

# The threats on the biodiversity of Bisotun Wildlife Refuge and Bisotun Protected Area (BPA & BWR) in the west region of Iran

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Manuscript received: 8 January 2014. Revision accepted: 24 January 2014.

## ABSTRACT

Reyahi-Khoram M, Rizvandy M, Reyahi-Khoram R. 2014. The threats on the biodiversity of Bisotun Wildlife Refuge and Bisotun Protected Area (BPA & BWR) in the west region of Iran. *Biodiversitas* 15: 67-74. Nature is necessary for the preservation of species and biodiversity richness; as a result, it has been protected for thousands of years. Bisotun Protected Area and Bisotun Wildlife Refuge (BPA & BWR) with about 95000 hectares is located in Kermanshah province in the west of Iran. The object of this study is to determine the physical properties and analyze the constraints that threaten the BPA & BWR. This research was conducted during the period from May, 2011 to November, 2012 in BPA & BWR. In this research, various animal and plant species were recognized through documentary analysis and also directly field observations. The obtained result indicates that major threats have occurred in biodiversity and ecosystem of BPA & BWR during 1980-2010. During these years, the study area has completely failed and lost some of its biological diversity. Limiting factors that affect wildlife population growth including destruction and conversion of habitats, unauthorized hunting and high frequency presence of animal and human, have influenced the restoration potential of wildlife, the habitats and other conservation areas.

**Key words:** Biodiversity, Bisotun, environment, habitat, wildlife

## INTRODUCTION

Preserving large predators is important but challenging because these species are typically wide-ranging, select multiple habitats at different scales and often present spatial or habitat separation between the breeder and floater sectors of a population (Tanferna et al. 2013). Protection of biodiversity and genetic Diversity could reliably support the goals of development. Today's, the process of destruction of habitats has outrivalled restoration and reconstruction. Extinction of species in all growth ecosystems has had a soaring increase and once the scientists do not investigate and solve this crisis, within a short time it would threaten the life of many plant and animal species (Reyahi-Khoram and Norisharikabad 2010). A protected area can be defined as "geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values". It has become a universally adopted way of conserving biodiversity for a wide range of human values (Ahmad et al. 2012). Wildlife refuge means Areas covering typical wildlife habitats selected with the purpose of preserving the population of animal species and improving their level of quality. The minimum area of a wildlife refuge must suffice to fulfill the animal species needs as well as the integrity and interactions among its units. These areas are appropriate places for educational and research

activities especially those pertaining to wildlife. Compatible utilizations and controlled tourism are allowed in refuges (Darvishsefat et al. 2008).

The climatic diversity of Iran has resulted in the growth of 7576 plant species, the occurrence of 517 bird species, 208 reptile species, 170 fish species, 164 mammal species and 22 amphibians (Reyahi-Khoram and Norisharikabad 2010). The legislation of the Protection Bill and the establishment of the Iranian Center for Hunting in 1956 are considered as the first documented actions taken toward protecting the Iranian wildlife population and diversity. This led to the formation of a new governmental organization in 1967 entitled the Hunting and Fishing Organization. Therefore, the year 1967 marked the pioneer attempts for the foundation of the Iranian protected areas, 95 years after the establishment of the first national park in the world (Yellowstone National Park in the USA) and 19 years after the foundation of the World Conservation Union (IUCN). In this year, the proposal for the foundation of three national parks and 15 protected areas was approved by the Supreme Council of Hunting and Fishing as the first series of protected areas in Iran. (Darvishsefat et al. 2008).

Kermanshah province is in the western of Iran, covers an area of 24,434.25 sq km which is approximately 1.5 percent of Iran's total land area. Kermanshah has a moderate mountainous climate and has been the home of man since the Paleolithic and Neolithic age. The economic livelihood of the population is dependent on agriculture,

tourism and manufacturing (Mohammadi and Khalifah 2010). Kermanshah province has one wildlife refuge (Bisotun Wildlife Refuge) and four protected areas: Bisotun, Bozin Merkhil, Badroparishan and Galajee covering an area of 166,000 hectares which is nearly 6.8% of the total area of the province.

The aim of this research is to evaluate the physical properties and analyze the constraints that threaten the Bisotun Protected Area and Bisotun Wildlife Refuge (BPA & BWR) in the province. Other objectives of the research include defining the ways to improve the plans for biodiversity conservation and protection.

## MATERIALS AND METHODS

This research was conducted during the period from May, 2011 to November, 2012 in BPA & BWR to identify various plant and animal species through documentary analysis and also direct field observations. Means, the physical properties and condition of BPA & BWR were studied based on careful field observation and document research during the study period. Accredited scientific references were used to identify dominant plant and animal species (Ziaie 1996; Lotfi 2000; Mansoori 2001; Mozaffarian 2006; Reyahi Khoram et al. 2013). Therefore, various animal and plant species were recognized during the mentioned period. Applied results presented in this study are based on the valid audit reports from experts and forest rangers in various times and locations in the studied area.

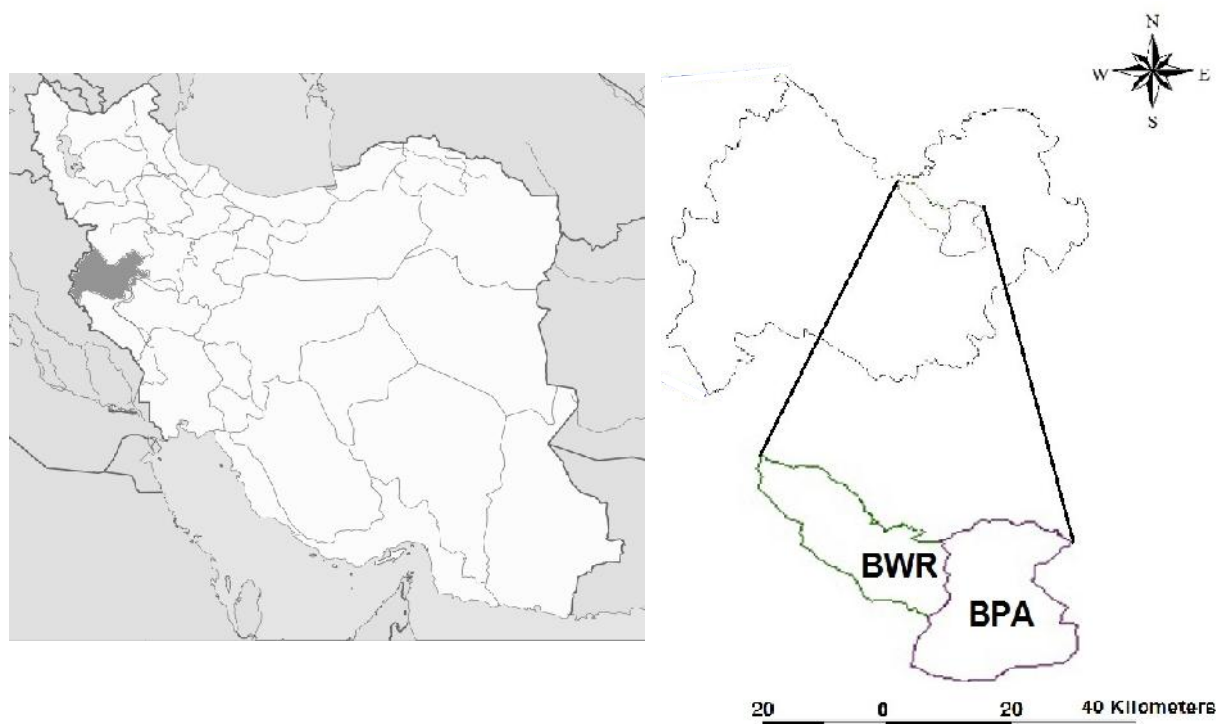
To determine the ecological resources of the area, digital maps were used and on this basis the topology situations as well as ground cover of studied area have been accomplished. In addition, Geographic Information System (GIS) and other technology such as remote sensing were used in this study (Demers 2009). The software used was Arc View (version 3.2a) with the Universal Transverse Mercator (UTM) projection and scale was 1/50,000.

## RESULTS AND DISCUSSION

### General status of the region

BPA & BWR are two of the areas in the country where the richness of biodiversity has been preserved by Department of Environment (DoE) of Iran. These areas are in critical danger of expansion of human population centers, unsustainable industrial and agricultural activities and other human impacts.

Bisotun Protected Area (BPA) with 40,000 hectares surface area is situated between 34°22',00" and 34°37',30" northern latitudes and between 47°09',00" and 47°26',30" eastern longitudes, on Northern East of Kermanshah Township, Iran. Slightly behind the mentioned area, is Bisotun Wildlife Refuge (BWR) with 55,000 hectares surface area that is situated between 34° 27', 30" and 34°, 44', 00" Northern East latitudes and between 46°, 54', 00" and 47°, 11', 00" eastern longitudes (Figure 1). However, regions are located in west of Iran. In 1975, BPA and BWR were officially declared as protected area and Wildlife Refuge respectively.



**Figure 1.** General status of BPA & BWR in Kermanshah Province, Iran

In 2009, Poraw Cave at BPA was announced as national natural monuments by DoE. This cave is located in the Poraw Mountain (Zagros Mountain Range) and the cave opening is a small hole. It is to be noted, that Poraw Cave has unique characteristics that distinguish it from similar caves. Means it is a vertical cave with a height of 3000 meters from sea level located in a Karsts formation. The cave measures approximately 1454 meters in length and 751 meters in depth and inside the cave there are 26 wells in depths ranging between 5 to 42 m. Caving is extremely difficult because the cave body is rocky and porous. It should be noted that Poraw Cave is also important from tourism point of view.

Therefore, BPA & BWR with about 95000 hectares is located in a mountain area characterized by vast open plains which are surrounded by cities. In the other hands, the cities of Kermanshah, Harsin, Kangavar, Songhor and Kamyaran are located around the said regions.

Razavar River on the north of the region, Dinvar River on the east, the flat plains surrounding the river, as well as communication roads have led to formation of various types of habitats and concentration of economic activities around the region. In general, the studied region is effective under arid to semi-arid climate condition with cool to hot summers and cold winters.

### Wildlife of the region

The studied region has a variety of animal species including Mammals, Birds, Reptiles, and Fishes. In the following, the characteristics of each are explained.

#### Mammals

Because the region is mountainous and has been preserved by DoE, most wild animal species can be observed in these areas. Totally 22 mammal species belong to 12 family were recorded throughout the study area (Table 1). Here, some important and typical species in the study area are described in the following section.

*Wild goat.* This species is one of the largest herbivore of the study area. At present time, its population has extremely diminished because of the limiting factors. The sharp decrease in the number of wild goat in the studied area could be attributed to lack of suitable habitat due to human interference, especially over-grazing impact, expansion of human habitats, development of industrial and service activities, lack of control and management as well as irregular, unlimited and unauthorized hunting by clan hunters, nomads, farmers and other native people and also, severe drought in recent years. Field studies showed that although the condition for successful migration of this species between Varmanjeh wildlife refuge and BPA & BWR is available, wild goat cannot easily pass between the two regions. The species pass only through limited and impassable cliff valleys. Field studies based on observations and interviewing the local people and forest rangers showed that wild goats in these habitats are mainly young while the old animals are very rarely seen. They can be observed only occasionally on the heights of complete rocky structure. In general, the status of populations of this species has declined within the last two decades due to

habitat destruction for agricultural uses, urban and industrial developments and over hunting; so that only small herds of about 2 to 3 animals could be seen. The remaining population is mainly young which are commonly seen in rocky and inaccessible heights. The existing population is very vigilant and unquiet which reacts upon events in its surroundings.

*Wild sheep.* This species is the giant herbivore of the studied area. Their habitat with a less steep slope is located in the lower portion of Wild goat habitat. This species' population has decreased because of human impact, which includes agriculture and industrial development. Means, decrease in Wild goat population is similar to the causes that have been described previously for Wild Goat.

**Table 1.** List of mammal species in BPA & BWR

Family	Scientific name
Canidae	<i>Canis aureus</i> (Golden jackal)
Canidae	<i>Canis lupus</i> (Wolf)
Bovidae	<i>Capra aegagrus</i> (Wild goat)
Felidae	<i>Felis silvestris</i>
Muridae	<i>Gerbillus nanus</i>
Erinaceidae	<i>Hemiechinus auritus</i>
Hyaenidae	<i>Hyaena hyaena</i> (Striped hyaena)
Hystricidae	<i>Hystrix indica</i>
Leporidae	<i>Lepus europaeus</i> (European hare)
Muridae	<i>Meriones persicus</i>
Vespertilionidae	<i>Miniopterus schreibersii</i>
Muridae	<i>Mus musculus</i>
Ochotonidae	<i>Ochotona rufescens</i>
Bovidae	<i>Ovis orientalis</i> (wild sheep)
Felidae	<i>Panthera pardus saxicolor</i> (North Persian leopard)
Erinaceidae	<i>Paraechinus hypomelas</i>
Vespertilionidae	<i>Pipistrellus kuhlii</i>
Rhinolophidae	<i>Rhinolophus euryale</i>
Sciuridae	<i>Sciurus anomalus</i>
Suidae	<i>Sus scrofa</i> (Wild boar)
Ursidae	<i>Ursus arctos</i> (Brown bear)
Canidae	<i>Vulpes vulpes</i> (Common fox)

The habitat of this species is more accessible. The presence of domesticated animal in the habitat of wild sheep is easier than the presence of domesticated animal in the mountainous rocky areas and Wild goat habitat. On this basis, its population is more susceptible than Wild goat population. The recorded observations in the studied region showed that the species population was mostly unquiet and highly vigilant. They respond very quickly to the events such as sound and smell. The observations of this species were possible through long distance. These behaviors proved that wild sheep population in the studied region was extremely influenced by stressful environmental conditions. Although this population is relatively young, its growth and survival rate is slow due to the prevailing environmental conditions such that birth rate of the species does not make up for the animal death due from natural and

unnatural causes. Therefore wild goat population has had a descending trend during the past years.

*North persian leopard.* This species is at the top of food pyramid and is very sensitive to stressful environmental conditions. This species are present in mountainous areas where they find a good prey such as wild goat, wild sheep or wild boar. The appropriate habitat for this animal is mountainous rocky areas. All of these conditions were available in the studied area. Means, wild goat, wild sheep or wild boar are the main native prey species of this region. When the population of these species is stable, north persian leopard species is stable too.

It is impossible to record the real number of north persian leopard species population because of the undercover nature of their life, being nocturnal, having fair habitat conditions, and the calm behavior and habits of animal. This species is only found by chance at a moment and quite accidentally. For this reason, it is not possible to determine the exact numbers available in the study area. The only figures representing the north persian leopard species are related to BPA. The figures represent one north persian leopard species in 1987, one in 1991, and five in 1994. Still there is controversy around five because it is practically out of question to see five north persian leopard species at a time. Even if such figure was correct, the information and reports presented later raised controversy on the presence of the species in the study area.

Questioning the natives that are residing in the area revealed that not even one north persian leopard species was observed during the past five years. Based on the opinions of locals, an overwhelming number of this species lived in BPA & BWR during the 1970s and 80s; but there are no reliable statistics on the real number of north persian leopard species in the studied area. Observations by native people conform to the norm of survival of wild goat and wild sheep during the 1970s and 80s. Means, in the last time, the balance of predator and prey was dominant in the studied area. As prey species have decreased in BPA & BWR, so have the number of north persian leopard. Although there is limited information on the presence of north persian leopard in this area, but no organization or individual has announced its extinction in BPA & BWR.

*Brown bear.* This species is the only species of the family Ursidae which lives in the study area. The species' population has been reduced by human influences in this area and is observed only by chance and very rarely. Past and current studies show that brown bear population was not widespread and extensive during 1980s but more frequent than today. It seems that habitat destruction and over exploitation by grazing are the most likely factors contributing to these changes.

Moreover, the extension of human habitat into the forests and cutting of shrubs and trees including chestnut and wild pear for various purposes, notably for fuel wood and charcoal, play a significant role in reduction of bears. These factors were exacerbated by drought and other events in the last decade and have made harmful impacts in reduction of bears in the study area. Available information shows that the species were seen in low numbers during the last 2 decades. In the other words, all extant brown bears

species of the region are prone to extinction.

*Wolf.* This species is the largest of the Canidae or dog tribe and is one of the most widespread carnivores in the region. Wolves are capable of traveling long distances in pursuit of prey and persisting in the environment. It survives not merely on big and small animals, but also on domestic animals that play a major role to the persistence of wolves in the study area. The species uses BPA & BWR and Varmanjeh wildlife refuge as a den or a safe place. Wolves are settling more permanently in BPA & BWR because it is more mountainous and thus more impassable than Varmanjeh wildlife refuge. Other reasons for presence of more wolves in BPA & BWR are extensive grazing of domestic animals, rock dens (caves), and a number of mountain refuges. This species has no destructive impact on the population of big herbivores but have a role in improving local ecosystems and natural habitats.

*Common fox.* The fox is an omnivore and most active at night with a relatively small home range. This species movement to the higher areas in summer seasons although is also commonly seen in rural areas during cold seasons. Based on the observations made in the area, the presence of the species has been confirmed in the surrounding areas particularly in residential areas where they find food. Like other carnivores, the fox population had been large fluctuations during the past two decades and these fluctuations are a downward trend. The decrease in the fox population is partly due to limited food availability, unauthorized hunting and competing with other carnivores.

*Golden jackal.* The range of this species in BPA & BWR overlaps with that of fox. But the number of fox population species is greater than that of the Golden Jackel. The habits and behavior of golden jackal are a little different from fox. Based on the results and observation, this species is more adapted to the current conditions of the studied region and take greater advantage of all available food sources. In other words, golden jackal successfully competes with foxes, although the feeding regimen has been the same. Based on the experimental observation, the golden jackel population has an ascending trend during the past years. This is in contrast to other species of the study area, which had a descending trend during this period. This increase is the result of lack of rival carnivores in the region, having a wide range of food, adoptability, lack of its natural predators and lack of interest and attention of humans for its prey.

*Wild boar.* This species lives in many parts of Iran such as the areas close to the rivers or springs. It can live in BPA & BWR and adapts itself to different conditions. Permanent fresh water springs and rivers such as the two rivers flowing in the region (Dinvar and Razavar), grass lands and oak forests have created ideal conditions for this species in the region. Although it is a carnivore, it eats lots of fruits, seeds, berries and vegetables because it is easy to get and available in abundance. Wild boar is abundant in prairie and forest, but is only found in plain areas. The species can be observed occasionally in the groups of 3 to 5 animals regarding the present condition of the region.

Although wild boar has a valuable ecological role in the balance of nature, it is not in a good condition because it

can cause considerable damage to agricultural crops. Also, wild boar can be dangerous to people and are known to cause injuries in rural areas of BPA & BWR. These research and observation indicate that, this species is limited by food shortages in the region. Feces samples analysis of the species showed abundant amounts of rat remains, the persian jird (*Meriones persicus*) and other mammals and small birds.

*European hare*. This mammal is uniformly distributed across the entire the study area with the exception of rocky and mountain areas. The abundance and distribution of this species in farming lands is higher than the regions with natural features. The high consumption of this species by the carnivores from one side, and its hunting by human predators on the other side, has caused declines in this species in BPA & BWR. As a consequence of these two events, this species lacks extensive distribution despite high production of its members. In general, it moves slowly and remains at home range most of the time. Also, it's offspring inside the home range.

*Striped hyena*. This animal is an active mammal with an extensive home range. Striped hyena is a skillful hunter, but mostly acts as a scavenger. Thus, its home range depends on the home range of other predators. In BPA & BWR, the hyena population has decreased from several years ago and it is seen more rarely. This situation is coherent with reduction of other species of wildlife in the region as a result of unnatural factors and drought.

### Birds

Birds are usually seen in the study area and their frequency is correlated with the relevance of biological-quality factors. The four essential elements of the birds' biological needs, water, food, security and shelter have attracted almost 14% of the bird species in Iran to the study area. Among these factors, the role of security is more important than other factors.

Totally 60 bird species belong to 21 family were recorded within the study area (Table 2). 52% of the birds of BPA & BWR are native while others are migratory. Means, the birds of BPA & BWR are divided into two main groups, based on the time of their presence in the region; native birds and migratory birds.

Native birds of BPA & BWR appear in the region in all of seasons, where they reproduce and do not leave the region. The typical species of native birds includes common raven (*Corvus corax*), little owl (*Athene noctua*), rock dove (*Columba livia*), rook (*Corvus frugilegus*), see-see partridge (*Ammoperdix griseogularis*), common magpie (*Pica pica*), red-billed chough (*Pyrrhocorax pyrrhocorax*) and chukar partridge (*Alectoris chukar*). Some of these species have economic values. The Passeridae family species have adapted to live in human communities and they are distributed around the villages and human communities of the study area.

Migratory birds are part of the biological diversity of BPA & BWR. Some of migratory birds come to the region in spring and reproduce and then leave the region. The typical of this group is black-headed bunting (*Emberiza melanocephala*). Also, some of migratory birds pass

through the region during spring and fall time. They are seen in the region for a few days.

**Table 2.** List of bird species in BPA & BWR, northern Iran

Family	Scientific name
Accipitridae	<i>Accipiter gentilis</i>
Accipitridae	<i>Accipiter nisus</i>
Alaudidae	<i>Alauda arvensis</i>
Phasianidae	<i>Alectoris chukar</i>
Phasianidae	<i>Ammoperdix griseogularis</i>
Anatidae	<i>Anas crecca</i>
Anatidae	<i>Anas platyrhynchos</i>
Anatidae	<i>Anser anser</i>
Apodidae	<i>Apus apus</i>
Accipitridae	<i>Aquila chrysaetos</i>
Accipitridae	<i>Aquila heliaca</i>
Accipitridae	<i>Aquila pomarina</i>
Accipitridae	<i>Aquila rapax</i>
Ardeidae	<i>Ardea cinerea</i>
Ardeidae	<i>Ardea purpurea</i>
Strigidae	<i>Athene noctua</i>
Strigidae	<i>Bubo bubo</i>
Accipitridae	<i>Buteo buteo</i>
Sylviidae	<i>Cettia cetti</i>
Columbidae	<i>Columba livia</i>
Columbidae	<i>Columba oenas</i>
Columbidae	<i>Columba palumbus</i>
Coraciidae	<i>Coracias garrulus</i>
Corvidae	<i>Corvus corax</i>
Corvidae	<i>Corvus corone</i>
Corvidae	<i>Corvus frugilegus</i>
Corvidae	<i>Pica pica</i>
Corvidae	<i>Pyrrhocorax pyrrhocorax</i>
Ardeidae	<i>Casmerodius albus</i>
Phasianidae	<i>Coturnix coturnix</i>
Cuculidae	<i>Cuculus canorus</i>
Ardeidae	<i>Egretta garzetta</i>
Emberizidae	<i>Emberiza melanocephala</i>
Falconidae	<i>Falco cherrug</i>
Falconidae	<i>Falco peregrinus</i>
Falconidae	<i>Falco subbuteo</i>
Falconidae	<i>Falco tinnunculus</i>
Alaudidae	<i>Galerida cristata</i>
Corvidae	<i>Garrulus glandarius</i>
Accipitridae	<i>Gypaetus barbatus</i>
Accipitridae	<i>Gyps fulvus</i>
Accipitridae	<i>Hieraaetus fasciatus</i>
Sylviidae	<i>Hippolais pallida</i>
Sylviidae	<i>Locustella luscinioides</i>
Sylviidae	<i>Locustella naevia</i>
Alaudidae	<i>Melanocorypha calandra</i>
Meropidae	<i>Merops apiaster</i>
Passeridae	<i>Montifringilla nivalis</i>
Accipitridae	<i>Milvus migrans</i>
Accipitridae	<i>Neophron percnopterus</i>
Passeridae	<i>Passer domesticus</i>
Passeridae	<i>Passer hispaniolensis</i>
Passeridae	<i>Petronia brachydactyla</i>
Sylviidae	<i>Phylloscopus trochilus</i>
Picidae	<i>Picoides major</i>
Picidae	<i>Picoides medius</i>
Picidae	<i>Picoides minor</i>
Picidae	<i>Picoides syriacus</i>
Pteroclididae	<i>Pterocles coronatus</i>
Pteroclididae	<i>Pterocles orientalis</i>

The typical migratory species recorded in documents and observations include mallard ducks (*Anas platyrhynchos*), common teal (*Anas crecca*), greylag goose, (*Anser anser*), grey heron (*Ardea cinerea*), purple heron (*Ardea purpurea*), great egret (*Casmerodius albus*), little egret (*Egretta garzetta*), eurasian hobby (*Falco subbuteo*), peregrine falcon (*Falco peregrinus*), saker falcon (*Falco cherrug*), common kestrel (*Falco tinnunculus*), griffon vulture (*Gyps fulvus*), tawny eagle (*Aquila rapax*) and common buzzard (*Buteo buteo*).

Also, the availability of various types of food in the region attracts birds of different food regimens. From the point of view of food regimen, the birds of BPA & BWR are divided into three main groups: (i) Carnivorous: these birds eat rodents, mice or other small mammals. Carnivorous birds such as falcons, eagles and hawks, which are abundant in the study area. (ii) Herbivorous: these are species of birds which depend on plants for their nutrition. Among the birds which feed on plants the Columbidae family are indigenous or native to the study area and the most important member of this family is *Columba livia*. (iii) Omnivorous: the species of Corvidae family such as *Pica pica* and *Corvus corone* are the most abundant omnivorous species of the region. Group of birds can eat everything is easy to access.

Documentary information and field observations prove that some of the typical species of the region have more attention in recent years. Here, some important species in the study area are presented in this section.

*Chukar partridge*. Chukar partridge is native to the region. It lives in mountainous areas and also observed in plains and farms during cold season. The observations indicate the overall reduction in the number of this species in the region. The number of chukar partridges observed in the BPA & BWR exceeds the chukar partridges in Varmanjeh wildlife refuge. Because BPA & BWR is more mountainous and has high rocky regions with a local habitat to the Chukar Partridge. The reasons of decrease in number of chukar partridges in recent years are difficult to identify. Potential local factors include extensive presence of cattle and sheep dog in the region which has influenced the reproduction, unauthorized hunting, collecting eggs and chicks of chukar partridge by native people and also natural elements such as cold temperatures and heavy snowfall states are often observed there.

*See-see partridge*. This bird is a native, mountainous species with economic value. Its preferred habitats are the Mounds of the region. The usual number of individuals observed of this species in BPA & BWR is much lower than the number of partridge in the region. The present trend indicates an extreme decrease during recent years. The reduction in the population could be attributed to excessive hunting of the birds and collecting of their eggs, destruction and occupation of preferred habitats and the drought during recent years which may have led to the decline in reproduction and population.

*Red-billed chough*. Review of literature and field studies indicated the extensive presence of this bird in rocky heights. It has been found that its presence in BPA & BWR is more widespread than Varmanjeh wildlife refuge.

It should be noted that the report indicates a decrease in the number of species recorded during recent years. Based on the inspections the downward trend of this species is due to reduction of food and hard climatic conditions particularly during periods of extensive drought. This species is an active bird and can fly beyond the BPA & BWR. But it performs its activities such as reproduction and most of biological activities inside the region and in mountainous areas.

*Golden eagle*. This species is one of the largest hunting birds of the study area. The preferred habitat of golden eagle is in the middle-high elevation areas of the Rocky Mountains. It nests on the precipices of the rocks and uses it for many years. This species is frequently observed in mountainous areas due to its size and magnificence. For this reason, reviewing the information offered in daily reports book of environmental guard stations in BPA & BWR shows that it has been present in the area from many years ago but its population has been monotonically decreasing with time and interconnectivity.

#### Reptiles

The reptiles found in BPA & BWR include snakes, turtles and lizards. Reptiles are cold blooded animals and so far about 26 reptile species have been identified in the region. Thirteen species of snakes have been identified in the region; three of these are poisonous, 4 species are semi-poisonous and other is non-poisonous. Since some reptiles are poisonous and they cannot adapt to human life, less research was down about them compared to other animals. Although Reptiles are scattered throughout BPA & BWR and Varmanjeh wildlife refuge, but lizards are observed in plains areas and Snakes are seen in rocky regions and turtles are generally found in riparian areas or flood plains particularly around Dinvar and Razavar rivers.

#### Amphibians

Three amphibian families have been found in BPA & BWR. Frogs are the most common amphibians in the study area. Also, Ranidae family is the most prominent frog family in the region. The amphibians are carnivorous and can eat fish, small reptiles, worms and insects. Also, are creatures that are consumed by a wide range of predators such as many mammals and birds. Amphibians are distributed in the areas around rivers and water reservoirs. Means, frogs habitats are generally near a water body and are often used as resting sites for many fish eating birds. Other amphibians in the region include green toad (*Bufo viridis*), tree frog (*Hyla savignyi*) and common toad (*Bufo bufo*). All amphibians have the greatest potential to impact ecological values in the region.

#### Fish

The Dinvar and Razavar rivers would have provided suitable habitat for the reproduction and survival of a large number of fish species. 13 species of fish have been identified in these two rivers (Table 3). The fishes that are present in these waters are warm water fishes and there is no cold water fish in the said rivers. Every species has ecological value; but only a few have economic value in the fisheries. For this reason, fishing by local people is not considered in the study area. These fishes are restricted

only to Teleostei group and mostly belong to Cyprinidae family. Based on the results of observations, most of the fish were carnivorous while a few of them are completely herbivorous and their natural habitat is clear freshwater rivers where they were born and spawn eggs.

**Table 3.** List of Fish species in BPA & BWR

Family	Scientific name
Cyprinidae	<i>Barbus esocinus</i>
Cyprinidae	<i>Barbus grypus</i>
Cyprinidae	<i>Barbus lacerta</i>
Cyprinidae	<i>Capoeta damascina</i>
Cyprinidae	<i>Capoeta trutta</i>
Cyprinidae	<i>Carassius auratus</i>
Cyprinidae	<i>Chalcalburnus chalcoides</i>
Cyprinidae	<i>Garra rufa</i>
Cyprinidae	<i>Leuciscus cephalus</i>
Cyprinidae	<i>Luciobarbus capito</i>
Mastacembelidae	<i>Mastacembelus mastacembelus</i>
Balitoridae	<i>Nemacheilus frenatus</i>
Balitoridae	<i>Nemacheilus kermanshahensis</i>

### Plant coverage of the region

Since economic condition of the native people in rural areas is related to farming, gardening and animal husbandry, BPA & BWR suffer from animal grazing or human activity. About 387 plant species have been identified in the region of which 42 species are endemic of Iran and should be managed as a genetic reserve (Darvishsefat 2006). The important plant species of BPA & BWR are presented in table 4. It is clear that plant cover in the study area is an important factor in water distribution within a watershed. Therefore, grazing management should be designed to prevent or reduce potential adverse effects to the environment. Otherwise, it would cause acute damage to the environment and economic loss for the future.

**Table 4.** List of important plant species in BPA & BWR

Family	Scientific name
Caryophyllaceae	<i>Acanthophyllum</i> sp.
Rosaceae	<i>Amygdalus scoparia</i>
Boraginaceae	<i>Anchusa</i> sp.
Asteraceae	<i>Anthemis</i> sp.
Papilionaceae	<i>Astragalus</i> sp.
Campanulaceae	<i>Campanula</i> sp.
Ulmaceae	<i>Celtis australis</i>
Rosaceae	<i>Cerasus</i> sp.
Asteraceae	<i>Cirsium</i> sp.
Rosaceae	<i>Cotoneaster</i> sp.
Rosaceae	<i>Crataegus</i> sp.
Asteraceae	<i>Echinops</i> sp.
Euphorbiaceae	<i>Euphorbia</i> sp.
Moraceae	<i>Ficus johannis</i>
Liliaceae	<i>Fritillaria imperialis</i>
Fabaceae	<i>Glycyrrhiza glabra</i>
Anacardiaceae	<i>Pistacia atlantica</i>
Fagaceae	<i>Quercus brantii</i>
Ranunculaceae	<i>Ranunculus</i> sp.
Rosaceae	<i>Rosa canina</i>
Asteraceae	<i>Senecio</i> sp.
Poaceae	<i>Taeniatherum crinitum</i>

### Discussion

As a result, the remaining small population of wildlife consists of young animals. It seems that the newborn population can not compensate for the natural death rate, because of factors such as long-term drought, unauthorized hunting and habitat loss. Therefore the growth rate of existing populations is low and makes no significant contribution to the increase in the number of population. Review of the boundaries of the study area showed that BPA & BWR and Varmanjeh wildlife refuge are surrounded by asphalt roads, agricultural farms and fruit gardens. There is no suitable habitat around the study area. Hence the studied region is separated as an island from other habitats.

The conservation of biodiversity is recognized as a key ecosystem service (Faith and Walker 2002). A few management studies that have been carried out have focused on the improvement of management and environmental education activities in protected areas (Brandon et al. 2005; Xu et al. 2006; Geneletti and Iris 2008; Reyahi-Khoram and Karami-Nour 2010; Andrade and Rhodes 2012). The results of this study may be compared with another study conducted in Kenya reported that Natural forests and mountainous protected areas are critical for ecological services; but are now increasingly becoming endangered ecosystems. Further, they are getting degraded through a variety of land uses such as livestock grazing, deforestation and charcoal burning. The net result has been serious threat to biodiversity and wildlife habitats, ecosystem degradation and loss of ecological services (such as water availability). Conservation authorities and the government have a responsibility to conserve and protect the country's ecosystems and associated biodiversity as both a national service and contribution to global biodiversity conservation (Kiringe and Okello 2007)

### Recommendation

In order to follow up the policies and approved programs of DoE related to habitat conservation and wildlife management, it is recommended to protect the BPA & BWR from wildlife hunters and livestock grazing. There are many indigenous people living throughout the world. According to the necessity and needs of the indigenous people and their problematic condition, it is recommended to utilize both indigenous knowledge and scientific knowledge to provide learning/ education for mentioned people around the study area concerned about environmental conservation and sustainability. Since carrying capacity of an ecological system is directly affected by the development, it is recommended that the carrying capacity of the BPA & BWR should be determined before converting it to agricultural development or industrial development projects.

Now a day, ecotourism is one of the most rapidly growing and involves many sectors of the economy and increase the income of local people, improve their quality of life and protect the environments in which they live and on which they depend. Regarding the ecotourism concept and the necessity and importance of their economic functions, it is suggested that the local people's community

should become better informed of their surrounding natural environment, recognition of ecotourism's social and economic importance and the role that it plays.

### CONCLUSION

The obtained result indicates that the major threats have occurred in BPA & BWR during 1980-2010. During these years, the study area has completely failed and lost some of its biological diversity. Limiting factors that affect wildlife population growth including: destruction and conversion of habitats, unauthorized hunting and high frequency presence of animal and human that have influenced on potential development and restoration of BPA & BWR. The effects of these negative events and weakness in control could decrease wildlife security and increase habitat fragmentation.

### ACKNOWLEDGEMENTS

This research was supported by Islamic Azad University (Hamadan Branch). The authors would like to thank Department of Environment of mentioned university. Also, the authors would like to thank Shahram Nadery, the expert of Kermanshah Provincial Directorate of Environmental Protection, Iran for their collaboration in this study.

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