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Biodiversity Conservation of Reptiles and Mammals in the Khorasan Provinces, Northeast of Iran

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ABSTRACT

The reptile and mammals fauna of North-East of Iran were investigated and the contraction and fragmentation of some species due to climatic changes and human activities were analyzed. The sampling was carried out in selected stations throughout the Great Khorsan. The results showed that there are approximately 71 reptiles (including 39 species of lizards, 32 snakes and one turtle) and 83 species of mammals. The exact number of vulnerable and threatened reptile and mammal species in Khorasan provinces is not clear, but there are at least 33 reptiles and 10 mammals categorized as threatened species. The distribution and population size of some species has greatly changed during recent years, most probably as a result of recent global warming, i. e. temperature rise, decrease of precipitation, drought and human harmful activities. The human activity in this region, especially urbanization, agricultural activities and cutting of shrubs has caused fragmentation and serious decline of population size in some species and even elimination of some local endemic population of relict species. The conservation of mammals and reptiles in the North-East of Iran demands organized collaborations including education of native people for protection of valuable vertebrate faunae of the area.

Keywords: Biodiversity, Reptiles, Mammals, Conservation, Climatic changes, Khorasan, Iran.

INTRODUCTION

According to Dobson (1995), "biodiversity is the variety and variability among living organisms and the ecological complexes in which they occur and the sum of all the different kinds of organisms inheriting one region". Biodiversity is one of the main issues suggested and discussed in the United Nation's conference of Rio de Janeiro in 1992 that resulted in compiling the Convention on Biological Diversity. There are several goals relevant to conservation of biological diversity including prevention decline or loss of species and preservation of the local and regional richness of species in ecosystems. Each species is a unique taxon as a genetic system, which has evolved during a long evolutionary time. However some species, which were abundant in the past, are now at risk of extinction; their habitats are being fragmentized and lost, they are threatened by continuous droughts, and they are endangered by human interference in nature. If these severe extinction promoting factors are not prevented, humanity will encounter a great environmental tragedy. The East of Iran is located in the arid belt of the northern hemisphere. This region is separated from the other regions of Iran by topographic barriers such as the Kopet-dagh mountain ranges in the north and two large deserts,

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Dasht-e-Lut in the south and Central Kavir in the west. Various investigators have contributed to the study of vertebrates in Khorasan and adjacent regions, including Misonne (1959), Lay (1967), Hassinger (1973), Etemad (1974), Latifi (1975), Baloutch (1977), De-Blaise (1980), Farzanpay (1990), Baloutch & Kami (1995), Ziaie (1996), Anderson (1999), Aghamiri *et al.* (2002), Firouz (2001 & 2002), Rastegar Pouyani (2006), Nasrabadi *et al.* (2008), Darvish (1992, 2004, 2005, 2006, 2008, 2009 & 2011). Dianat *et al.* (2010), Shahabi *et al.* (2011). Tabatabaie *et el.* (2012), Siahsarvie *et al.* (2012). Rastegar Pouyani *et al.* (2010), Rastegar Pouyani (2009), Rastegar Pouyani *et al.* (2012). This unique zoogeographical region was named the Iranian Cradle of speciation by Misonne (1959). This region has encountered severe conditions such as continuous droughts and interference by man that have caused severe habitat fragmentation and loss of species. The present study was performed in light of the situation described above. Its objectives were twofold. First, to determine the approximate number of reptile and mammal species in Khorasan; reliable data on these numbers are not presently available. Second, to prioritize the status of reptile and mammal species and identifying the rare, endemic, and vulnerable species.

MATERIALS AND METHODS

The Great Khorasan is a geographic realm located in northeastern Iran that encompasses Razavi Khorasan, North Khorasan, and South Khorasan provinces (Fig. 1). Field surveys were carried out during 2002 to 2006 and 2009 to 2011 at many localities in Great Khorasan province. All specimens collected during the field surveys are deposited at the Zoological Museum, Ferdowsi University of Mashhad (FUZM) and at Hakim Sabzevari University. Temperature and precipitation data of 16 meteorological stations including sum of monthly precipitation, mean maximum and minimum temperatures, difference between means of maximum and minimum temperature, and mean annual precipitation for the past 50 years during (1952-2003) were taken from the Meteorological Organization of Khorasan (Fig. 2). The univariate analysis of the mean temperatures was performed using SPSS statistical package V. 15.

Reptiles are nocturnal and diurnal species that live in different habitats ranging from the open planes of central Khorasan up to the highlands in the northern regions of the area. For sampling of nocturnal reptiles such as geckos and snakes, crevices and under rocks in their preferred habitats were searched. Additionally, reptile footprints were followed on sandy grounds. For capturing large lizards and venomous snakes, thick gloves were used to prevent injuries. In addition, pitfall traps and traps made of fishing thread and long sticks with a hoop and a loose knot were used to capture lizards. Large and venomous snakes were collected using a T-shaped sticks; the sticks were placed on the back of the snake and then the head was carefully held with thumb and fingers. As with other reptiles, captured snakes were carefully transferred to a deep cloth bags and kept away from direct sunshine. The reptile specimens were killed using chloroform and preserved in 10% buffered formalin. Specimens were identified using available identification keys (Leviton *et al.* 1992, Anderson 1999 and Rastegar-Pouyani *et al.* 2006). The large mammals in protected regions were observed using binoculars. The small mammals such as rodents and insectivores were caught live with snap traps and Chiroptera were caught with miss nets and hand nets. Identifications were carried out using Corbet (1978).

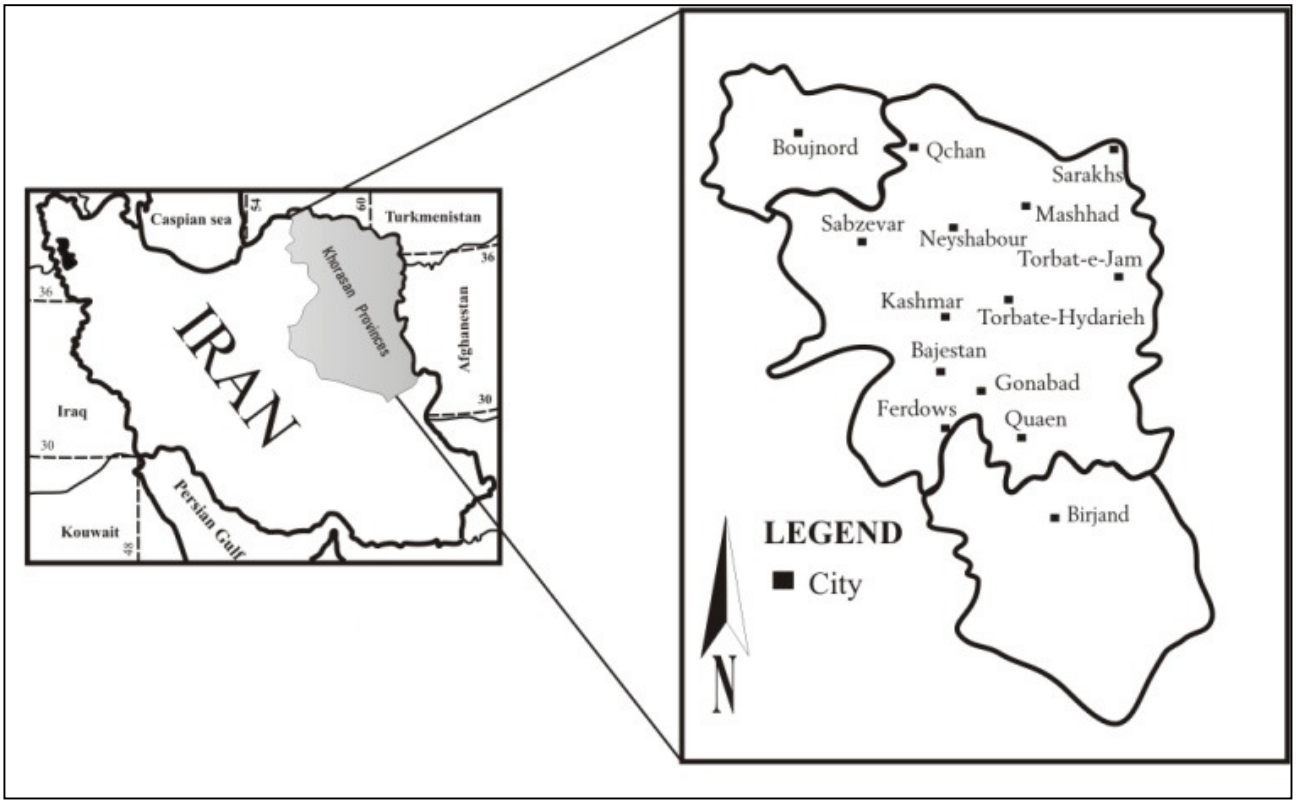


Figure 1. Sampling localities in three provinces that constitute Great Khorasan.

Results

Role of climatic changes on the distribution of reptiles and mammals

Since climatic changes affect vegetation and water resources of the arid ecosystems of the North-East Iran, we compared the additive variation of temperature and precipitation during past 50 years. The periods recorded in the regions differed and depended on year of establishment of respective meteorological stations and periods during which they functioned (Fig. 2).

The analysis of the climatic variations in the Khorasan provinces show that in the Southern Khorasan cities including Boshrouyeh, Khour, Birjand and Nehbandan the annual precipitations are 97.5, 112.8, 169.9 and 129.4 mm, respectively. These are the most arid regions. The precipitations in Ghouchan, Bojnourd and Mashhad in the north are 307.1, 267 and 257.5 mm, respectively, and these are the more humid areas as compared to the southern regions. The multivariate analysis of the mean temperatures in Great Khorasan shows that this region can be divided into two subregions, a dry subregion and a wet one. The cluster analysis shows that Khorasan could be divided into two different ecological regions, the highlands and the lowlands. Highland - limited species are found in semi-arid areas like Kopet-Dagh and Binaloud. Some of these species are reptiles such as *Anguis fragilis, Pseudopus apodus, Ablepharus bivitatus* and mammals such as *Acinonyx jubatus, Lynx caracal, Lynx lynx, Felis silvestris, Felis manul, Vulpes corsac, Crocidura leucodon, Sorex minutus, Chionomys nivalis, Blanfordimys afghanus, Ellobius talpinus, Meriones zarudnyi, Rhombomys opimus, Rattus ratoides, Allactaga toussi, Spermophilus fulvus, Spermophilopsis leptodactylus*. The

lowland species are *Jaculus blanfirdi* and *J. thaleri, Gerbillus nanus, Meriones libycus* and *M. crassus.*

Reptile and mammals faunae of Khorasan

Reptiles of Khorasan provinces consist of 71 species including 39 lizards, 32 snakes and one turtle (Table 1). The reptile fauna of the area is, in fact, one of the richest faunae in the country.

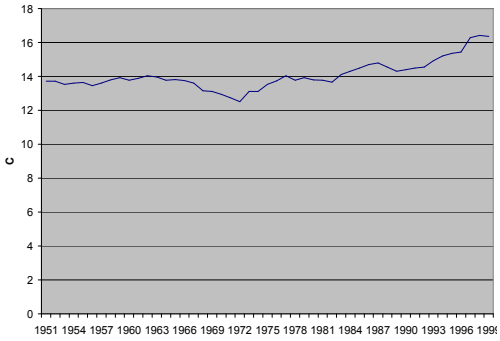
Of particular note are three reptile hotpots in Khorasan provinces; one is the Sarakhs district in which some elements of the Central Asian herpetofauna can be seen (e. g. *Trapelus sanguinolentus*, *Eremias lineolata* and *Eumeces taeniolatus*). Another rich area is located in central Khorasan, around Jungle town; this relatively small area is the sole habitat for *Eremis grammica* and *Phrynocephalus ornatus* in Iran that unfortunately both of which are now critically endangered due to extreme habitat demolition. The third one is the Sabzevar area in eastern part of the region. It is noteworthy that nearly two-thirds of Khorasan reptiles can be found in the Sabzevar area; but many species therein are fragmented and limited to small habitats. Another case of note is that several species of the Iranian reptile are confined to small parts of Greater Khorasan (e. g. *Eremias grammica, E. intermedia, Eumeces taeniolatus, Phrynocephalus ornatus, Crossobamon evresmani*). The lizards are well known, as funder of species, best adapted to aridity. It is the case in Khorasan too but the lizard population in the area in most cases show a pattern of fragmented populations and dispersions due to human activities.

There are 86 species of mammals belonging to 35 genera, 19 families and seven orders in the Khorasan provinces. The repeated finding of warm area species such as *Tatera indica*, and *Gerbillus nanus* belonging to subfamily Gerbillinae, confirm that the range of distribution of these species has been displaced from the low latitudes in the south and center of Iran to the northern part of Iran. *Gerbillus nanus*, as a warm area desert species, has penetrated the valley of Jajarm between Binaloud and the Copet-dagh mountain chains near Bojnord (Fig. 3). The situation is the same for *Tatera indica* that is now present in Torbat-Jam in the north-east of Iran; a half century ago, this species lived the Tabas Region (Misonne, 1959). In contrast, alpine species such as *Chionomys nivalis*, are now refuged to the top of the Binaloud mountain chains. Due to global warming and drought, *Blanfordimys afghanus* that is distributed in steppe region of Mashhad valley, based on pallet analysis, is actually could be found in the highland of Binaloud and Tandoureh National Reserve in the Northeast of Iran (Darvish, 1992). Therefore, the aridity, topography, vegetation, and climatic variations have greatly influenced the distribution range of small mammals in the Khorasan provinces.

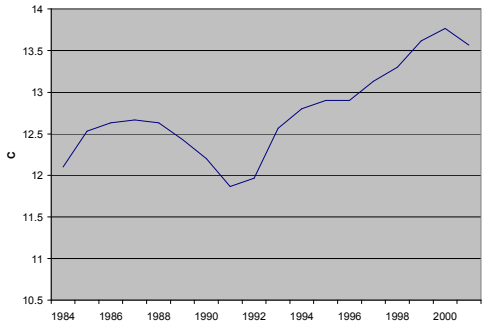
Conservation status of species

The rare and vulnerable species among reptiles and mammals of Khorasan, based on this study and and the data from Panteleyev (1998), Majnoonian (2005), red data book of Turkmenistan (1999), and IUCN (2006) for each taxonomic groups are presented as follows:

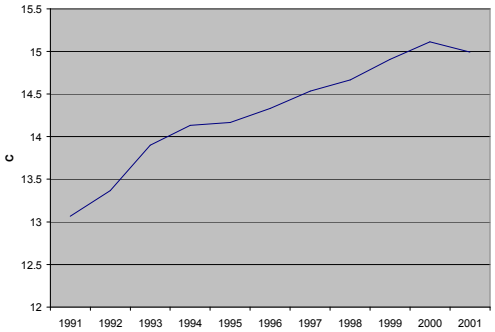
Reptiles: *Phrynocephalus maculatus* (isolated relict populations), *Phrynocephalus scutellatus* (declining population)*, Bunopus crossicaudus* (rare); *Cyrtopodion longipes* (a rare and insufficiently known species)*, Eremias nigrocellata* (declining population), *Ophiomorus chernovi (*rare in Polekhatoun). *Pseudopus apodus* (rare and fragmented, Saleh-Abad, Tandoureh and Esfarayen), *Varanus griseus* (declining population because of destruction and transformation of habitats and death on the roads), *Typhlops vermicularis* (rare), *Elaphe quatuorlineata*



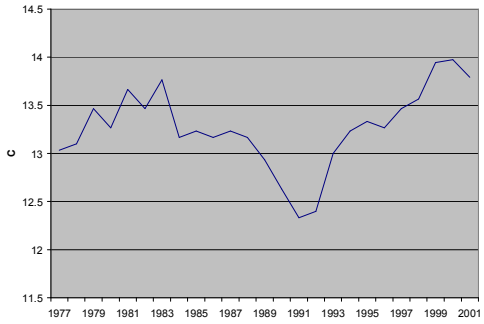
Mashhad ,1951-1999



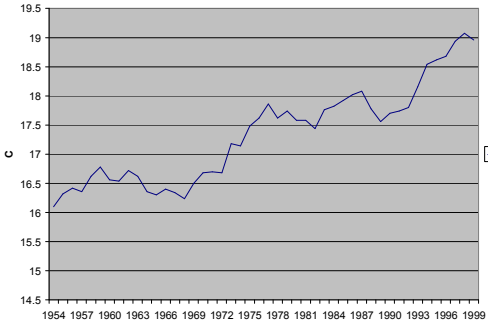
Torbat-Jam,1993-2002



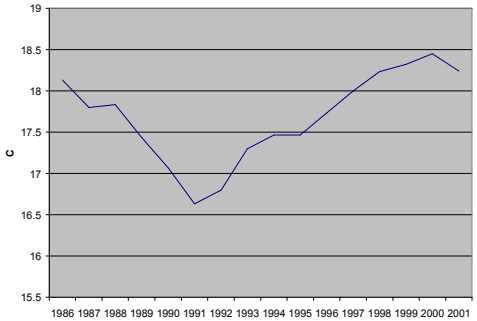
Nishabour, 1991-2002



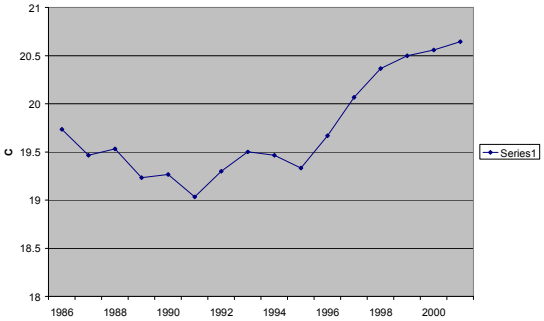
Bojnourd 1977-2001



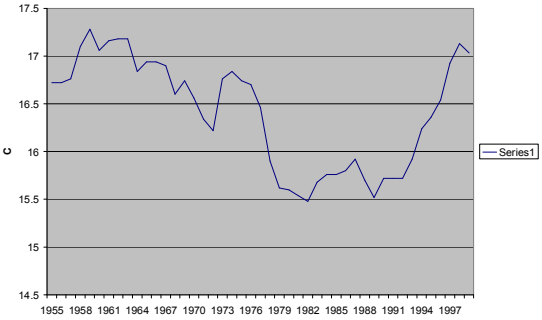
Sabzvar, 1954-1999



Kashmar, 1986-2002



Gonabad, 1986- 2001



Birjand, 1955- 2000

Figure 2. Additive variation of mean annual temperatures between 1951 and 2001 in some cities within Greater Khorasan.

(rare), *Naja oxiana* (declining in population number), *Macrovipera lebetina* (declining in number of populations), *Testudo horsfieldi* (declining in number of populations), *Eremias grammica* (critically endangered), *Phrynocephalus ornatus* (critically endangered); *Phrynocephalus mystaceus* (endangered), *Eumeces taeniolatus* (rare), *Eremias lineolata*, *E. fasciata, E. velox* and *E. persica* (declining the population size and fragmented), *Agamura persica* (a rare and insufficiently known species), *Eumeces schneideri*, *Trachylepis aurata*, *Ablepharus bivitatus* (rare and insufficiently known species). *Natrix tessellata*, *Boiga trigonata* (rare), *Echis carinatus* (threatened), *Pseudocerastes persicus* (endangered).

Figure 3. Penetration of *Tatera indica* and *Gerbillus nanus* from the south and center of Khorasan to the north, and limitation of *Chionomys nivalis* and *Blanfordimys afghanus* to the alpine and highland regions of Binaloud and Kopet-Dag (seen as patchily distributed populations.

Mammals: *Vulpes cana* (Least concern and stable), *Felis manul* (rare, vulnerable), *Caracal caracal* (vulnerable & rare, declining), *Panthera pardus* (near threatened, decreasing), *Acinonyx jubatus* (critically endangered and rare), *Hyaena hyaena* (near threatened and decreasing), *Lutra lutra* (near threatened and rare, decreasing in number of population), *Equus hemionus* (declining in population number),

Gazella dorcas (vulnerable and decreasing), *G. subgutturosa* (vulnerable and decreasing), *Capra aegagrus* (vulnerable and decreasing), *R. blasii* (least concern and decreasing), *R. hipposideru*s (least concern and decreasing), *Nyctalus leisleri* (endangered), *Mnipterus schreibersi* (near threatened and decreasing), *Ellobius talpinus* (least concern and decreasing), *Meriones crassus* (least concern and decreasing), *Myomymus personatus* (rare, endemic to the Turkemen-Khorasan Mountains), *Jaculus thaleri* (vulnerable and rare), *Allactaga hutsoni* (least concern and unknown), *A. toussi* (rare), *M. transcaspicus* (isolated population, least concern and unknown), *Chionomys nivalis* (isolated population), *Blanfordimys afghanus* (isolated populations), *Gerbillus nanus* and, *Meriones meridianus* (isolated populations), *M. zarudnyi* (a rare and insufficiently known species), *M. crassus* (isolated populations), *Rattus ratoides* (isolated populations, unknown), *Sorex minutes* (vulnerable and rare), *Crocidura leucodon* (unknown, rare), *C. suaveolens* (vulnerable and rare).

Table 1. Checklist of reptiles and mammals of Greater Khorassan and considerations on their conservation status.

Family	Species name	Status
Agamidae	*Laudakia caucasia*	Stable populations
	L. erytherogastra	Stable populations
	L. microlepis	Stable populations
	L. nupta	Isolated populations
	Trapelus agilis	Stable populations
	Phrynocephalus maculatus	Isolated, relict populations
	Ph. scutellatus	Declining population
	Ph. mystaceus	Endangered
	Ph. Helioscopus	A rare and insufficiently known species
	Ph. Ornatus	Critically endangered
Geckonidae	*Agamura persica*	A rare and insufficiently known species
	Bunopus tuberculatus	Isolated populations
	B. crassicaudus	A rare and insufficiently known species
	Crasobamon everesmanni	Isolated populations
	Teratosincus bedriagai	Rare
	T. scincus	Rare
	Cyrtopodion caspium	Stable populations
	Cyrtopodion longipes	A rare and insufficiently known species
	C. russowi	A rare and insufficiently known species
	C. scabrum	Stable populations
	C. agamoroides	A rare and insufficiently known species
Lacertidae	*Ermias fasciata*	Isolated populations
	E. nigrocellata	Declining population
	E. persica	Isolated populations
	E. Lineolata	Isolated populations
	E. grammica	Critically Endangered
	E. intermedia	Rare

	E. strauchi kopetdaghica	Isolated populations
	E. velox	Isolated populations
	Mesalina watsonana,	Stable populations
Scincidae	*Ablepharus bivittatus*	A rare and insufficiently known species
	A. pannonicus	Very rare
	Ophiomorus chernovi	Rare, in Polekhatoun only
	Trachylepis aurata	Isolated populations
	Eumeces schneideri	Isolated populations
	E. taeniolatus	A rare and insufficiently known species
Anguidae	*Pseudopus apodus*	Rare and fragmented, Saleh abad, Bagh Keshmir, Tandoureh, and Esfarayen
	Anguis fragilis	A rare and insufficiently known species
Varanidae	*Varanus griseus caspius*	Declining the population
Colubridae	*Rhynchochalamus melanocephalus*	A rare and insufficiently known species
	Spalerosophis schiraziana	Stable populations
	Platyceps karelini	Stable populations
	P. ventimaculatus	Rare
	P. najadum	Rare
	P. rhodorachis	Stable populations
	Eirenis modesta	Very rare
	Elaphe quatrolineata	Isolated relict populations
	Zamenis persica	Vulnerable
	Psmmophis schokari	Stable populations
	P. lineolatus	Unknown status
	Oligodon trigonata,	A rare and insufficiently known species
	Malpolon monspessulanus	A rare and insufficiently known species
	M. insignitus	A rare and insufficiently known species
	Telescopus rhinopoma,	A rare and insufficiently known species
	Hemorrhois ravergieri	Stable populations
	Dolichophis jugularis	Stable populations
	D. Schmidti	Stable populations
	Lycodon striatus	A rare and insufficiently known species
	Natrix tessellata	Isolated populations
Boidae	*Eryx jaculus*	Unknown status
	E. tataricus	Unknown status
	E. miliaris	Vulnerable
	E. elegans	Unknown status
Elapidae	*Naja oxiana*	Declining in population number
Typhlopidae	*Typhlops vermicularis*	Very rare
Viperidae	*Macrovipera lebetina*	Vulnerable
	Pseudocerastes persicus	Endangered
	Echis carinatus	Declining in number of populations
Crotalidae	*Glodius intermedius caucasicus*	Rare, Vulnerable

Testudonidae	*Testudo horsfiedi*	Declining in number of populations
Canidae	*Canis lupus*	Least concern & stable
	Canis aureus	Least concern & stable
	Vulpes vulpes	Least concern & stable,
	Vulpes cana	Least concern& stable
	Vulpes ruppelli	Vulnerable & rare,
Felidae	*Felis manul*	Vulnerable
	Caracall caracal	Vulnerable & Rare,
	Felis chaus	Least concern& stable population,
	Felis margarita	Near threatened
	Panthera pardus	Near threatened, decreasing
	Acinonyx jubattus	Critically endangered & rare
Hyaenidae	*Hyaena hyaena,*	Near threatened & decreasing,
Mustelidae	*Martes foina*	Least concern & stable
	Lutra lutra	Near threatened &, rare
	Mustela nivalis	Least concern & Stable
	Vormella pergusna	Vulnerable
Equidae	*Equus hemionus*	Declining in population number
Suidae	*Sus scrofa*	Least Concern & stable
Bovidae	*Capra aegagrus*	Vulnerable & decreasing
	Gazello subgutturosa	Vulnerable & decreasing
	Gazella dorca	Vulnerable & decreasing
	Ovis orientalis	Vulnerable & decreasing
Vespertilioidae	*Myotis mystacinus*	Unknown
	Myotis emarginatus	Vulnerable & decreasing
	Myotis blythi	Unknown
	Myotis emarginatus	Least concern & stable
	Myotis mystacinus	Least Concern & unknown
	Vespertilio murinus	Vulnerable
	Nyctalus leisleri	Endangered
	Otonycteris hemprichii	Least concern
	Miniopterus schreibersii	Near Threatened & decreasing
	Pipistrellus kuhli	Stable
	Eptesicus serotinus	Globally least concern & unknown
	Eptesicus bottae	Least concern
Rhinolophidae	*, Rhinolophus blasii*	Least concern & decreasing
	Rhinolophus hipposideros	Least Concern & decreasing
	Rhinolophus. ferromequinum	Unknown
	Rhinolophus muscatellum	Unknown
	Rhinolophus. aegypticus	Unknown
Erinaceidae	*Hemiechnus auritus*	Unknown

Soricidae		
	Paraechnus hypomelas	Vulnerable
	Crocidura gmelini	Least concern & unknown
	Crocidura. russula	Least concern & stable
	Crocidura. suaveolens	Vulnerable & rare,
	Crocidura leucodon,	Unknown
Leporidae	*Sorex minutus*	Vulnerable & rare,
	Lepus capensis	Least concern & decreasing
Ochotonida	*Ochotona rufescens*	Least concern & stable
Sciuridae	*Spermophilopsis leptodactylus*	Unknown
Hystricidae	*Spermophilus fulvus*	Least concern & unknown
	Hystrix indica	Least concern & stable
Dipodidae	*Allactaga elater*	Stable but insufficiently known species
	Allactaga hotsoni	Least concern & unknown
	Allactaga toussi	Isolated populations
	Jaculus thaleri	Vulnerable & rare,
	Jaculus blanfordi	Least concern & decreasing
Calomyscidae	*Calomyscus elburzensis*	Least concern & unknown
Muridae	*Apodomus witherbyi*	Least concern & unknown
	Rattus norvegicus	Least concern & stable
	Rattus ratoides	Unknown
	Mus musculus	Least concern & stable
	Nesokia indica	Least concern & unknown
	Meriones crassus	Isolated populations
	Meriones libycus,	Least concern & stable
	Meriones zarodnyi	A rare and insufficiently known species
	Meriones meridianus	Least concern & unknown
	Meriones persicus	Least concern & stable
	Rhombomys opimus	Least concern & stable
	Tetera indica	Least concern & stable
	Gerbillus nanus	Isolated populations
Cricetidae	*Blanfordimys afghanus*	Isolated populations
	Chionomys nivalis	Least concern & stable
	Microtus transcaspicus	Isolated populations
	Microtus paradoxus	Least concern & unknown
	Ellobius Fuscocapillus	Least concern & unknown
	Ellobius talpinus	Least concern & decreasing
	Cricetulus migratorius	Least concern & unknown,
Myoxidae	*Myomimus personatus*	Data insufficient & unknown
	Dryomys nitedula	Least concern, stable

Discussion And Conclusion

Many lacertid lizards such as *Eremias persica*, *E. fasciata*, *E. velox, Phrynocephalus maculatus* and *P. scutellatus* were once widely distributed in the open planes of eastern Iran. These taxa are now limited to small area in the form of fragmented and patchy populations (Anderson, 1999; Leviton *et al.,* 1992; Szczerback, 2003) .

The provinces of Khorasan suffered three phases of plant and animal eliminations. The first phase was occurred by human activities after the agricultural age, which resulted in destruction and elimination of some species of plants that were used for cooking and heating (Firouz, 2000). Some very important shrubs of the area such as *Tamarix* and *Haloxylon* are regularly cut for various purposes (e. g providing coal). The second phase was the new age of industrialization that caused the fragmentation of habitats and destruction of species' niches. The third, which was the result of previous phases, which is a crucial phase, is global warming. This study confirms that during last 50 years, the temperature in Khorasan provinces has been increasing regularly, while precipitation has been decreasing particularly in the South Khorasan province. The perturbation in food chains has also caused threatening of some endangered species. There are some rare species such as *Ablepharus bivitatus* and *Bunopes crossicaudus* which live as isolated relicts under rocks and stones on effusion surfaces close to the entrance of rodents' holes. They feed on ants and hymenoptera. The populations of monitor lizard *Varanus griseus* is decreasing because of destruction and transformation of habitats, and killing by men due to superstitions. One of the most endangered species of lizards in the area is the lacertid species, *Eremias grammica*. The distribution range of this species in the region is now limited to a small area around Jungle town where its habitat is dramatically destroyed due to human harmful activities. Likewise, to some extent, this is applicable to *Phrynocephalus ornatus*, a small agamid lizard of the area. Unfortunately the sand dunes around Jungle town is the only known locality for *E. grammica* and *P. ornatus*.

Present rreptile and mammal species are the result of long term evolution**.** The range of distribution of each species depends on the physiological capacities and geographic barriers. The ability of each species to tolerate climate changes depends on its biological capacities. The most xerophylous species of reptiles and mammals are observed in the arid regions of the South Khorasan. These are adapted to extreme xeric areas and maximum temperature. Whereas, the most hydrophilous species are found in the North, i. e. Kopet-dagh region or near Atrak and Tjen rivers. Changes in ecological parameters, could drastically cause lose of some or all species. The extreme condition is seen in Dash-Lut and Dasht-Kavir in the west and southwest of Khorasan provinces, where vertebrates are very scarce. Population stabilities were previously maintained as a result of adaptation to arid conditions. But, the recent pressures of global warming and human activities have resulted in declining populations of species in the northeast of Iran, the area which was earlier named as "Iranian tension zone" by Misonne (1959).

The mammals are the group under the highest threat and decline, due to perturbation in food chain, urbanization and hunting. *Acinonyx jubattus* is now critically endangered, and rare; *Caracall caracal, Vulpes ruppelli* are vulnerable and rare; *Felis margarita* is near threatened; *Hyaena hyaena* and *Panthera pardus* are near threatened and decreasing; *Equus hemionus* is declining in population number; *Ovis orientalis, Gazella subgutturosa, Gazella*

dorcas and *Capra aegagrus* are vulnerable and decreasing.

Small mammals as Glires and Insectivora are adapted to the microclimate. Small changes in the ecological conditions could influence their long time survival. *Crocidura suaveolens*, *C. gmelini* and *Sorex minutus* are now very rare species in the Khorasan provinces. The ground squirrel, *Spemopholus fulvus* once was a species with population continuity. But, due to expansion of desert to north of Iran, this species is now fragmented into two discrete populations. Recent urbanization is the cause of second fragmentation in distribution of the ground squirrel in northeast Iran. In the other words, some populations of this species are now entangled with closely living humans who have occupied their natural habitats. This is a main cause of population destruction. In many countries there are rules and regulations for protection of wild animals such as making animal paths under newly constructed roads. Recent observations show that newly constructed side barriers along the roads and highways in some areas prevent the normal movement of wild mammals and reptiles and consequently cause population disruption and animal death.

Rodents are also highly sensitive to climatic changes and their distribution is always in contraction. Myomimus personatus, Jaculus blandfordi, J. thaleri, Allactaga toussi, Ellobius talpinus, M. transcaspicus, Chionomys nivalis, Blanfordimys afghanus, Gerbillus nanus, Meriones persicus, M. meridianus, M. zarudnyi, M. crassus, Rattus ratoides are patchily distributed and their population number is decreasing due to destruction and transformation of habitats and global warming. Such a situation was reported by Wilson and Reeder (2005)

The priority is now to publish the red book on vertebrates of Khorasan provinces and take action plan for protection of rare species in this highly diverse region and fascinating biodiversity hotspot in the Iranian plateau.

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