce, and mitigate destructive effects
- Capacity providing for wetland managers and organizations responsible for conducting transparent and systematic vulnerability assessments
- Increasing resilience, and reducing the vulnerability of habitats, species, and communities associated with wetlands

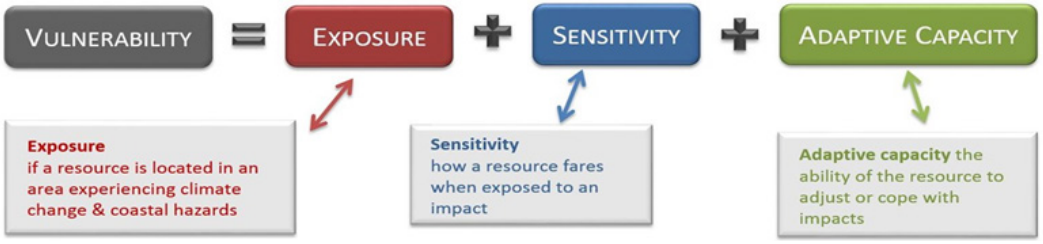
Hamun Wetland, Sistan & Baluchestan

Photo: Ali Mohajeran

Vulnerability

Vulnerability is a cumulative concept that involves analyzing the dual economic-social responses to environmental change. Some scientists define vulnerability as: The sensitivity of a system that is vulnerable to exposure to environmental and social changes due to lack of capacity for compatibility.

Therefore, individuals or systems are damaged in varying degrees in this phenomenon; vulnerability is defined as the ability of individuals or a system to predict, resist, quit, and regain its power against dangers and defines two dimensions. The external dimension emphasizes the exposure, and the internal dimension the coping disability and low capacity for re-construction. The concept of vulnerability is a function of three elements of exposure, sensitivity, and adaptive capacity.



Exposure

Exposure is a set of ways to deal with environmental, social, and economic stress. Exposure refers to the pressures of varying frequency, nature, severity, duration, and area of stress change.

Sensitivity refers to the intrinsic properties of species or systems, and the extent to which the system is affected by the degree of vulnerability. Sensitivity can be described as having a different degree of exposure to disturbances and shocks.

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Adaptive Capacity

Adaptive capacity refers to the ability of species or systems to remedy the negative effects of threats. This adaptive capacity can be achieved through species response, or ecosystems, or through human activities to reduce vulnerability to actual or expected changes in wetland areas. It refers to the ability of a system to deal with, or solve social, economic, and environmental stress. The ability of a system to respond to stress and tensions is defined as an adaptive capacity.

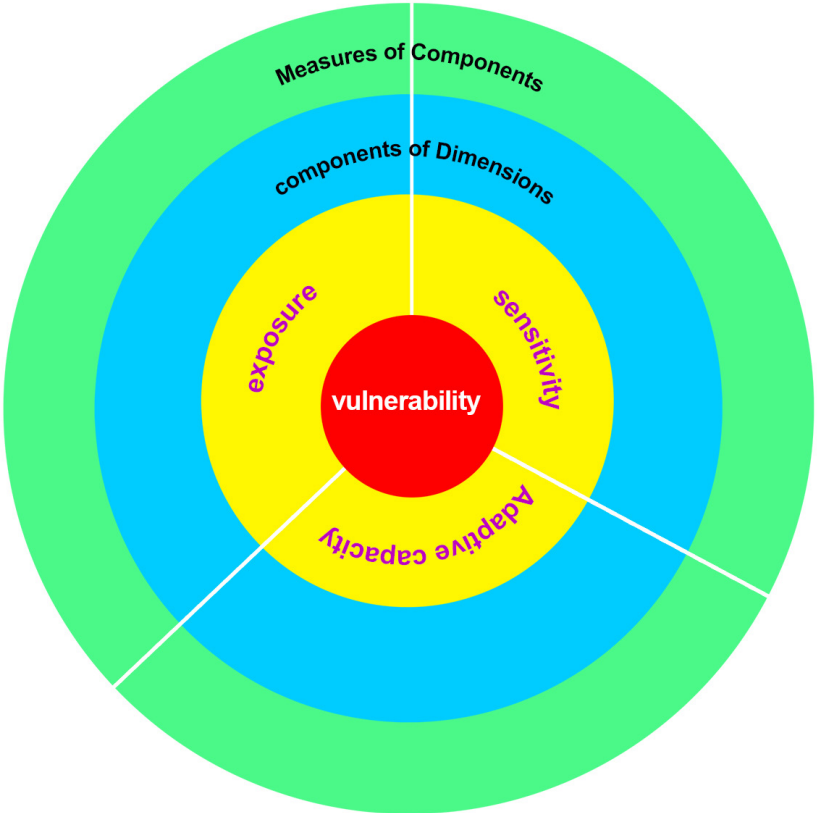

Fig 2. Vulnerability: a combination of exposure, sensitivity and adaptive capacity

The mode of interaction of exposure, sensitivity and adaptive capacity

Vulnerability assessment depends on exposure, sensitivity and adaptive capacity. Their interaction can be seen in Figure (3). This vulnerability assessment sought to geographically portray each of the factors by looking at the sub-factors that drive exposure, sensitivity and adaptive capacity. In order to quantitatively and qualitatively understand the vulnerability of process and outputs, vulnerability assessment is combined with a range of parameters. Although, vulnerability assessment is not a metric quantity, it has relative, dimensional, and non-measurable features. Three dimensions of vulnerability assessment are categorized into components or features that are from exposure, sensitivity, and adaptive capacity. These attributes can be evaluated with a number of measurements that are the visible features of each component.

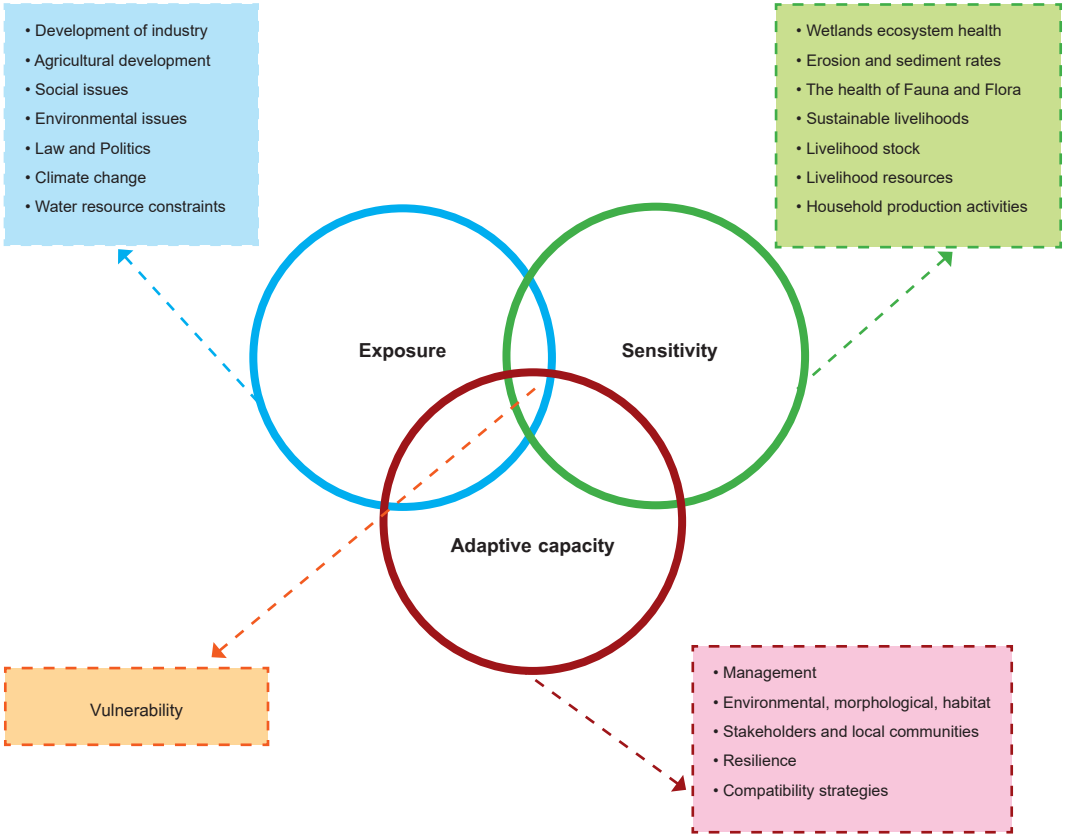

Fig 3. The mode of interaction of exposure, sensitivity and adaptive capacity

Deltas of Rude-e-Shur,Rud-e-Shirin and Minab, Hormozgan

Photo: Neda Pazukinejad

The vulnerability assessment method of Iran Ramsar sites

The vulnerability assessment method presented here, can be used to measure the level of vulnerability of Ramsar sites at three levels of biodiversity, habitats and their dependent communities, providing the capacity for wetland managers and organizations responsible for implementing transparent and systematic vulnerability assessment, providing management advice in the direction, reducing and modifying destructive effects and identifying information needs.

By reviewing the previous sources and considering the prevailing conditions in Iran's Ramsar sites, the International Center for Environmental Management (ICEM), vulnerability assessment method, implemented in 2012 under the joint project between IUCN, World Fish, SEA StART in Hanoi, Vietnam, The International Center for Environmental Management (ICEM) has assessed the vulnerability of wetlands at three levels; habitat, biodiversity, and local communities. Advantages of the method (ICEM), in addition to a rapid assessment provide information for managers to prioritize management and conservation programs for species and habitats. Addressing vulnerability assessment in terms of climate change is one of the disadvantages of this approach.

Considering the conditions governing Ramsar sites of Iran and because climate factors are not the only factors affecting Ramsar sites, the office of conservation of Iranian wetland project, and by accepting the general framework of this method, decided that with the participation of provincial, regional and local experts, they would devise a set of indices influencing the human and natural activities affecting the wetlands, species and local communities associated with wetlands in the form of worksheets, developing and evaluating the level of vulnerability of Ramsar sites. Accordingly, in order to assess habitat vulnerability and biodiversity in wetlands, four basic information worksheets, threats, exposure, sensitivity and adaptive capacity were developed, due to different dimensions and complex relationship between culture, economics and ecology, and in order to assess the vulnerability of wetland-dependent local communities, and in addition to worksheets of exposure, sensitivity and adaptive capacity, worksheets containing threats and strategies,

productive activities, sustainable livelihoods, measuring the level of vulnerability of livelihood resources, livelihood strategies, and measuring the resilience of household livelihoods. These criteria and indicators are valued in a numerical range between 1 (the lowest) and 5 (the highest).

To understand the dimensions, components, and evaluation indicators, and after identifying and evaluating the indicators, according to the managers and experts involved in the process, the vulnerability scoping diagram will be drawn (The diagram below is schematic).

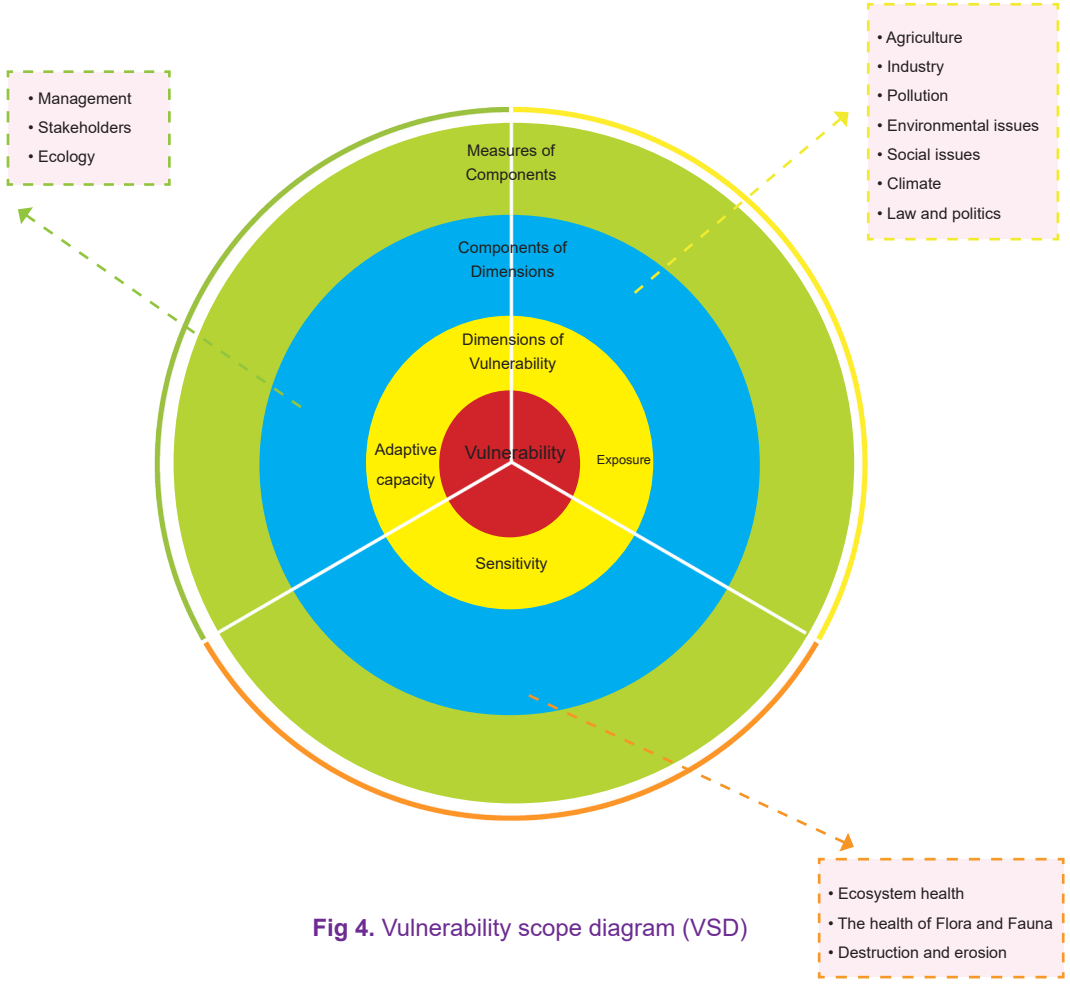

Fig 4. Vulnerability scope diagram (VSD)

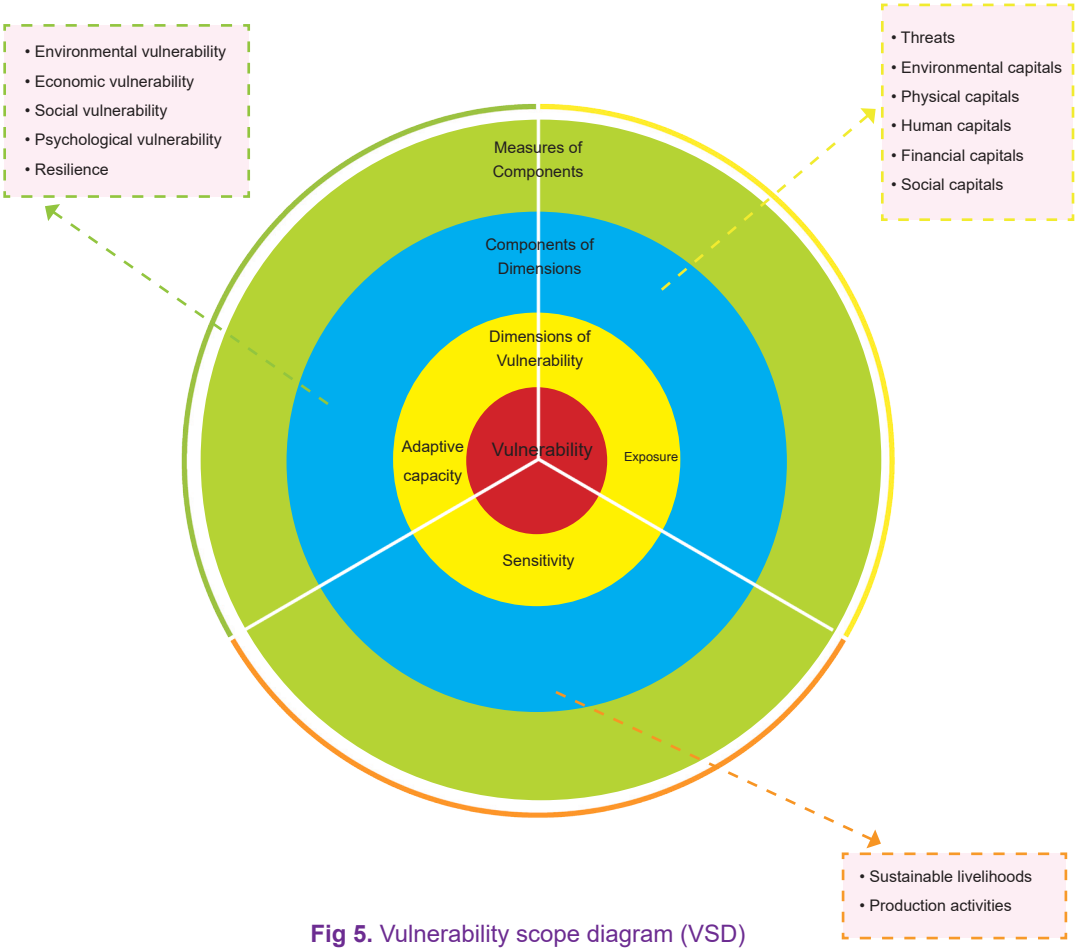

Fig 5. Vulnerability scope diagram (VSD)

Table 2. Habitat and biodiversity vulnerability assessment indices

Agriculture	1-Extraction of surface water 2-Extraction of ground water 3-Agricultural development 4-Land subsidence
Industry	5-Implementation of industrial projects 6-Implementation of construction projects 7-Sand mining 8-Expansion of oil, gas and petrochemical projects 9-Road development 10-Land use change 11-Docking and occupation of beaches 12-Tourism 13-Aquaculture 14-Urbanization
Pollution	15- Pollutants and waste disposal
Environmental issues	16- Susceptible geological formations 17-Water and soil salinity 18-Enter non-native species
Social issues	19-Increasing population 20-Hunting 21-Fishing 22-Overgrazing
Climate	23-Temperature change 24-Precipitation change 25-Dealing with drought 26-Dealing with flood 27-Hurricanes and strong winds 28-Sea level changes 29-Tsunami 30-Tide
Law and politics	30- Environmental law 31- Ecological water right violation 32-Border issues and overseas 33-Lack of inter-basined integrated management 34-Lack of provincial integrated management
Ecosystem health	35-Surface water level 36-Water table dropdown 37-Development of agriculture 38-Agricultural drainage pollution 39-Eutrophication 40-Nitrate density 41-Oil pollution 42-BOD and COD concentration 43-Increasing water and soil salinity 44-Extreme harvest from wetland vegetation 45-Rangeland degradation 46-Changing in the time pattern of precipitation 47-Changing in the amount, intensity, frequency precipitation 48-Flash floods sediment 49-Changing the depth of the wetland 50-Hydrological changes 51-Partial decisions making

The health of flora and fauna	52- Increasing poverty of local community 53-Decreasing of key species 54-Conflicts between native and non-native species
Erosion, sedimentation	55- Land degradation 56-Water erosion 57-Wind erosion
Management	58-Problemsd in management plan and executive policies review 59- Power of rules and regulations 60- Monitoring 61- Adequate human resources 62-Research 63- Implementing business plans
Stakeholders	64-Effective communication between NGOs and beneficiaries 65- Training to learning new approach of conservation and utilization 66-Identifying alternative careers 67- People's participation in decision making 68-Lack of adequate knowledge of local communities
Ecology	69-Resilience wetland flora and fauna 70- Increasing invasive species due to climate change 71-Restoration relative to the weather events 72-Adequate space for change allow expansion or "movement" of the habitat 73-Physical barriers that might prevent expansion or "movement" of the habitat 74-Habitat be a existing or future refuge or other species 75-Habitat Communication 76-Matching species with sexual reproduction with conditions 77-Genetic diversity and population size 78-Behavior species compliance with new conditions 79-Ability to self-pollinate in environments 80-Ability of adaptation to ecological niches 81- Ability of adaptation or change biological threshold of species

Table 3. Local communities vulnerability assessment indices

Threats	1.Drought 2.Flood 3.Extreme winds 4.Extreme heat 5.Extreme cold 6.Typhoon 7.Hail 8.Dust 9.Terrible fire 10.Sand storms 11.Rainstorms 12.Outbreak of contagious diseases
Environmental capitals	13.Diversity of plant species, 14.Diversity of terrestrial species, 15.Diversity of aquatic species, 16.Quality of water, 17.Quality of soil 18.Microclimate regime, 18.Landscapes
Physical capitals	20.Ownership of residential land, 21.Ownership of cropland and horticultural land, 22.Ownership of land around the wetland, 23.Per capita water available, 24. Households irrigated cropland area 25.Number of crops produced, 26.Number of small livestock, 27.Number of big livestock, 28.Number of poultry (geese, ducks, turkeys, …)
Human capitals	29.Knowledge about production of non-agricultural produce (mushrooms and honey), 30.Health, 31.Life expectancy, 32.Abilities to diversify income sources
Financial capitals	33.Reserves and savings in families, 34.Satisfaction from the amount of income, 35.Access to facilities, 36.Income from agriculture, 37.Income from tourism
Social capitals	38.Communicating with others in the village, 39.Participating in events such as festivals, joyous occasions and mourning ceremonies in the village, 40.Participate in village meetings
Sustainable livelihoods	41.Reduction in income, 42.Loss of job opportunities, 43.Loss of rural infrastructure, 44.Vulnerability of livelihood resources (land, orchards, rangelands…), 45.Increased levels of crime, homicide and disputes, 46.Loss of norms and values, 47.Loss of local traditions and customs, 48.Loss of social capital, 49.Decrease in trust between the people, 50.Increase in migration, 51.Loss of natural and man-made recreational facilities, 52.Instability in status of women in communities, 53.Loss of attractive landscapes, 54.Increase of pollution (water, soil and air), 55.Increase in dust haze and respirational diseases, 56.Damage and loss of fauna/flora, 57.Decline in the quality of water resources and energy, 58.Increased public awareness about environmental matters, 59.Increased participation of community elders in governance and decision-making, 60.Increased farmer participation in programs relative to wetland degradation, 61.Increased social inequality in the village, 62.Increasing physical and mental illness

Production activities	63.Livestock, Agriculture, 64.Hunting and Fishing, 65.Handcraft, 66.Harvesting vegetation, 67.Industrials depended on wetland (Aquaculture, …)
Resilience	68.Economic 69.Social 70.Psychological 71.Environmental 72.Institutional
Environmental vulnerability	73.Cropping pattern, 74.Soil erosion, 75.Water quality, 76.Method of irrigation, 77.Drought resistant varieties, 78.Dust
Economic vulnerability	79.Poverty, 80.Malnutrition, 81.Land modernization, 82.Crop insurance, 83.Savings, 84.Crop loss, 85.Agricultural income, 86.Non-Agricultural income
Social vulnerability	87.Occurrence of homicide and crime, 88.Relying on government, 89.Cultural customs, 90.Social status, 91.Community cohesion, 92.Life stability, 93.Migration of Youth, 94.Addiction
Psychological vulnerability	95.Self-esteem, 96.Self-efficacy, 97.Hope, 98.Risk taking, 99.The ability to make decisive decisions, 100.Social overall happiness

Hamun Wetland, Sistan & Baluchestan

Photo: CIWP Archive

After evaluating the indicators, the P-VSD diagram, which is based on the conceptual framework and graphical representation of the status of indicators of exposure, sensitivity and adaptive capacity, is presented to integrate knowledge and to find a comprehensive view of all relevant indicators and factors.

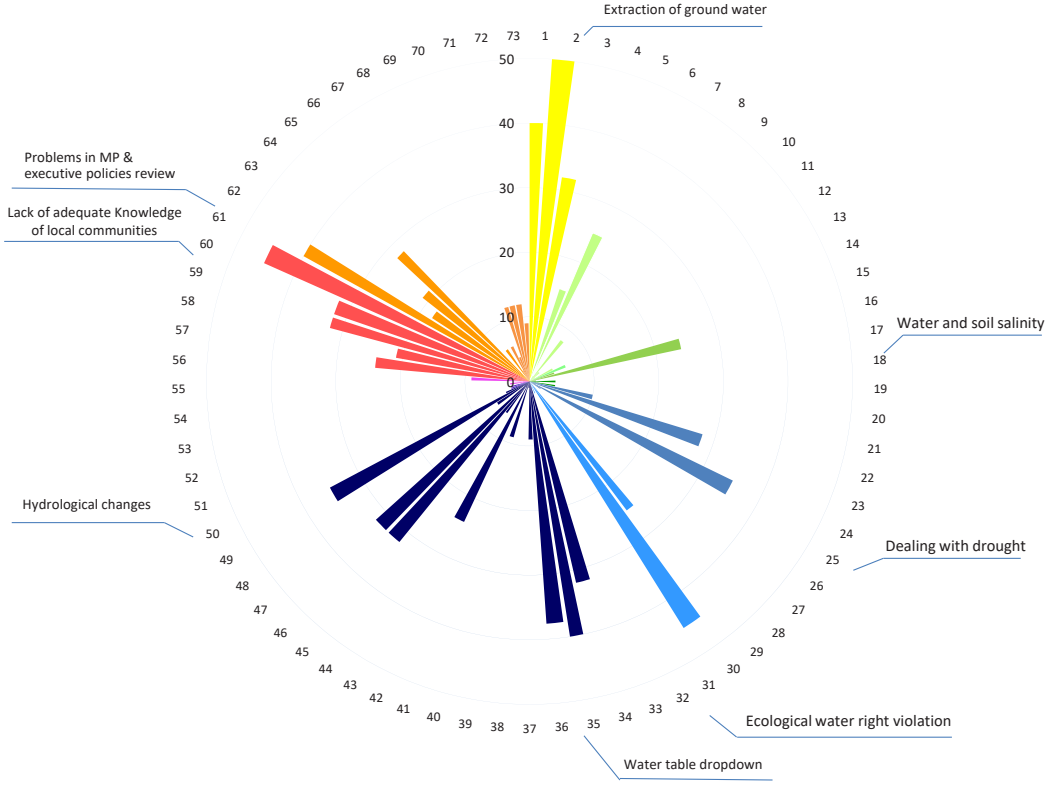

Fig 6. Participatory Vulnerability Scoping Diagram

Accordingly, the value and coefficient of influence of each index of the number of vulnerabilities are obtained according to the following formula.

$$\text{Vulnerability of each Dimension} = \frac{\text{SUM (Score of each indicator * Weight of each index)}}{\text{(Total value of weight of all indices)}}$$

$$\text{Vulnerability} = \frac{\text{(Exposure+Sensitivity+Adaptive capacity)}}{3}$$

The vulnerability range (1 to 5) is divided into 5 categories. Each degree of vulnerability is within a time interval of 0.7

Table 4. Vulnerability classification

Categories intervals	Low	High
Extremely high vulnerability	4.2	5
High vulnerability	3.4	4.1
Moderate vulnerability	2.6	3.3
Little vulnerability	1.8	2.5
Very few vulnerabilities	1	1.7

Some questions and indicators may not be appropriate for all habitats, species, and communities. So, the nature of some questions may change. It needs to be explained, prior to the implementation of the vulnerability assessment process, that there should be agreement on the content of the questions, indicators and criteria. Also, in order to estimate the uncertainty of the evaluation, a section is introduced in order to enter the confidence rating of experts. The confidence score for each question will be considered according to the table below. The result of this assessment method is to identify the relative vulnerability of wetland habitats, species, and local communities to stressors. However, the results of this process are non-quantitative, and are based on expert opinions. In order to limit the uncertainties arising from the views and opinions of the experts and the accuracy of the assessment, according to the information gathering reference, the relevant assurance score is assigned to each question according to the table below.

In addition to considering the relevant scores for expert opinions and determining the existing uncertainties, the status of national and international conservation of habitats and species should also be identified.

Table 5. The score table assures the opinions of different users (ICEM, 2012)

Confidence score	The probability of being correct	Degree of assurance expert's opinion	Degree of confidence with regard to local environmental knowledge
4. Very high confidence	At least 9 out of 10	expert's opinion and accurate examination of available documents	Experienced local people or team consensus and observation of the phenomenon
3. High confidence	About 8 out of 10	The only expert opinion	Group consensus with local expert opinion
2.Medium confidence	About 5 out of 10	Non-expert opinion	Experienced local people
1. Little confidence	About 2 out of 10	Best guess	Individual opinion
0 - Very low confidence	Less than 1 out of 10	I do not know	I do not know

Table 6. Basic status and vulnerability number

	score	confidance
Base status		
Vulnerability		

Table 7. The national and global conservation status

The Final Confidence	score
Description of Final Confidence	
National Conservation Status	
Global Conservation Status	

Table 8. National conservation status

A	National Park
B	Natural Monument
C	Wildlife Refuge
D	Protected Areas
E	Unprotected

Table 9. Global conservation status

F	Ramsar Site
G	UNESCO Biosphere Reserve
H	World Heritage Site
I	Not specified

In order to understand the potential contribution of the vulnerability to the base situation, the vulnerability scores are designed to be against the baseline conservation. The graph below shows the four sections of the low-security status and low vulnerability to high conservation status and high vulnerability. These charts will help managers identify and prioritize management plans generally, species and habitats that are under low conservation conditions and exposed to low stress require less attention. Species and habitats that are located in a low conservation area and high vulnerability require long-term strategies to maintain population and quality of habitats and need less urgent action finally, species and habitats that are high in protection and vulnerability require immediate action against threats.

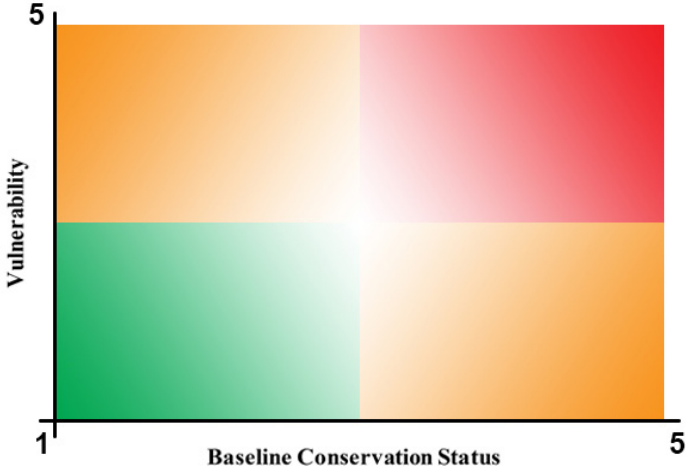

Fig 7. Vulnerability quad parts and conservation status

- Require immediate management attention
- Require longer term strategies to maintain populations or habitat quality
- Require less attention

Throughout the process of implementing the vulnerability assessment process, managers, experts and local experts participate in setting up specialized workshops and meetings to target and exchange information. Stakeholders are continuously involved in the consultation process, email, meetings and exchange of reports, and participate in the evaluation process. At the end of the evaluation process, workshops will be held to analyze the results for the preparation of programs to improve policies, formulate management priorities and provide effective adaptation strategies.

Deltas of Rude-e-Shur,Rud-e-Shirin and Minab, Hormozgan

Photo: Neda Pazukinejad

Components & general steps of vulnerability assessment of Iran Ramsar sites

The CIWP vulnerability assessment method has two main components in the elementary part, and by evaluating the documents, records, reports and information available, the ecological assessment is carried out by local experts and specialists from habitats and wetland species types. In the second part, during a visit with managers, experts and a team of local experts from the wetland being present, a rapid assessment of the status of the wetland is carried out. Both components will help to provide a transparent assessment of the wetland and provide a high degree of reliability assessment.

The main components

- **Assessment relying on ecologists, taxa and rural development experts**
- **A rapid vulnerability assessment can be made in the field with wetland managers and community experts.**

The vulnerability assessment process involves four general steps in the first stage, information is collected from the history of the wetland, species, wetland habitats and local communities associated with the wetland this information includes the physical conditions, the main beneficiaries of the wetland, the species and habitats of the wetland. In the second phase, meetings and joint workshops will be held with the participation of managers, experts and representatives of popular organizations and local communities in

order to understand the methodology, indicators and evaluation criteria. In the third stage, field surveys are conducted to quickly assess the presence of the wetlands and local communities around the wetlands for managers, experts and experts. In the final stage, according to the results of the relevant worksheets and field observations, a summary of the vulnerability of the wetland will be made.

Four general steps

Steps to implement the vulnerability assessment process of Iran Ramsar Sites

First step: Understanding the concept of vulnerability assessment

Second step: Organizing a team that includes: managers, experts and local

Third step: Holding the common meeting in order to understand the project

Fourth step: Investigation documents and available information, identifying key

Fifth step: Holding a workshop and understanding indicators and evaluation

Sixth step: Filling worksheets and estimating quantitative indices by expert

Seventh step: Holding workshops with stakeholders and reviewing worksheets

Eighth step: Field visits with the presence of managers, specialists and experts

Ninth step: Reviewing results and understandings the

Tenth step: Determining the conditions and conservation status

Eleventh step: Determining the degree of habitat vulnerability, species and local communities

Twelfth step: Holding meetings with stakeholders and manager regarding management recommendations for habitats and species, and recommendations for specific Ramsar sites

Thirteenth step: Conclusion and compiling guideline for vulnerability assessment and development the master plan and action plan

Shidvar Island, Hormozgan

Photo: Neda Pazukinejad

Samples of vulnerability assessment

The outcome of vulnerability assessment for habitat/species

Vulnerability scope diagram (VSD)

Stakeholder engagement in vulnerability assessments is also highlighted in the VSD. This conceptual framework was designed to improve understanding of index-based vulnerability and to facilitate comparisons among index. The VSD provide techniques for rapid subjective vulnerability assessment. According to outcomes of shared meetings and participatory procedures with the attendance of managers, experts, specialists, and local community representatives, the most influential factors on habitats and species were detected, and the vulnerability scope diagram was drawn (Fig 5). According to the following diagram, agriculture, industry, pollution, environmental and social issues, climate, law and policy are considered the most significant factors in the dimension of exposure; whereas ecosystem health, fauna and flora healthfulness and destruction and erosion for sensitivity dimension and management, stakeholders' and ecology for adaptive capacity dimension were taken into account.

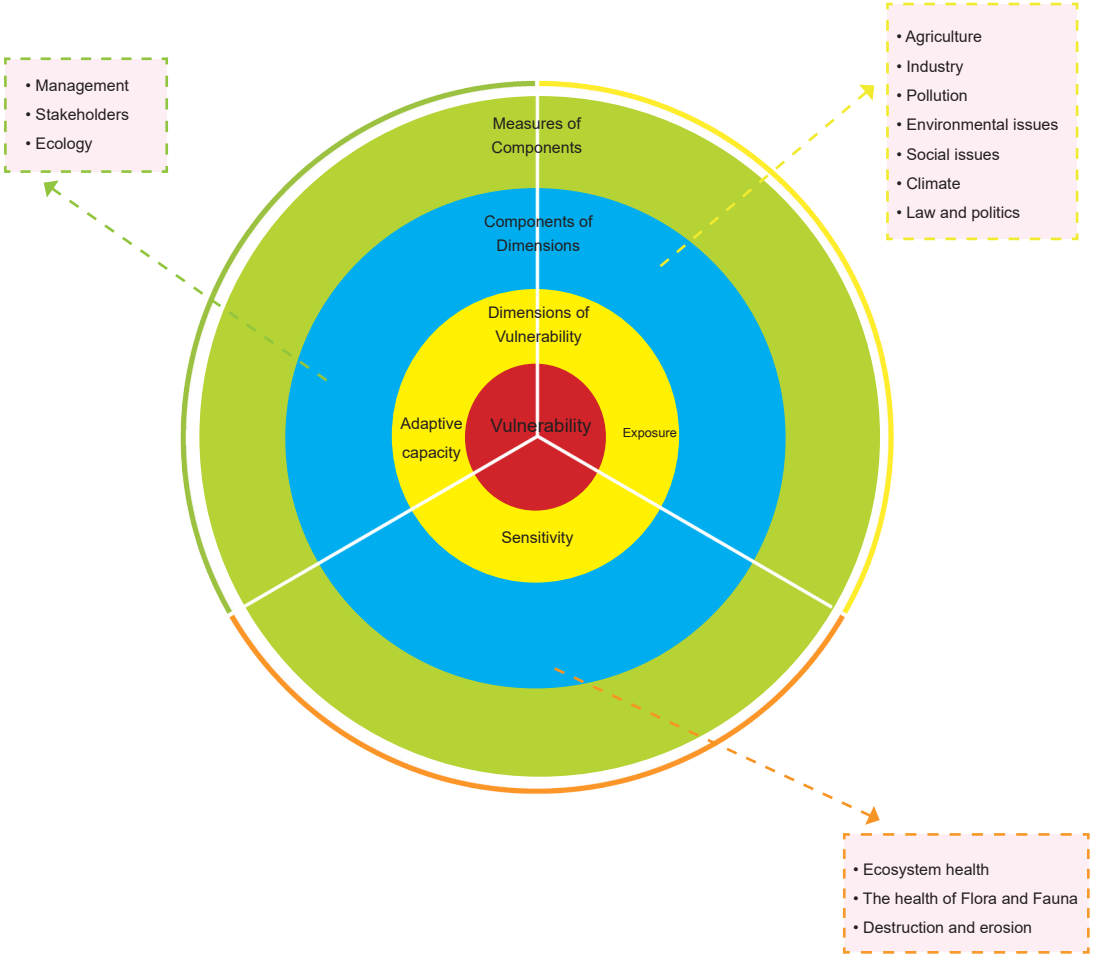

Fig 8. Habitats and species vulnerability scope diagram

P-VSD participatory vulnerability scope diagram

The P-VSD begins with participant-driven identification, definition, and categorization to provide a manageable ranking of a large number of vulnerability. To obtain the overall risk ranking, the P-VSD involves deliberative valuation, which is an iterative process of determining ranks through group discussion. When the worksheets were filled out, the affecting indicators and the score of each factor, the P-VSD diagram were illustrated. According to the outcomes of P-VSD the factors of extraction of grand water, water and soil salinity, dealing with drought, ecological water right violation in the dimension of exposure, the factors of water table dropdown and hydrological changes in dimension of sensitivity, lack of adequate knowledge of local communities in utilization and conservation of wetland and problems in management plan and executive policies review for the dimension of adaptive capacity were detected as the most significant. The outcomes of P-VSD illustrate how managers and experts can provide a place-specific picture of subjective vulnerability that distinguishes between index of exposure, sensitivity, and adaptive capacity. Also results of this diagram can lead the managers to a better decision-making process and prioritize the actions to be taken.

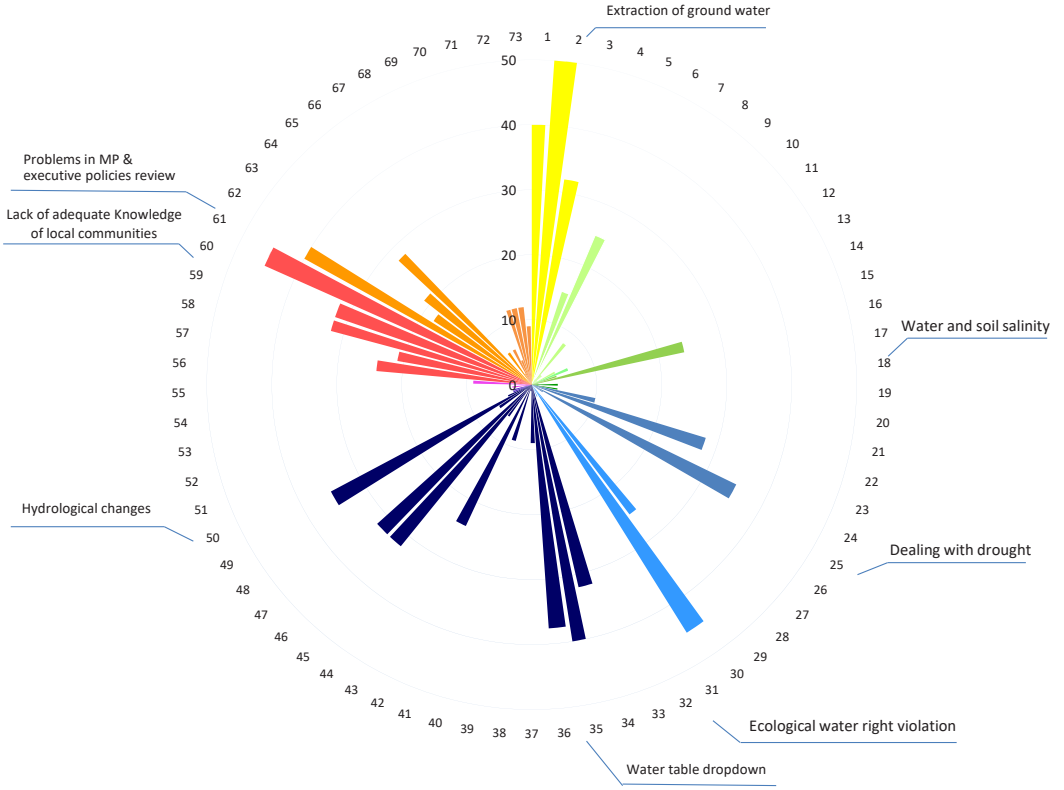

Fig 9. Participatory vulnerability scope diagram (P-VSD)

Vulnerability final score

The value and coefficient of the influence of each index of the number of vulnerabilities are obtained according to the following formula.

$$\text{Vulnerability of each Dimension} = \frac{\text{SUM (Score of each indicator * Weight of each index)}}{\text{(Total value of weight of all indices)}}$$

$$\text{Vulnerability} = \frac{\text{(Exposure+Sensitivity+Adaptive capacity)}}{3}$$

The confidence score obtained 4.2 on the basis of expert opinions.

Table 10. Summary of vulnerability assessment of habitat

Vulnerability dimension	Vulnerability score	
Baseline	3.16	The extinction and severe reduction of species in this habitat is a serious issue and there are a wide range of threats against the conservation of habitat. The habitat normally require flood for regeneration and normally does not require fire for regeneration
Threat	3.78	Extraction of surface and ground water, agricultural development, water and soil salinity, exacerbated droughts, hydrological changes and ecological water right violation
Exposure	3.75	Extraction of surface and ground water, implementation of construction and industrial projects, agricultural development, wind erosion, water and soil salinity, exacerbated droughts, Precipitation change, ecological water right violation
Sensitivity	3.78	Reduce surface and groundwater level, hydrological changes
Adaptive capacity	3.71	Problems in management plan and executive policies review, lack of adequate knowledge of local communities in conservation and utilization of wetland, not identifying alternative careers, weaknesses in the rules and regulations
Vulnerability	3.75	High vulnerability

Management recommendations

According to the estimated of habitat indicators, the level of vulnerability is high and requires immediate management measures against threats. Formulating policies to create a mechanism for inter-basin policy, formulating effective rules and regulations, and taking the necessary steps to reduce the following levels Integration can be considered as an indicator in order to develop long-term strategies to reduce vulnerability, taking into account complementary livelihoods.

The four-quartered diagram of vulnerability/protection situation was illustrated according to the vulnerability and protection situation amount, based on which the diagrams for relatively habitats/species are situated in fairly high protection sector and high vulnerability one which demonstrates the necessity of urgent measures against the threats.

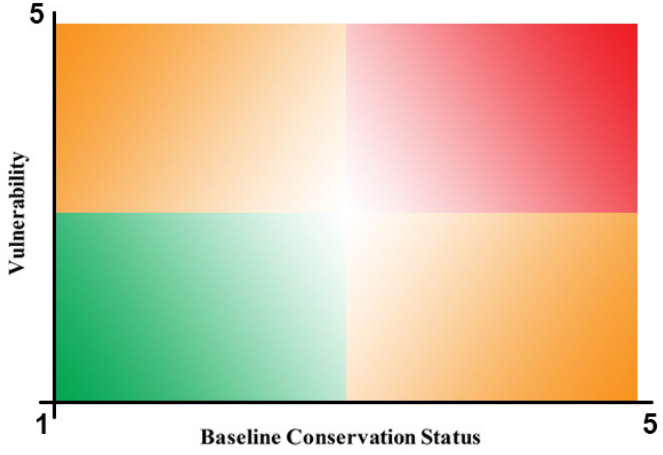

Fig 10. Vulnerabilities part and conservation status

- Require immediate management attention
- Require longer term strategies to maintain populations or habitat quality
- Require less attention

The outcomes of vulnerability assessment for local communities

Vulnerability scope diagram (VSD)

VSD is illustrated according to the results of experts shared meeting. According to the following diagram threats, capitals livelihood, sustainable livelihood and production activities, resilience and level of vulnerability (economical, social, psychological and environmental) belong to as being the key component.

Fig 11. Vulnerability scope diagram (VSD) for local communities

Participatory vulnerability scope diagram (P-VSD)

According to the outcomes of P-VSD diagram the factors of drought, extreme winds, extreme heat, dust, outbreak of contagious diseases in the component of threats, the factor of aquatic species diversity, soil and water quality, microclimate regime and landscape (Environmental), per capita water available, variety of cultivated agricultural crops, the number of small and heavy livestock (Physical), health and life expectancy (Human), ability to diversify income sources and ability to save income in households (Financial), traditions of the local indigenous (Social), in the component of capital livelihoods, the reduction in income, loss of job opportunities, vulnerability of a variety of livelihoods, reduce people's trust in each other, losing the attractiveness of the landscape, increasing environmental pollution, water resources quality degradation, increasing the phenomenon of social inequality in the village, increased physical and mental illness in the component of sustainable livelihoods, the factors of agriculture and harvest vegetation in the component of production activities,

The results shown social, environmental and institutional resilience were high, but the resilience to economic and psychological were low. Also in the component of vulnerability water quality degradation and dealing with dust (Environmental), reduction in agricultural incomes, increasing agricultural waste (Economical), decreasing in the marriage of children, Increasing Migration (Social) and reduction in hope, risk taking and social overall happiness (Psychological) were detected as the critical index.

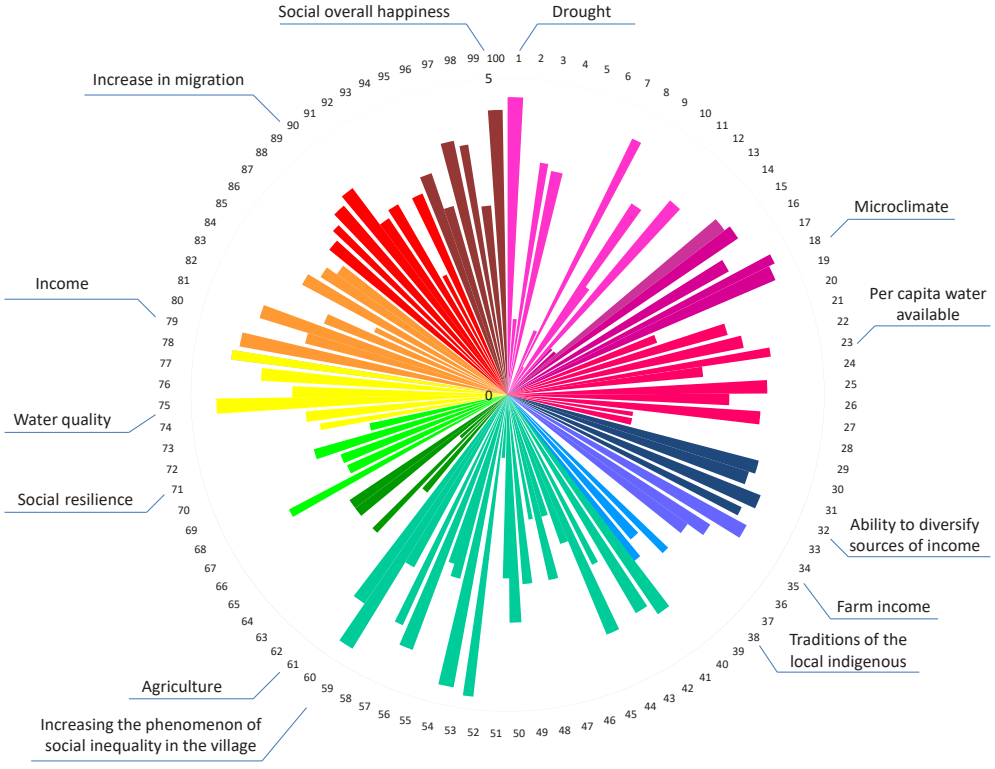

Fig 12. Participatory vulnerability scope diagram (P-VSD) for local communities

The final amount for vulnerability of local communities

Due to complicated relationships between culture, economy, ecology, adaptability, and their being bound to vulnerability of local communities, the collection of different indices were evaluated. According to the outcomes from VSD and P-VSD diagrams, the vulnerability of local communities in terms of Psychological, Social, Environmental, Economic are 4.0, 2.7, 3.6, 3.5 respectively.

Table 11. Summary of vulnerability assessment of local communitie

Vulnerability dimension	Description
Threats	Drought, Extreme winds, Extreme heat, Dust, Outbreak of contagious diseases
Environmental capital	Aquatic species diversity, Soil and water quality, Microclimate regime and Landscape
Physical capital	Per capita water available, Variety of cultivated agricultural crops, The number of small and heavy livestock
Human capital	Health, Life expectancy
Financial capital	Ability to diversify income sources, Ability to save income in households
Social capital	Traditions of the local indigenous
Sustainable livelihoods	Reduction in income, Loss of job opportunities, Vulnerability of a variety of livelihoods, Reduce people's trust in each other, Losing the attractiveness of the landscape, Increasing environmental pollution, Water resources quality degradation, Increasing the phenomenon of social inequality in the village, Increased physical and mental illness
Production activities	Agriculture, Harvest vegetation
Resilience	Social, environmental and institutional resilience are high, but the resilience to economic and psychological are low
Environmental Vulnerability	Water quality degradation, Dealing with dust
Economic Vulnerability	Reduction in agricultural incomes, Increasing agricultural waste
Social Vulnerability	Decreasing in the marriage of children, Increasing Migration
Psychological Vulnerability	Reduction in hope, Risk taking and Social overall happiness

Management recommendations

Local communities of the wetland have a high vulnerability level of aspects of social, environmental and psychological. Depending on the type of production activity and damage to livelihoods of local communities, in particular the reduction of farm and farming incomes focuses strategies on agricultural supplementation. Varied livelihoods and non-agricultural activities and formulate appropriate plans for capacity building of local communities in addressing the risks and development of the subcontractors needed to maintain health is one of the strategies that can be recommended to reduce the vulnerability of local communities.

Glossary

Adaptive capacity: The ability of the species or system to correct and deal with the effects of threats.

Economic capital: Economic capital as the basic structure, production, financial resources that people use to achieve their livelihood goals.

Environmental capital: A term used to talk about saving natural resources from flows and source services (such as food, soil erosion prevention), which is useful for livelihoods.

Financial capitals: Help for financial assistance and grants, such as the existence of banks, credit institutions and microfinance funds in the region, and mechanisms for accessing loans and grants.

Human capital: Human capital involves skills, knowledge, ability, work and health that enable people to pursue different livelihood strategies and achieve their livelihood goals. Agricultural knowledge and skills, economic efficiency of labor force and labor force density are among the most important human capital.

Institutional capital: As a provider of people's access to markets, sharing interests, and accessing and participating in the policy-making process to the extent that the satisfaction of the people involved in decision-making reflects better livelihood outcomes.

Livelihood components: Includes human capital, social capital, environmental capital, institutional capital, physical capital and financial capital.

Livelihoods vulnerability: Livelihood vulnerability is a major issue in which livelihood assets are badly affected.

Livelihoods: Includes capabilities, assets and activities necessary for livelihood and a dynamic process that adapts to internal and external stressors and changes.

Physical capital: Includes health and medical, economic, supportive, developmental and educational-cultural infrastructures that are mostly based on the infrastructure of food and family health and sanitation, including the provision of access to sanitation and access to the clinics and health care centers.

Resilience: The ability of systems to adapt to changes, without collapsing in accidents.

Sensitivity: The characteristics of the species or system and the degree to which the species or system is affected by the vulnerability.

Social capital: Social capital is a social resource that helps people to pursue their livelihoods, and includes social trust, social solidarity, social participation, social networks, and membership in groups, political empowerment and socialization.

Sustainable livelihood: Livelihood that can be adapted and improved by stresses and shocks strengthens or maintains its capabilities and assets.

Vulnerability: The sensitivity of a system that is damaged by exposure to environmental and social changes due to the lack of adaptive capacity.

Exposure: The pressures associated with changes in the frequency, nature, severity, duration and area of stress change.

Livelihood strategy: A combination of activities and choices that point to people's dreams in terms of assets, vulnerability, and the system in which they live.

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Karun River, Khuzestan

Photo: Mostafa Gholamnejad