

An overlook to Houbara Bustard (*Chlamydotis undulata*) status in center of Iran (Case study: Shahrood County)

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ABSTRACT

The purpose of this research was to assess various habitats for the Houbara, their role in the conservation of this species, and identification of threats to Houbara Bustard habitats in the Touran protected area (2001 to 2010). The threats identified were prioritized based on the factor analysis method in order to determine the most important ones. By using Geographic Information System (GIS) and Index Overlaying (IO), 12 important plains with the highest possibility of Hubara distribution were identified and field surveys were carried out in these sites. The field studies were mostly based on line and point transects to investigate the birds in each site. The optic equipment for observations includes binoculars with specification of 8×30 and 10×42. In addition, binoculars telescope with 20×50 specification was used for long range viewing. In the next step, an open questionnaire was administered in each site to identify the major threats to the habitats. The interviewees consisted of Department of the Environment guards, experts, eco-volunteers and interested people. The results showed that the habitats for Houbara bustard were degrading. The low diversity of Houbara habitats lead to vulnerability to threats. Concerning present condition, if there is no suitable conservational act, the population would be in great danger and jeopardy.

Key words: Houbara, Habitat, Shahrood County, Biodiversity, Bird Conservation

INTRODUCTION

Protecting biodiversity in a network of reserves has been a major goal of conservationists for more than a century (1). Many national parks and protected areas worldwide are ineffective at protecting biological diversity and ecosystem processes (2).

Despite the fact that Iran is an arid and semi arid country, the bird biodiversity is highly rich. The updated checklist of the birds of Iran consists of 517 species (3).

The presence of birds in a habitat is a good sign of ecosystem integrity and health, and the study of bird avifauna and biodiversity in different habitats is one habitat evaluation methods (4). Scott's (1975) states that protected areas of Shahrood County are amongst the most significant bird areas in Iran and the Middle East.

The Houbara Bustard *Chlamydotis undulata macqueenii* (Figure 1) is a medium-sized gruiform of the family Otididae which inhabits semi-desert and shrub-covered arid plains of West Asia and North Africa (5 & 6). In recent years the species has seen a severe decline throughout its habitat, and the population of the Asiatic Houbara bustard has been declining throughout its geographical range (7). However, very little information is available pertaining to this bird in Iran.



Figure 1. Houbara in natural habitat, Photographed in 2009 in Touran Protected Area, (Photo: Seyed Babak Mousavi)

Furthermore, poaching and habitat destruction have caused unfavorable conditions for this bird, so that it has been classified under LR/t * in the IUCN Red Data Book 2007 (4). According to BirdLife International (2003), source on which IUCN Red List Houbara classification is based, no reliable data on Houbara population decline rates are available; however, “given the substantial threats, declines are likely to be significant and possibly widespread” (8). *Chlamydotis undulata* and *C. macqueenii*, are considered as *C. undulata* by IUCN, and is listed as vulnerable (VU A2bcd 3bcd 4bcd) on the IUCN red list of threatened species (9 & 10). In spite of its global importance, there is no scientific information about the population and distribution of this bird in Iran. The main difficulties for researchers are the large number of habitats, long distances, and its wide distribution throughout Iran (11). Due to the distribution pattern of the Houbara in Iran, the bird is found in over three quarters of Iran (12). The Houbara lives in large areas of remote deserts in Iran. The bird is distributed over the central plateau desert region from the Kavir National Park in the north-west and the Touran desert in the north-east, south to the Sistan plain, central and southern Baluchistan, the low-lying deserts of Khuzestan, Southern Fars, and the desert north of the Persian Gulf. There are only a few reports about the distribution, breeding and wintering of this species in Iran (13-16).

Habitat loss and destruction because of agriculture development, power lines and road construction, military activities, overgrazing, mine prospecting, over hunting including poaching, live catching and smuggling, and gathering of eggs, diseases, and the introduction and presence of alien predators in Houbara habitats are amongst the most important reasons of Houbara classification as a threatened bird (11).

Houbara bustard is an omnivorous bird and its food regime reflects the abundance of seasonal plants and small animals. Plants such as *Medicago sativa* and *Salsola* spp are important food source in winter. Houbara is highly dependent upon alfalfa (*Medicago sativa*) farmlands (17). It selects places with higher vegetation height (18). Having 1.2 to 1.8 percent calcium in dry material alfalfa is a suitable food for Houbara bustard in the winter season. In spring and summer, the bird feeds on invertebrates such as grasshoppers, termites, beetles, silkworms, spider, and ants. Chicks often feed on insects and small reptiles (7 & 19-21). According to the previous studies, the breeding population of the Houbara is found in areas of central, southern and north eastern Iran (14). The studies showed that the relative density of the Houbara in Iran is around 4.95 per 10 000 ha (6). Although a great deal of research has been conducted on Houbara bustard in Arabian countries and Asia, there is a lack of information on density and status of this species in Iran. Table 1 represents a summary of the studies conducted in Iran.

Knowledge about the habitat selection of threatened species is an essential component of their successful management and conservation (22).

The main purpose of this research was to investigate the suitability and importance of the various habitats for the Houbara and the role of these habitats in the conservation of the species. Identification of threats to Houbara Bustard habitats in center of Iran and in the Touran protected area, as one of the biggest and oldest protected areas of Iran, was another purpose of this research. After identification, all threats were prioritized based on the factor analysis method in order to determine the most important ones.

Table 1. Summary of researches on Houbara in Iran

Author (s)	Title	Publication
Mansoori (1974)	The Houbara Bustard in Iran	Report, DOE
Scott (1975)	The Houbara Bustard (<i>Chlamydotis undulata</i>) in Iran	Report, DOE
Mansoori (1983)	The status of the Houbara Bustard (<i>Chlamydotis undulata</i>) in Iran	International Symposium Article
Mortazavi (1993)	Houbara situation in Yazd Province	Report, DOE
Mansoori (1996)	The status of the Houbara Bustard (<i>Chlamydotis undulata macqueenii</i>) in I.R. of Iran	International Symposium Article, IUCN
Saint Jalme & Van Heezik (1996)	Propagation of the Houbara bustard	Book Chapter
Mansoori (2001)	An ecological study of Houbara Bustard in Iran	Ph.D Dissertation
Mansoori & Hassanzadeh Kiabi (2002)	Ecological status of the Houbara population in Iran	Journal Article
Mansoori & Kiabi (2003)	Ecological status of the Houbara Bustard population in Iran	Journal Article
Tourenq et al (2004)	Migration patterns of four Asian Houbara <i>Chlamydotis macqueenii</i> wintering in the Cholistan Desert, Punjab, Pakistan	Journal Article
Ziaei et al (2005)	Master plan for Touran protected area	Report, DOE
Mansoori (2008)	The Hand book for Birds of Iran	Book Chapter
Hingrat et al (2007)	Habitat use and mating system of the Houbara bustard in a semi-desertic area of north Africa: implication for conservation	Journal Article
Heydari et al (2010)	Captive breeding of Asiatic Houbara bustard in Iran: preliminary data and experiences	Journal Article
Riou et al (2011)	A 10-year assessment of Asian Houbara Bustard populations: trends in Kazakhstan reveal important regional differences	Journal Article

MATERIALS AND METHODS

Study area

This area, which is a desert area, was designated as protected area in 1972. Due to its specific characteristics, some parts of the region were later allocated to both wildlife refuge and national park. As a part of the Touran complex, this area has been recognized as a biosphere reserve since 1976 (23). The current area of this region is 1464 992ha and the region lies between longitude 35° and 36°25'N, 55° and 57°E (24). The area is located in Shahrood County (Figure 2) with an altitude range of 700-2400m, annual precipitation between 78 and 231mm, and absolute maximum and minimum temperatures of 42/2 and -15/6 °C, resulting in extra-arid to temperate arid climates (25). Diversity of animal and plant species is a pronounced feature of the region, and 654 plants, 63 of which are endemic, and 250 animal species have been identified (23).

The main steppe vegetation involves prickly thurst, ephedra, halocnemum strobilaceum, soda plant, salt tree, halostachys, glasswort, fennel, plain cousinia, aellenia, wormseed, kashgar tree, almond, cotton cousinia, rosinweed, tamarisk, saxaul, bean caper, willow, trileaf butter cup, and wild Syrian rue. A great number of endemic plant species also grow in the region.

This area is also one of the important habitats for many species, some of which are in the IUCN Red Lists; for example, Cheetah *Acinonyx jubatus venaticus*, Persian Leopard *Panthera pardus saxicolor*, Goitred Gazelle *Gazella subgutturosa*, Persian Wild Ass *Equus hemionus*, Macqueen's Bustard *Chlamydotis macqueenii*, and Eastern Desert Monitor *Varanus griseus caspius* (26). No permanent river is found in the park. The salty seasonal Khartouran River flows in the eastern part of the area (23). High biodiversity of the region, desert nature, and natural sceneries create an invaluable collection of features that provide for educational and scientific activities. They also serve as tourist attraction and genetic treasure (27).

Data collection

This research consists of two different parts, that is to say field survey and literature review. Our investigation was conducted in two time spans, one of which took place from 2001 to 2005 and the other from 2009 to 2010. In the first step, the literature review was done and related sources and documents were collected. In addition, the authors' fifteen-year-old field experience, interview with the local people, hunters and even poachers were other sources of the study. The digital layers and information used were obtained from Iran DOE. To identify possible habits for Houbara bustard, its habitat characteristics were collected from previously conducted researches. These characteristics are presented in table 2.

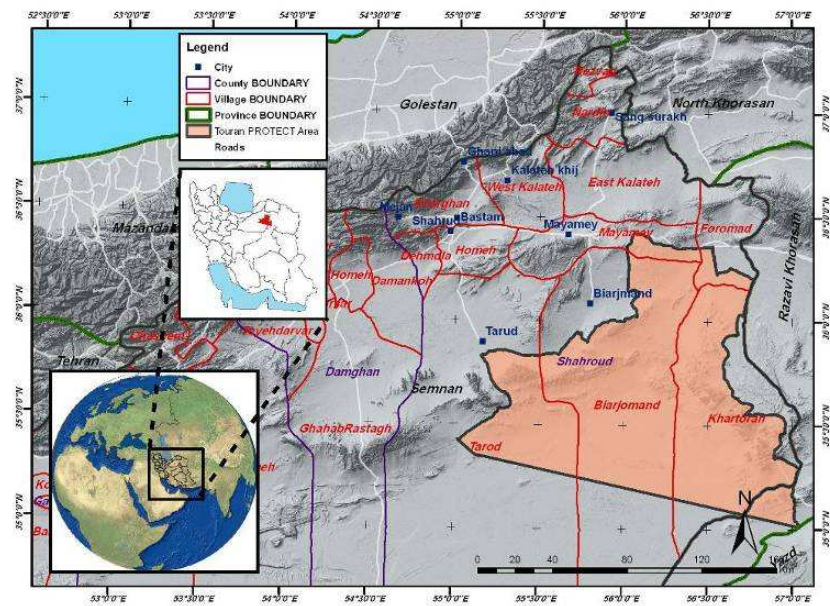


Figure 2. Geographical location of the study area in the world and Iran (Touran Protected Area, 2010)

Table 2. Houbara bustard habitat characteristics

Slope	Vegetation (Important Grass Family)	Aspect	De Martonne Drought index	Slope (%)	Composition of Plant Species (%)		Elevation from sea level (m)	Soil texture	Land use change (%)	Distance from village s(m)
					Grass	Tree				
<20	Euphorbiaceae Compositae Crassulaceae	N S E W NW SW NE SE	<10	<20	10-30	<20	<1500	Sandy Loam Loam Clay Loam	<10	>1000

Source: Adapted from (11, 12 & 23)

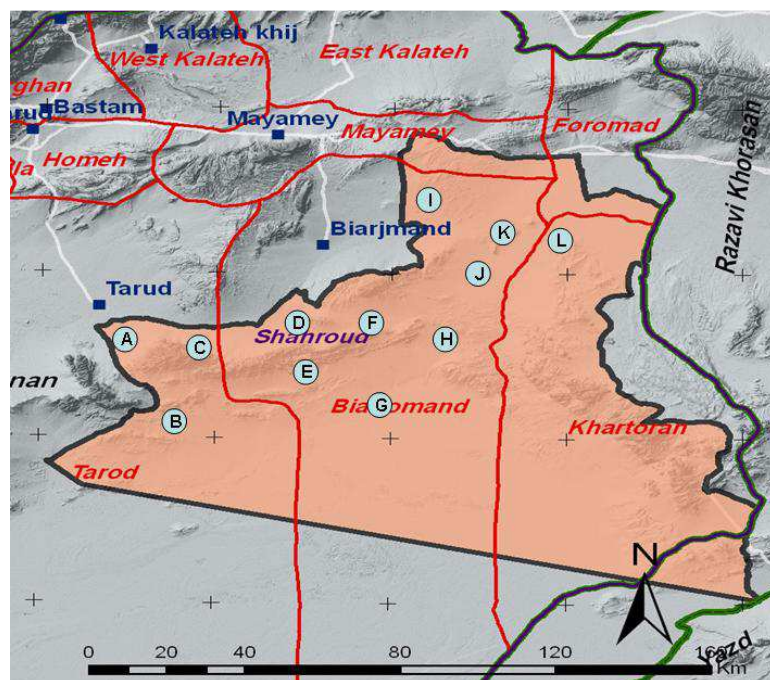


Figure 3. Location of primary (possible) sites believed to have a population of Houbara based on primary data (Touran Protected Area, 2001-2010)

Methodology

Identifying the Houbara habitats

In order to identify the possible habitats for Houbara bustard, GIS and IO were used. The information layers were prepared by means of ArcGIS software version 9.2. Consequently, 12 important plains with the highest possibility of Houbara distribution were identified and the field surveys focused on these sites. The most important habitat sites were determined based on the thirteen layers produced in GIS as follows: 1) situation of the plains, 2) topography, 3) water resources, 4) slope, 5) aspect, 6) distance from the villages, 7) soil condition, 8) floral diversity, 9) mean elevation, 10) floral density, 11) threatening elements, 12) population density, and 13) land cover. Figure 3 shows these 12 sites. In this research, all the maps were prepared in a 1:250000 scale.

In the next step, the field study started. The methodology of the field study was mostly based on line transects to investigate the birds in each site. However, in some places, point transects were employed. The optic equipment for observations includes binoculars with specification of 8×30 and 10×42. Also, for long range viewing, the binoculars telescope with 20×50 specification was used.

There are two types of transect most commonly used in bird surveying, line transects and point transects. Both are based on recording birds along predefined route within a predefined survey unit. In the case of line transects, bird recording occurs continually, whereas for point transects, it occurs at regular intervals along the route and for a given duration at each point. Line and point transects are the preferred survey methods in many situations (28). The advantages of each method are presented by Bibby *et al*, in 1998. Line transects advantages are:

- Covering ground more quickly and recording more birds;
- Less chance of double recording the same bird;
- Good for more mobile, conspicuous and those which flush easily;
- Errors in distance estimation are less serious than point counts; Point transects advantages are:
- Concentrating fully on the birds and habitats without having to watch where you walk;
- More time available to identify contacts;
- More likely to detect the cryptic and skulking species;
- Easy to relate bird occurrence to habitat features

Our pattern of sampling was stratified random sampling. In order to establish our point and line transects the study area (potential habitats) was divided into equal grids with 25km² area and then transects were established in these units randomly.

The flatness of habitats and low density of vegetation made it possible to see most of big and diurnal animals by means of binoculars and telescope. The lack of water resources in the area and its clumped distribution is the cause of bird patchiness around these sources from spring to mid autumn and that is why these are the best for bird watching. Because of these reasons most of our investigation and field surveys was done from the middle of September to middle of October, when there is no grass and water sources are limited.

By comparing previously identified Houbara habitats with the habitats identified in this study, a new map of Houbara distribution was prepared in GIS media.

Determining major threats to the habitats

In order to identify the major threats to the habitats, an open questionnaire was administered in each site. The interviewees were Department of Environment guards, experts, eco-volunteers, and interested people.

Abbreviations used:

GIS: Geographic Information System

IO: Index Overlaying

DOE: Department of the Environment (Iran)

RESULTS AND DISCUSSION

The results are presented in two sections as follows.

A) Houbara Population and distribution

The results revealed that Houbara population in the study area consisted of a native population and a migratory one. In the Touarn Wildlife Refuge and Protected Area, the Houbara population is mainly centralized in three regions:

- Naz Kooh area and Dow Shakh and Haft Dashi plain located between Delbar and Naz Kooh;

- Near to Abooyahya between Chah Madan and Shakh Asb Andaz;
- The plain of Harb located in Teerkoooh side hills and Majarad mountains

Figure 4, shows the Distribution of Houbara in Touran protected area. The results showed that the habitats of Houbara in Touran Protected Area mostly consist of plain areas with relatively dens vegetation. Generally three groups of Houbara can be identified in Touran protected area:

First group:

This group included the population that stayed a while in the study area at the beginning of autumn in their migration paths from countries like Turkmenistan and north eastern parts of Iran. As the weather changes and temperature declines, they migrate to the southern parts like Arabian Peninsula and Pakistan. In this season, Houbara bustard was mostly seen in Touran area. The number of flocks seen amounted to 10 to 15. The total number of this population is estimated about 50.

Second group:

This group was made up of the population that came to the Touran area at the beginning of spring from southern parts and mated in this area. The number of population fluctuated yearly, and there is no record of more than 5 pairs. These Houbara bustards would leave the Touran area with their chicks at the beginning of autumn.

Third group:

This group involved the population that wintered in the Touran area and would not migrate. This group often consisted of solitary birds and their number was not more than 10. All in all, there were 75 Houbara across the study area in 2005.

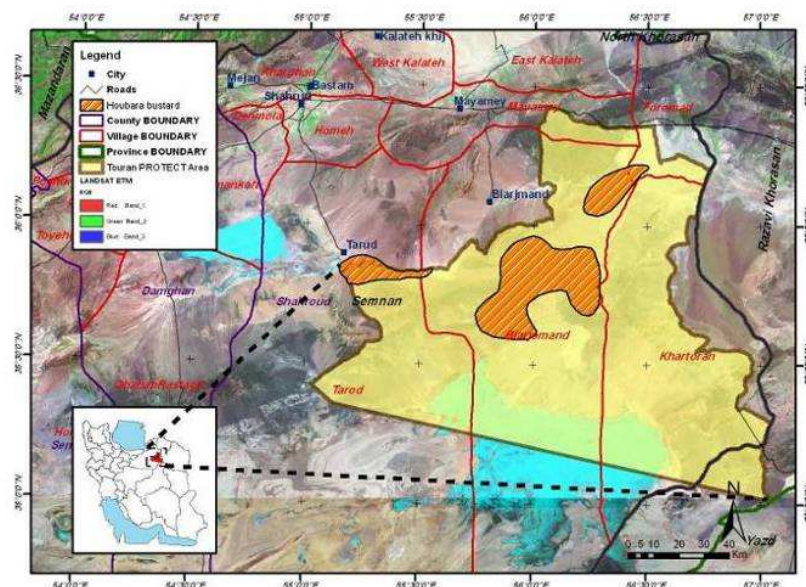


Figure 4. Distribution of Houbara in Touran protected area based on fieldwork (Touran Protected Area, 2010)

Two episodes of census showed that there were 75 Houbara in 2005 and it decreased to 59 in 2010. As a result, the existence rate of Houbara during each period was 1 per 19 533ha in 2005 and 1 per 24 830ha in 2010.

B) Major threats to the Houbara habitats

Habitats of Houbara bustard in the Touran area is declining. The result of our study and questionnaires showed that the most important cause of Houbara population decline is habitat degradation. Moreover, the most important cause of habitat degradation is livestock grazing. Table 3 represents the main causes of habitat destruction and prioritizing each cause based on factor analysis method. The food regime of Houbara bustard is too diverse, while its habitat is not. Figure 5 shows the main causes of population decline of Houbara bustard in the Touran area.

Table 3. The reasons for habitat destruction and prioritizing each criterion

The reasons for Habitat destruction	Contribution	The weight of each criteria in each site											
		A	B	C	D	E	F	G	H	I	J	K	L
Road development	79/16%	5	5	6	3	6	5	6	3	5	4	5	4
Mining	41/6%	4	3	3	2	2	2	2	2	2	2	4	2
Vegetation cutting and removal	75%	3	4	4	6	5	3	5	5	4	6	3	6
Live stock grazing	86/11%	6	6	5	4	4	6	3	6	6	5	6	5
Maneuver and military activities	52/7%	2	2	2	5	3	4	4	4	4	3	2	3
Other	16/6%	1	1	1	1	1	1	1	1	1	1	1	1
<i>Most (6), Much (5), Medium (4), Low (3), Very Low (2), Least (1)</i>													

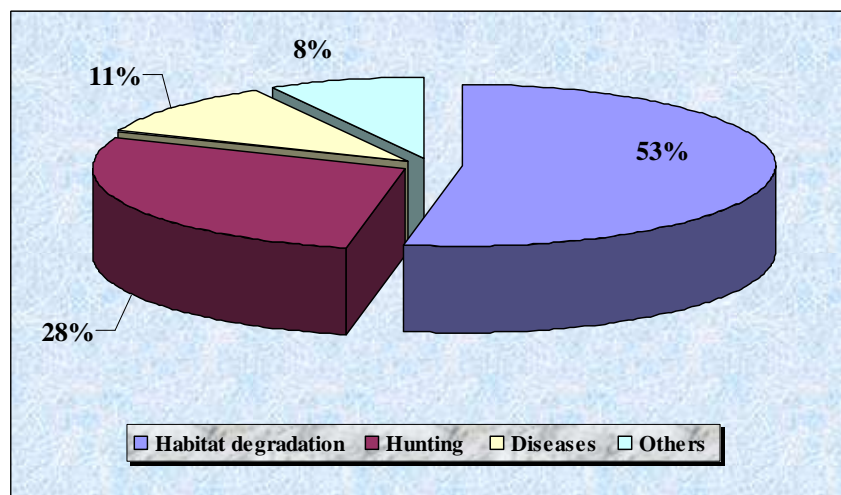


Figure5. The main causes of Houbara bustard population decline in the Touran area (2010)

CONCLUSION

Houbara inhabits arid plains, stony or sandy steppes, and desert or semi-desert areas. It also could be seen in open areas to areas with scattered shrubs and grass as well as farms like cornfields (29 & 30). Previous studies illustrate that Houbara Bustard (*Chlamydotis undulata*) lives in large areas of remote deserts and vast flat plains in Iran where vegetation is mainly composed of plants like *Artemisia* spp and *Zygophyllum* (12 & 31). Our study findings prove this, and the results showed that Houbara can still be found in some of such areas like Naz Kooch and Dow Shakh plains. Additionally, we found some new habitats for Houbara which are hilly lands and mountainous areas, namely Teerkooch and Majarad. Although most of Houbaras are migratory birds, in the Touran area they are present in most times of the year. Man-made alterations to natural habitats and landscape have increased greatly during the twentieth century, leading to an ever-growing impact on wildlife (32). The results showed that the habitats of Houbara bustard were declining. The habitat fragmentation of Houbara bustard results in patchiness of habitats, and study revealed that there are only three main habitats left right now. Our findings confirm BirdLife International assertion in 2003 about habitat destruction as the most important threat to Houbara population. The low diversity of Houbara habitats makes it hard to resist upon threats. Moreover, Zhi-Yun et al (1999) findings about bird and vegetation diversity decrease because of change in land cover are in accordance with our findings in this research. In addition, the findings of present research are similar to Yen-Chang's (2003), which emphasizes the relation between landscape structure and bird biodiversity. Land cover change directly affects ecological landscape functions and processes with far-reaching consequences for biodiversity and natural resources (32-36). Biodiversity is of vital importance for conservation of natural communities which are increasingly threatened by industrial and urban expansions and forest clearing (37). Effective and appropriate management of natural resources cannot be provided without a comprehensive scientific recognition (38-40). Environmental protection and performance have become two of the world's most important priorities in order to attain sustainable development (41). Environmental knowledge is a kind of general knowledge and includes the concepts of environmental protection, and natural ecosystems (42). This means that environmental knowledge involves what people know and are concerned about regarding to the natural environment, their responsibilities towards environmental protection and the relationship between the economy and sustainable development (43). People with environmental knowledge will process information using this knowledge (system knowledge), know what can be done about the environmental problems (action related knowledge) and understand the benefits (effectiveness) of environmentally responsible actions (44).

Concerning present condition, if there is not suitable conservational act, the population would be in great danger and jeopardy. Therefore, the need for a complete action plan is felt. The focus of the action plan could be on livestock grazing control. Livestock grazing management in the Touran protected area needs a new approach and revision. The management of the Touran protected area is facing great challenges that need practical approaches especially when it comes to livestock grazing. It seems that the management of protected areas in Iran needs a certain part concerning organizing native people and their occupation. Considering local people as a part of management plan is a necessity in Iran.

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REFERENCES

- [1] DellaSala, A. D., Staus, N. L., Strittholt, J. R., Hackman, *Natural Areas Journal*, **2001**, Vol. 21, No. 2.
- [2] Timko, J. A and Satterfield, T. *Natural Areas Journal*, **2008**, Vol. 28, No. 3.
- [3] Mansoori, J. The Hand book for Birds of Iran; 3th edition. Published by farzaneh, Tehran. **2008**.
- [4] IUCN Redlist. www.iucnredlist.org, **2007**.
- [5] Combreau, and Smith, T. R. *Biological Conservation*, **1998**. 84, 147-155
- [6] Mansoori, J and Hassanzadeh Kiabi, B. *Environmental studies journal*, **2002**, No. 31, 10-25 p.
- [7] Heydari, F., Hemami, M. F and Aghanajafari zadeh, Sh *Journal of Iranian Biology*, **2010**. No 2: 23.
- [8] BirdLife International. the site for bird conservation. Version 2.0. BirdLife International, Cambridge, UK. **2003**, Available from: <<http://www.birdlife.org>>.
- [9] IUCN Red List of Threatened Species. IUCN. <http://www.redlist.org>. **2008**.
- [10] IWA. Iranian Wildlife Association. {www.iranianwildlife.com}. **2010**.
- [11] Mansoori, J and Kiabi, B. of *Environmental Studies*, **2003**, 31: 1-24.
- [12] Mansoori, J. An ecological study of Houbara Bustard in Iran. PhD Dissertation, Islamic Azad University, **2001**, 122 pp.
- [13] Mansoori, J. Job completion report. Iran Department of the Environment, Tehran. **1974**.
- [14] Mansoori, J. IUCN Species Survival Commission, Working Group on the Houbara Bustard. Technical Meeting, Muscat, Soltanate of Oman. **1996**.
- [15] Mansoori, J. International Symposium on Bustard Conservation. Peshawar, Pakistan. **1983**, 4 pp.
- [16] Scott, D. A. Job completion report. Department of the Environment, Iran. **1975**.
- [17] Medina, F. M. (Canary Islands). *Bird Conserv. Int.* **1999**, 9: 373–386.
- [18] Martin, A., Nogales, M., Hernandez, M. A., Lorenzo, J. A., Medina, F. M and Rando, J. C. (Canary Islands). *Bird Conserv. Int.* **1996**, 6: 229–239.
- [19] Hingrat, Y., Saint, M., Ysnel, F., Lenuze, E and Lacroi, F. *Ornithology*. **2007**, 148: 39-53.
- [20] Mortazavi, M. Job completion Report. Department of the Environment, Iran. **1993**.
- [21] Saint Jalme, M. S and Van Heezik, Y. Propagation of the Houbara bustard. London: Kegan Paul International. **1996**.
- [22] Aghainajafi-Zadeh, S., Hemami, M., Karami, M and Dolman, P. M. (2010) *Journal of Arid Environments*, 47. 912–917
- [23] DOE. Atlas of Protected Areas of Iran, I. R. of Iran Department of the Environment, Tehran, Iran. **2006**.
- [24] Ziaei, H and Zanjapour, G. Job completion report. Iran Department of the Environment, Tehran. **2005**.
- [25] IMO. I. R. of Iran Meteorological Organization. {www.irimo.ir}. **2011**.
- [26] Amery, M. E and Karami, M. Action Plan for Turan Biosphere Reserve. BSc Thesis, Azad University, Environmental Academy. **2003**.
- [27] Shahnama, H. Shahrood Tourism Attractions, Publication by Shahrood Industrial University, Shahrood, Iran. **2009**.
- [28] Stoate, C.; Boatman, N. D.; Borralho, R. J.; Carvalho, C. R.; De Snoo, G. R.; Eden, P., *Ec. J. Environ. Manage.*, **2001** 63, 337-365 (29 pages).
- [29] Porter, R. F., Christensen, S and Schiermacker-Hansen, P. Field guide to the Birds of the Middle East. T & AD POyser, London. **2005**. 460 pp.
- [30] Scott, D. A., Marvej Hamadani, H and Adhami, M. A. The Birds of Iran (In Persian, with Latin, English and French names). **1975**.
- [31] Ziaie, H. Bustards. *Iran Museum of Nature and Wildlife*. 30 pp. **1996**.
- [32] Rubolini, D., Gustin, M., Bogliani, G and Garavaglia, R. an assessment, *Bird Conserv. Int.* **2005**, 15: 131–145
- [33] Hansen, A. J.; De Fries, R.; Turner, W., Springer-Verlag, New York, **2004**, 277-299.
- [34] Solaimani, K; Modallaldoust, S; Lotfi, S. *J. Environ. Sci. Tech.*, **2009**. 6 (3), 415-424.

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- [35] Lawal, A.F., Omotesho, O.A and Adewumi, M.O. *African Journal of Agricultural Research*, Vol. 5(3) pp. **2010**, 178-187
- [36] Yeo, K., Konate, S., Tiho, S and Camara, S.K. *African Journal of Agricultural Research*, **2011**, Vol. 6(2), pp. 260-274.
- [37] Eshaghi Rad, J; Manthey, M; Mataji, A., *J. Environ. Sci. Tech.*, **2009**, 6 (3), 389-394.
- [38] Gueu, S.; Yao, B.; Adouby, K.; Ado, G., *J. Environ. Sci. Tech.* **2007**, 4 (1), 11-17 (6 pages).
- [39] Igwe, J. Ch.; Abia, A. A.; Ibe, Ch. A., *J. Environ. Sci. Tech.*, **2008**, 5 (1), 83-92 (10 pages).
- [40] Mataji, A.; Zahedi Amiri, Gh.; Asri, Y., *J. Forest Poplar Res.* **2009**, 17 (1), 85-98 (14 pages).
- [41] Nouri, J.; Karbassi, A. R.; Mirkia, S., *J. Environ. Sci. Tech.*, **2008**, 5 (1), 43-52.
- [42] Fryxel, G.; Lo, C. W., *J. Bus. Ethics*, **2003**, 46 (1), 45-69.
- [43] Huang, P. S; Shih, L. H., *J. Environ. Sci. Tech.*, **2009**, 6 (1), 35-50.
- [44] Frick, J.; Kaiser, F. G.; Wilson, M., *Pers. Individ. Differ.*, **2004**, 37 (8), 1597-1613.