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# Faunal Heritage of Rajasthan, India

Conservation and Management  
of Vertebrates

Volume 2

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 Springer

*Editors*

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*I hold that, the more helpless a creature,  
the more entitled it is to protection  
by man from the cruelty of man.*

Mahatma Gandhi\*

*\*Mohandas Karamchand Gandhi, popularly known as Mahatma Gandhi or Bapu (Father of Nation), was an iconic leader of the Indian freedom struggle during 1917–1947 who uprooted the British rule and led India to Independence by employing nonviolent civil disobedience and civil resistance which he called Satyagraha (Satya in Hindi meaning “truth” and Agraha meaning “insistence”). He deployed the philosophy and practice of Satyagraha in the Indian Independence Movement. Mahatma Gandhi is known to have greatly inspired movements for nonviolence, civil rights, and freedom across many parts of the world, the most famous being Nelson Mandela’s struggle in South Africa under apartheid and Martin Luther King Jr.’s campaign during the civil rights movement in the United States.*

*Vivid memories of childhood still gleam in my heart, when he taught me English grammar even while running in his late 70s. His spirit to fight with odds gives me strength and incessantly inspires me to never give up. He actually laid the foundation for my academic pursuits, as the values instilled by him breathe in me and his profound persona enlightens me in the midst of challenges even today. His journey of life proved that quest for knowledge coupled with hard work and passion can only give contentment and helps us realize our dreams. This effort is a reflection of that passion which might have silently got passed from him to me!*

*With reminiscence, I dedicate this volume to one of the best English teachers of his times and the founder Principal, Shri Khandelwal Vaish Central Senior Secondary School, Station Road, Jaipur, my grandfather (Late) Pt. Jai Nath Sharma (1892–1979).*

7 July, 2013

Dr. B.K. Sharma,  
Chief Editor

# Foreword



The contents of this diligently edited work enrapture me. They have an intimate link not only with my core subject of Zoology but also other areas of my interest as Secretary of the Zoological Society of London (ZSL) responsible for London and Whipsnade Zoos, the Institute of Zoology and our worldwide conservation programs. Fauna have always attracted me as an avid observer, interpreter, and reader; the present volume wonderfully describes and analyzes the vertebrate faunal abundance of Rajasthan, currently the largest state of the Indian republic.

Being home to the most exotic biological diversity, splendid ecosystems and colorful cultural heritage, Rajasthan has fascinated researchers, conservationists, academics, travelers, and tourists from around the globe. I am particularly impressed with the fact that through this well-researched work, the editors have achieved an extraordinary accomplishment not only in further unveiling the well-known Thar or Great Indian Desert but also putting in the spotlight the much lesser known yet ravishing wilderness, communities, lush green landscapes, and wetlands of Rajasthan. More than 600 illustrations are a direct testimony to this. These two volumes are an assemblage of what is bound to become some of the most sought after chapters and brilliantly



synthesized scientific information available. The content of this monumental yet modern faunal treatise will surely make it a distinguished contribution to knowledge in the area of faunal ecology and conservation. The first book (Volume-1) entitled "*Faunal Heritage of Rajasthan, India: General Background and Ecology of Vertebrates*" in its 24 chapters covers a spectrum of vertebrate fauna of the region. Individual chapters dedicated to threatened faunal species are of special significance in the contemporary setting. The second book (Volume-2) entitled "*Faunal Heritage of Rajasthan, India: Conservation and Management of Vertebrates*" aptly describes the conservation- and management-related aspects spread over 20 chapters.

This publication will be highly appreciated since there is no comparable account currently available. I am delighted to find that the physiographic and biodiversity profile of Rajasthan, conservation strategies covering a vision on the future of the fauna of Rajasthan, and information that fills significant gaps in research each find a bold presence in these superbly edited volumes. In addition, separate chapters on ecotourism, community conservation, and wildlife trade covered in Volume-2 will be useful resources, introducing concurrent themes for researchers interested in this part of the world. The editors have effectively revised the image of the Thar from that of merely a desert to a more vivid landscape housing some of the most resplendent and majestically unique fauna and flora.

The opening chapters of the first volume provide a well-focused introduction to Rajasthan as a vivacious state of India. The historical, sociocultural, mythological, and anthropological aspects of faunal conservation and the tribes of Rajasthan together with the fossil records set the scene for the book. I am certain that this work will serve not only zoologists, wildlife biologists, conservationists and natural scientists, and social scientists but also the general reader. Students, teachers, and active researchers on wildlife and conservation biology will find these volumes particularly valuable as an important reference and textbook. Although, there are many lacunae in our knowledge about faunal ecology and its conservation, this formidable twin volume set will surely help in bridging the gaps, while enabling conservationists and policy makers to arrive at a consensus regarding future strategies in Rajasthan. The editors have superbly compiled the latest information on both the ecology of Rajasthan and the conservation of the region's myriad vertebrates.

Today, when mankind has encroached, exploited, and decimated the natural habitats of our planet, and we find ourselves in the midst of impending environmental calamities, these volumes will spur a sense of responsibility towards nature; they deserve to create mass awareness about sustainable development, conservation, and management of our forests, wildlife, and natural resources.

I extend my hearty congratulations on the publication of *Faunal Heritage of Rajasthan, India* as two separate yet closely linked volumes. I further take this opportunity to congratulate wholeheartedly the dynamic chief editor Dr. B.K. Sharma, for it was he who conceived, carried forward, and delivered this massive work. I wish him further good fortune in his academic and professional endeavors.

March 21, 2011

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# Preface

Today, when the ecosystems of the planet Earth are fast changing and habitats of wildlife are being rapidly destroyed due to unsustainable development, the present edited volume is expected to give a bird's-eye view of the state of fauna in Rajasthan. Like other parts of the globe, Rajasthan, too, has faced rapid climatic changes recently; flooding in the desert being the most striking phenomenon. It is well known now that many plant and animal species are disappearing from the face of the earth at an alarming rate, some even without being discovered or known. In this situation, when it is widely believed that human activity is largely responsible for this inhuman destruction, should we not make concerted efforts to modify human behavior and limit population growth for sustainable biodiversity? In fact, the inordinate exploitation and prodigal wastage of natural resources that preceded and followed establishment of a materialistic and so-called prosperous civilization has put a question mark on the existence of both wildlife and mankind. Rajasthan and India are no exceptions, as similar conditions have existed in the past in western countries when forests were massively cut down, water sources were polluted, wildlife was ruthlessly hunted and livestock was exterminated to meet the demands of the moment without thinking of tomorrow. Eventually, it was felt that if strict measures to save the environment from human tempering were not taken, all of this pollution and waste may inevitably pose a serious threat to the very existence of man. Actually, such a fear has compelled us to take time out of the blind race for material gains and look into this issue on priority. This attitude subsequently paved way for massive environment and conservation-related studies.

With only 2.4% of the world's land area but with 16.7% of human population and 18% of its livestock, India contributes about 7% of Earth's known biodiversity. India is home to world's largest tiger population and has a unique assemblage of globally important endangered species. Wildlife conservation and management in India is currently facing a myriad of complex issues that are both ecological and social in nature. Issues such as habitat loss and/or fragmentation, overuse of biomass resources in the context of biotic pressures, increasing human-wildlife conflicts, livelihood dependence on forests and wildlife resources, poaching and illegal trade, and the need for maintaining a broad base of public support for wildlife

conservation exemplify and characterize the contemporary wildlife conservation scenario in India. The government and the civil society are taking several measures to address these issues. Improved synergy and better coordination amongst the wide array of stakeholders are needed to meet the challenges of conserving India's wilderness. These and other conservation management related aspects apply to the other states of the country too, though with a varying degree depending on the physiographic and other features.

A network of 668 protected areas (PAs) exists in India as of today and the output of such massive in-situ conservation effort in restoring a viable population of large mammals such as tiger, lion, rhinoceros, crocodile, and elephant has been significant. There are four categories of the Protected Areas (PAs) namely, National Parks, Wildlife Sanctuaries, Conservation Reserves and Community Reserves. The Ministry of Environment and Forests (MoEF), Government of India provides financial assistance to the State/Union Territory Governments for protection and management of the PAs under three main Schemes viz., Integrated Development of Wildlife Habitats, Project Tiger and Project Elephant. Formation of the *State Compensatory Afforestation Fund Management and Planning Authority* (State CAMPA), intended as an instrument to accelerate activities for preservation of natural forests, management of wildlife, infrastructure development in the sector and other allied works, is one of the major conservation initiatives by the MoEF. The State CAMPA would undertake compensatory afforestation, assisted natural regeneration, conservation and protection of forests, infrastructure development, wildlife conservation and protection and other related activities and for matters connected therewith or incidental thereto. The state forest department is responsible for the management of forests and wildlife in the state. It implements three major acts, viz., Rajasthan Forests Act 1953; Indian Wildlife (Protection) Amendment Act, 2006 and Forest (Conservation) Act 1980. The various activities undertaken by the department include forest protection, forest development works, wildlife management, soil and moisture conservation works, forest planning, harvesting, ecotourism activities, research, extension and training.

Conservation landmarks of the state cover 2.80% (9,121.61 sq km.) of the total area with three national parks namely, Keoladeo and Ranthambhore and the recently notified Mukundra Hills; 26 wildlife sanctuaries (WLS); four conservation reserves; two eco-sensitive zones; two Ramsar Sites (Keoladeo National Park [KNP] and Sambhar Lake); one proposed biosphere reserve (Desert National Park [DNP]); two tiger reserves (Sariska Tiger Reserve and Ranthambhore National Park); five zoos/zoological gardens at Jaipur, Udaipur, Bikaner, Kota and Jodhpur; one private zoo at Panchwati, Pilani; two biological parks; 10 safari parks/deer parks; and 24 Important Bird Areas (IBAs) as identified by Bombay Natural History Society, Mumbai, India. KNP and Sajjanganrh Wildlife Sanctuaries are the walled protected areas (PAs) while the National Chambal Water Sanctuary is a ravine system. On the other hand, Taal Chhapar and Gajner Wildlife Sanctuaries in Churu and Bikaner districts are the PAs of the arid zone. On May 17, 2013, the State Wildlife Board, Department of Forests, Government of Rajasthan has declared Jeenmata (Sikar district), Mansamata (Jhunjhunu district), Grass-farm Nursery (Jaipur district) and Mokhla (Jaisalmer district) as new conservation reserves. The board also decided to

increase the forest area of Sawai Mansingh WLS (situated near Ranthambhore Tiger Reserve) to 4137.40 ha; of Kailadevi WLS to 9624 ha; of Sariska Tiger Reserve to 39816.98 ha and of Bassi WLS to 5396 ha. 86.26 km sq revenue area of Todgarh-Raoli WLS and some area of Ramgarh WLS which falls under the Bundi city will be excluded. It is interesting to note that majority of PAs of Rajasthan initially came into existence as hunting reserves and private zoos of former kings and royals. *Shikar* (hunting) was a favorite sport of the erstwhile rulers which always found a place in the itinerary of visiting viceroys and British officers in the pre-Independence era. Royal families in Rajasthan also owned private zoos, most of which were taken over by the government following independence and later developed as wildlife sanctuaries and national parks. Governed by the National Tiger Conservation Authority (NTCA, formerly “Project Tiger”), the tiger reserves of Rajasthan are of global significance. Following a ruling by the Supreme Court of India and subsequent orders issued by the Central Government, tourism activities will now be shifted from core areas of National Parks to buffer areas. To this end, a tiger safari will be created at the Olwari-Niwari forest area of Ranthambhore Tiger Reserve and Nahargarh Biological Park.

The faunal richness of Rajasthan encompasses 140 species of fishes, 14 amphibians, 67 reptiles (including eight endangered reptiles and five falling under Schedule I of the Indian Wildlife [Protection] Amendment Act, 2006), 477 birds (including six Critically Endangered, Five Endangered, 12 Vulnerable, 19 Near Threatened, 14 Red Data and one Conservation Dependent species as per IUCN Redlist of Threatened Animals) and 87 species of mammals (including seven of Endangered mammals and 10 species falling under Schedule I of the Act).

The religious beliefs and socio-cultural traditions of the people of Rajasthan have contributed a great deal to the preservation of wildlife. Temples dedicated to various animals are a strong testimony to this, indicating the faunal linkages of the people, whereas birds such as *Kurjan* (Demoiselle Crane), Parakeet, Indian Peafowl, and House Crow are favorite themes of the Rajasthani folk music since time immemorial. *Bishnois* of Rajasthan stand apart from countless other sects and communities in India for their commitment to protect wild plants and animals. Amrita Devi, a *Bishnoi* lady who along with 363 villagers was martyred in the year 1730 while trying to stop tree-cutting by men of the then-ruler at the Khejadi village near Jodhpur district, is a burning example of the passion of *Bishnois* toward biodiversity conservation. Saako-363 Amrita Ki Khejadi (Hindi: साको - ३६३ अमृता की खेजडी) is an upcoming Hindi movie produced by Suraj Bishnoi and directed and written by Kalyan Seervi under the banner of Shri Maruddhara Films Pvt. Ltd. This film is based on the true story of Amrita Devi – a Bishnoi woman who fought with and revolted against the Deewan (Chief Minister of the Ruler) of the then *Jodhana* realm and his men to save Mother Nature and to particularly protect the ambient flora and fauna in her locale, *Khejarli* village near Jodhpur. Planned to be shot in Rajasthan, the movie has the famous Bollywood actress Gracy Singh as the main lead and is expected to release in December 2013. The story is about a fearless woman’s trials and tribulations to save the environment, a topic so relevant in the present times. The makers of the movie who belong to the Bishnoi Community have added a special clause in the film agreement whereby the cast and crew have been asked to abstain

from non-vegetarian food and alcohol till the shooting is completed. The ethics of conservation nurtured by saints and spiritual teachers such as Guru Jambheshwarji, the great environmentalist of the fifteenth century, are deep-rooted in the religions and culture of Rajasthan. Unfortunately, the current generation seems to have been distancing from religious ethos and values regarding zoolatry.

Biotic pressure continues to be one of the most important conservation problems in Rajasthan. Other prominent conservation issues include encroachment and mosaic human settlement inside PAs; scarcity of surface water, exotics and weeds; destruction of grasslands; drought; pollution; myths and zoophobia; mining; habitat loss, habitat alteration, habitat fragmentation and loss of eco-corridors; the presence of canals, roads, railway track and electricity lines inside of PAs; *Aida* (tribal treat)—a communal *shikar* (hunting) operation in the Udaipur–Rajsamand–Bhim area; wells and water-storing tanks without parapet wall inviting accidents of wild animals and incorrect rescue practices. For example, starred tortoises are unfortunately thrown in water in the name of rescue, ultimately killing these non-aquatic reptiles. Poaching records of Wildlife Flying Squad (eastern zone) reveal 383 cases during 1974–1975 and 1997–1998. In addition, as many as 51 tribes/communities were found indulged in these heinous offenses. This is the reason editors have added a separate chapter on tribes [Ch.4. In: Faunal Heritage of Rajasthan, India: General Background and Ecology of Vertebrates Volume-1. Sharma BK et al. (eds.), Springer, 2013.].

The state of Rajasthan is under the clutches of further desertification due to the ongoing climate crisis, already existing xeric ecosystem, fast pace of urbanization, mining, oil extraction and nuclear tests. On the other hand, the Indira Gandhi Irrigation Canal Project has completely changed the landscape in some regions of the Thar Desert. Fauna in the rest of Rajasthan are dwindling in population due to habitat loss and habitat fragmentation. Tremendous ecological changes are believed to have taken place in Rajasthan, especially in the Thar, due to the development of the 649 km long Indira Gandhi Nahar Pariyojna (IGNP) in Bikaner, Jaisalmer and Jodhpur districts and heavy afforestation activities. The habitat, cropping pattern and avian spectrum has drastically altered in many pockets. If proper conservation measures are taken, this canal can benefit both humans and wildlife. However, incorrect agricultural and water-use policies are putting desert life at a great risk. In addition, the expansion of agriculture and decreasing availability of surface water, especially in the northern Rajasthan has considerably affected the faunal abundance, replacing the native xeric elements by mesic forms. It is clearly felt that establishment of the Desert National Park (DNP) in Rajasthan by Indian government has positively affected wildlife in addition to promoting international tourism. Apart from its strategic importance for Indian defense, the park attracts a large number of investigators from the realms of zoology, botany, agriculture, sociology, geology, geography, non-conventional sources of energy and pedology. Though deficient in water resources, the DNP has rich mineral deposits, oil and natural gas. However, expansion of settlements on account of increase in human population, uncontrolled tourism and over-exploitation of natural resources may prove detrimental to the park. Another major threat is the proposal to build a canal that will bisect the park and bring many ecological changes. The unparalleled floral and faunal diversity of

the DNP not only provides a rich feast to the ecologists and historians but also shows the intricacies of a natural ecosystem. The DNP is perhaps among the most unique parks in the desert region of the world. Proper management plans for the DNP and surrounding PAs are imperative for the conservation management of Rajasthan's wildlife.

The Eastern Plains are famous for Keoladeo National Park (KNP), the only World Heritage site in Rajasthan and home to thousands of migratory avifauna and other rare and endangered animals. Unfortunately, the Siberian Cranes stopped visiting the area in 2003. Southern Rajasthan harbors mammalian fauna such as the Mouse Deer or White-spotted Chevrotain (*Tragulus meminna*), Common Palm Squirrel (*Funambulus palmarum*) and Elliot's Giant Flying Squirrel or Large Brown Flying Squirrel (*Petaurista philippensis*) which are not found anywhere else in Rajasthan. Despite being rich in biodiversity, this part is fighting to save its large number of wetlands and dense forests due mainly to unsustainable development and excessive human encroachment. The River Chambal has Gharial (*Gavialis gangeticus*), Marsh Crocodile or Mugger (*Crocodylus palustris*) and Gangetic River Dolphin (*Platanista gangetica*) apart from a variety of fishes. Mass mortality of *Gharial* in Chambal has recently shocked both conservationists and common men. The presence of Wild Dog or the *Dhole* (*Cuon alpinus*), also known as the Asiatic Wild Dog, Indian Wild Dog, or Red Dog and Wild Ass (*Equus hemionus khur*) also called Khur continues to be doubtful in Rajasthan. Two major carnivores, the Asiatic Lion *Panthera leo persica* and the Asiatic Cheetah *Acinonyx jubatus venaticus* became extinct during the last 65–100 years. Moreover, escalating human population and the resultant expansion of rain-fed cropping has resulted in shrinking grazing area for wild herbivores. Furthermore, overgrazing by livestock (their number being much above the carrying capacity of arid land) has almost reversed the natural vegetational succession leaving very little edible plants for the fauna in wilderness. As a consequence, the overall number of larger species is fast declining and that of smaller ones such as destructive rodents and insect pests is increasing. These facts point towards a dire state of affairs as far as conservational planning of the state is concerned.

On the other hand, continuous mining activities (Rajasthan has near monopoly with respect to mineral wealth and large deposits of stone) are posing a serious threat to the Aravalli Ranges and thus, to the faunal species present in this area. The Aravalli Ranges and its dry deciduous forests provide shelter to the threatened fauna such as the Sloth Bear (*Melursus ursinus*), Grey Wolf (*Canis lupus*), Striped Hyena (*Hyaena hyaena*), Leopard or Panther (*Panthera pardus*) and a variety of cats. The destruction of the Aravalli Ranges due to mining is having a negative impact on the ecosystem and wildlife.

We are also not able to save the wetlands and lakes of the state which are either dried or vanished and are never filled in their full capacity. The Sambhar Lake, a Ramsar Site of the arid zone, is continuously deteriorating and is being visited by only a few hundreds of wintering migratory birds such as the Greater and Lesser Flamingos (*Phoenicopterus roseus* and *Phoeniconaias minor*) since last decade while some of the other rare birds have stopped visiting the lake altogether due to



drastic shrinkage in the water spread. Likewise, the White-naped Tit also known as the White-winged Tit (*Parus nuchalis*) has completely disappeared from some pockets of the state. This has happened due to the callous attitude of administration towards the existing threats to its conservation. If proper conservation measures are taken, other wetlands of the state can greatly benefit both humans and wildlife. On the occasion of World Wetland Day (February 4, 2012), the Ministry of Environment and Forests (MoEF), Government of India's indications toward reviving Siberian Crane breeding project at KNP is a welcome first step for the conservation of this magnificent migratory bird which altogether stopped visiting the park in 2003. The MoEF plans to develop this project in association with the WWF-India and International Crane Foundation. On the same lines, the MoEF has plans to revive and conserve Sambhar Salt Lake, which is spread over an area of 225 sq km. Illegal salt extraction, mining, encroachment, anicut formation and drainage has caused severe shrinkage of the lake reducing its area to 100 sq km. during past decades. The tourism department, Government of India has recently decided to develop Sambhar Lake as a tourist spot which is again a welcome first step towards the conservation of this ancient lake.

Things were in a bad shape from 1980–2000 so far as implementation of wildlife laws is concerned. This was a crucial period for wildlife, particularly for the carnivores and schedule I animals due to the heavy demand from western countries for fur, skin, bones and other body parts. A separate chapter mentions some of the infamous wildlife crimes and notorious smugglers from the state which have attracted both national and international attention namely, Sansarchand and Shabeer Hasan Qureshi—both international wildlife smugglers responsible for the poaching of hundreds of tigers, leopards and other endangered wild animals including a variety of small cats, pangolins and porcupines. This chapter also describes the ensuing Sariska debacle, trade of critically endangered animals like Peregrine (resident species) and Shaheen Falcon (migratory species) in Jaisalmer district, recovery of 250 kg of elephant tusks (ivory) in Jaipur, film star Salman Khan's case of Blackbuck and Chinkara killings in Jodhpur district and Kaliya Bawaria case—a tribal who killed large number of leopards in Rajasthan. The chapter also mentions flaws and loopholes in the laws, taking advantage of which maximum number of accused are discharged even after following long legal battles. Indiscriminate cutting of the state tree *Khejadi*, parts of which have been recently found to be effective in the treatment of cancer. is another serious problem.

After the shocking news of January 2005 that no tigers are left in Sariska, the Government of Rajasthan in cooperation with the Government of India and the Wildlife Institute of India (WII) planned re-introduction of tiger which was accomplished in three stages, i.e., in June 2008, February 2009 and July 2010. At present, five tigers - two males and three females - are dwelling in the reserve. The state of affairs at Ranthambhore National Park is also worrying wildlife lovers and conservationists. Tigers leaving their protected territory to reach faraway places has given a hard time to forest guards with six of them leaving the park during recent years to inhabit other forests far and near. The death of tigers following territorial fights resulting from shrinking forest cover and human encroachment has now become a

serious concern. Nine tigers have been killed during the past four years. It is worthwhile to mention here that this book is covering in an altogether separate chapter, the first hand account of the historic tiger re-introduction in Sariska written by the scientists and forest officials who were actually involved in the entire operation. It is a sigh of great relief that, besides 26 adult tigers, 25 cubs born during January, 2011 to June, 2012 currently inhabit the Ranthambhore Tiger Reserve.

Besides, there exist a number of still-unexploited potential ecotourism sites boasting dense forests rich in biota, natural scenic beauty, waterfalls and monuments including palaces, forts and temples. Hadoti region and Abu Hills of south-western Rajasthan are key examples which are likely to attract thousands of native and international tourists, naturalists and researchers. Rajasthan has extensive wetlands too. In addition, the traditionally conserved *Orans* and *Gauchars*, or common property reserves, and the age-old water conservation structures are also indicative of the wise use of the limited natural resources since ancient times. This volume also analyses the biodiversity protection of the Thar Desert by its village institutions and their immense utility as the common pool resources to rural population. These village institutions are *Gaucher*, *Oran* (common property), fallow lands, plough fields, sand dunes, forest enclosures, gravel lands, wasteland and agriculture land. Approximately 5.6% of total land area is covered by these village institutions and they support the faunal diversity and its conservation in a great manner.

The state forest department is currently playing an important role in the conservation of rare and endangered wild animals and “Village Displacement Schemes” in and around Protected Areas. As most of the biodiversity-rich dense forest areas are situated in and around the wildlife sanctuaries and national parks, efforts have been made to reduce the biotic pressure caused by the human settlements. The end result of such biotic and anthropogenic pressures is reflected as everyday conflict between wildlife managers and local villagers. In a bid to handle this tension and competition, buffer zones lying close to protected areas are being developed so that the dependence of locals on these areas for various reasons e.g. fodder and fuel wood etc. could be minimized. Apart from this, habitat improvement programmes, development of water bodies, food resources and roads/passages inside forests are being undertaken in these rapidly declining wildlife-rich areas. The major efforts completed or proposed by the state forest department from 2009–2011 include: deployment of ex-army personnel and home guards in Ranthambhore and Sariska Tiger Reserves to strengthen security; displacement of villages from Ranthambhore and Sariska Tiger Reserves and Karouli buffer zone; water restoration to the World Heritage Keoladev National Park via Goverdhan Drain and Panchna Dam; establishment of “Tiger Conservation Foundation” for Ranthambhore and Sariska to facilitate ecotourism activities and other eco-development programmes like water-harvesting projects, eco-corridors at Sawai Mansingh and Kailadevi Wildlife Sanctuaries, especially created for tigers to stop territorial fights; management of wildlife outside protected areas targeting the satellite wetlands of the Thar Desert and Keoladeo National Park, development of Kumbhalgarh and Hadoti as potential ecotourism destinations; development of Kheechan and Tal Chhapar WLS; relocation of two more tigers to Sariska; establishment of “Rajasthan Protected Area



Conservation Society” for the management of national parks and wildlife sanctuaries of the state; Bustard Conservation Project; Mount Abu declared as an “Eco-sensitive Zone” and meeting of the Directors of all the national parks and tiger reserves falling under “Project Tiger” held at Sariska Tiger Reserve during July 2009 to discuss management of tiger projects. The newly notified national park by NTCA, Mukundra Hills in Kota district of Hadoti region shall be the major conservation strategy in coming years. Efforts are being made to develop and include this area as a tiger reserve which is popularly known as the “maternity home” for Ranthambhore tigers. The world famous Ranthambhore National Park and tiger reserve is fighting with problems related to shrinking territory. Very recently, the Central Government has asked all the state forest departments of the country to establish Ecosensitive Zones/buffer areas in a 10 km radius around national parks and wildlife sanctuaries. This plan was dormant for the past nine years due to pressures created by local people, miners and hoteliers; there are a number of mines and hotels running in many of these areas. In addition, the Government of Rajasthan has decided to conserve Sariska Tiger Reserve by developing a 10 km-long ring road in Thanagazi area around the reserve for vehicular traffic which is presently running through Sariska Tiger Reserve. Plans to develop eco-corridors between Ranthambhore and Kailadevi WLS and Sariska Tiger Reserve to Kunho–Palanpur of Shivpuri district of Madhya Pradesh are being pursued in order to eliminate the frequent territorial fights among tigers. In addition, places of pilgrimage and historical importance in and around the reserve are also being constructed. This scheme, apart from the Sariska Tiger Reserve will include Ajabgarh–Bhangarh, Taalvriksha and Garhi Mamund, Virat Nagar, Parashar and Jahaaj, Bhrathari, Pandupol and Neelkanth Mahadev.

The grasslands of the eastern Rajasthan hold significant number of important species including Lesser Florican and Godavan or Great Indian Bustard (GIB). On June 05, 2013, Rajasthan became the first state to launch “Project Great Indian Bustard”. To this end, development of enclosures in an area of 400 ha will be created at Ramdeora and Saunkhalia for these birds in the first phase. In addition, a separate task force will be set up for stepping security for these birds apart from strict monitoring of their habitat and poaching related issues. The Government of Rajasthan also plans to write to international agencies like WWF to persuade Pakistan to protect these endangered birds in its territory. According to recent media reports and population estimates by the central environment and forest department, less than 200 GIBs are left in India as of today and half of them are in western Rajasthan. The bird is now confined only to eight pockets in the six states of India including Rajasthan. Forest Department has received 50 million Indian rupees as the first installment of project GIB and the total budget for this project for 2013 is 680 million Indian rupees.

Other in situ conservation initiatives taken on this day by the state forest department include restoration of Sariska Tiger Reserve; panther conservation project at Pali; semicaptive exhibit centre for the Siberian Crane at Bharatpur; Notification for Shakambhari, Gogelav, Rolu, Beed Jhunjhunu, Umedganj and Jawaibandh (leopard) Conservation Reserves; corridor restoration in Ranthambhore Tiger Reserve;

recruitment of 1800 forest guards and strengthening protection force with 144 new vehicles; setting up of a centre for excellence in forestry and wildlife at Jaipur with a subcentre at Sawai Madhopur; and notification regarding Mukundra Hills Tiger Reserve and National Park at Kota and Kumbhalgarh National Park at Rajsamand (Udaipur).

Rajasthan Government's forest department in conjunction with the MoEF, Government of India has recently taken some serious steps towards in situ conservation. On July 9, 2012, the Government of Rajasthan cleared the forest department's plans to create buffer zones in the peripheries of Ranthambhore National Park (RNP) where in the future the growing population of tigers can move from the park's core area. This will be investigated and finally approved by the National Tiger Conservation Authority (NTCA). These buffer zones would be developed in the 647 sq km Kailadevi Sanctuary and the 127 sq km Sawai Mansingh Sanctuary adjoining the 392 sq km core area of the RNP. In addition, plans to develop natural corridors or eco-corridors connecting the Ranthambhore forest with Kailadevi Sanctuary have also been finalized. To accomplish this, 23 villages from the sanctuary will be relocated outside the forest area and the forest land thus vacated will be used to develop prey base for the tiger. Conservationists, however, are in favor of developing corridors connecting all the tiger reserves in Central India in order to have a natural mix of genes among the entire tiger population thriving at Ranthambhore and Sariska in Rajasthan and that of Palampur Kuno in the adjoining state of Madhya Pradesh.

The present volume endeavors to function as a compendium on the habitat level and other pressures faced by the existing species and their conservation both in situ and ex-situ. In addition, wetlands, community conservation and resource dependency, legal measures, ecotourism, gaps in research and restoration efforts currently being done are also covered. To keep the readers abreast with the overall view of the subject, relevant appendices have also been included. This volume is expected to contribute greatly to the further study of vertebrate conservation while the contents will surely stimulate, hasten and strengthen the march towards faunal conservation and management. It is hoped that the book in hand will serve as a useful and indispensable text and reference material for teachers; researchers; amateur and advanced students of Zoology, Environmental Science, Wildlife and Conservation Biology, Animal Behavior and Biodiversity; wildlifers and forest officials; conservationists; ecologists; wildlife organizations; freelancers; nature lovers; wildlife photographers; policy makers; sensible and sensitive citizens; intellectuals; the public and the young minds.

To this end, the editors have tried to gauge the progress while covering the burning issues like vulture crisis (the world famous Diclofenac issue), crocodile mass mortality, water crisis and the disappearance of the Siberian Crane from Keoladeo National Park (KNP), territorial fights among Ranthambhore tigers and the missing tigers of Sariska Tiger Reserve in addition to the vanishing fresh water and salt lakes, changing desert climate and destruction of Aravalli Hills due to mining. Upcoming government policies on serious issues like creation of new national parks, conservation and community reserves across the state, and conservation

efforts done by both small regional groups and leading NGOs of the country have also been incorporated. This edited volume deals with a range of still other important issues and topics like the trade in animals and animal parts and wildlife crimes; the impact of altered land use pattern on small mammalian diversity of hilly tracts; in situ conservation; conservation and management of wetland birds; extension of the protected areas; the hunting tribes; community conservation; rehabilitation of tribes such as the *Mogiya* rehabilitation initiative; the age-old concept of *Oran*; ecotourism and heritage tourism; gaps and impetus in research and initiatives and awareness programmes of wildlife groups and other premier agencies towards faunal conservation in Rajasthan. All these topics are discussed at length with their related prospects, perspectives, ramifications, development schemes and so on with penetrating insights with reference to the state of Rajasthan. Contributors to this volume include both seasoned and young scholars, experienced conservation practitioners and managers, forest officials, teachers, social scientists and life scientists. The editors have meticulously attempted to compile various important recommendations from experts with respect to conservation of the wonderful faunal heritage of Rajasthan. Please also see *Faunal Heritage of Rajasthan, India: General Background and Ecology of Vertebrates*. Sharma BK et al. (Eds), 2013, Springer (ISBN: 978-1-4614-0799-7) for an overview about Rajasthan in general and the fauna of Rajasthan focusing ecology of the vertebrates in particular.

It is high time to conduct intensive surveys to monitor these altered land use patterns, the status of endangered species from various geographical and ecological regions of the state and other faunal species lying on the verge of extinction in order to chalk out conservation strategies and eradicate existing potential threats as early as possible. Applying relevant forest management technologies, making ecotourism more attractive and productive, rehabilitating hunting tribes and minimizing the impact of mining activities on faunal abundance and survival are the issues which need intensive research, concrete action plans and strategies. The present volume stresses upon the dire need for further research on the ecology and status of various faunal groups in the light of alarmingly changing climatic conditions. At this juncture, the need of an efficient database centre for providing updates on the current status of existing faunal species, their population and distribution has long been felt. On May 12, 2013, the Forest Department, Government of Rajasthan proposed to set up a training institute in the state where appropriate training in connection with wildlife, forests and related aspects would be made available by experts from India and abroad. A branch of this 'institute of excellence' would be opened at Ranthambhore National Park in Sawai Madhopur. It is worthwhile to mention here that, the Wildlife Institute of India (WII) situated at Dehradun (Uttarakhand) is currently the only such institute in India.

Initially, it seemed difficult to present the aspects of conservation management in a tightly edited volume but soon after the volume's inception, we chose the most relevant topics to be covered. For convenience of understanding by the reader, the entire manuscript has been further splitted into four major sections. It was indeed tricky to provide appropriate headings to cover the wide variety of chapters under

these heads. Last but not the least, the present edited volume is an earnest attempt towards the scientific documentation of existing vertebrate fauna of Rajasthan and under a single cover. We hope that this volume will be useful for wildlife specialists, conservationists, environmentalists, zoologists, ecologists, researchers, students, policy makers and education administrators not only in Rajasthan and India but throughout the Globe.

At this crucial juncture when natural resources of the planet earth are depleting rapidly, the animal life is being driven to its ultimate retreat in the fast diminishing ecosystems, wild creatures are annihilated, the insensitivity of humans towards fellow creatures is increasing and when man's outlook upon the domain of nature has drastically changed, the teachings of Indian philosophy, theology, moral and social sciences can help us to relive the times when the human race had comfortably flourished by affectionately mingling with Nature. A serious approach towards wildlife and forests is still lacking in India, but the need for such an approach is paramount. In fact, the callous attitude of policy makers, administrators, politicians and the intelligentsia coupled with the greed of businessmen have badly affected the pace of welfare efforts and implementation of laws. The forgotten concepts of social sciences and the concepts of animal liberation and animal rights also seem pertinent in the present milieu if India has to survive as a country which always commanded respect of the rest of the world on account of the culture and traditional values. The biggest testimony to this is our honest consideration of the protective umbrella or the environment around us as Mother Nature. A few quotes relevant to the present context and worth mentioning here are: *Man is the only creature that consumes without producing. He does not give milk, he does not lay eggs, he is too weak to pull the plough, and he cannot run fast enough to catch rabbits, Yet, he is the lord of all the animals*—George Orwell; *Life is life—whether in a cat, dog or man. There is no difference there between a cat or a man. The idea of difference is a human conception for man's own advantage*—Saint Sri Aurobindo; *We can judge the heart of a man by his treatment of animals*—Immanuel Kant; *The Greatness of a nation and its moral progress can be judged by the way its animals are treated*—Mahatma Gandhi.

According to a recent report by The Asian News International (ANI), “Any truly meaningful biodiversity conservation effort must take the expanding human population footprint into consideration”. It is estimated that, there would be 3.3% more threatened species in the next decade and 10.8% of species would be threatened with extinction by 2050. The data speak loud and clear that not only human population density but the growth of the human population is still having an effect on extinction threats to other species. The report points out that ‘increase in human population could inevitably crowd out mammals’.

With thousands of years of culture, India will surely act as the *Vishwaguru* (world teacher) in the times to come. In the present scenario of terrible unrest, biodiversity conservation is something pragmatic that must be directly linked with education and incorporated in the curricula at schools, colleges and universities not only in India but the whole world. In a country of rich traditional heritage where *ahimsa parmodharma*

(a phrase in Sanskrit language which means that “non- violence is the topmost duty to the extent that it supersedes all other duties”) and *Vasudhaiva Kutumbakam* (a phrase in Sanskrit language which means that “the whole world is one single family”) are the guiding principles, destruction should have no place. It’s high time that we come together to live alongside nature, commiserate with the harmless animals and join hands to create a symphony of peaceful coexistence. Nature conservation is the key to this concept.

It is a pleasant coincidence that the book was accepted for publication in 2010—the international Year of Biodiversity and was written through 2011 which marked the beginning of a crucial decade in the international calendar for biodiversity. This was the start of the United Nations “Decade on Biodiversity” and was declared “International Year of Forests”. It was a great delight to witness that the final proof reading of the manuscript was completed towards the end of 2012— which is marked as the “International Year of Sustainable Energy” and when India hosted the XI Conference of Parties (CoP) on Convention on Biological Diversity (CBD) at Hyderabad.

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Dr. B.K. Sharma  
Chief Editor

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Writing acknowledgement for something one has been doing for years can be both easy and tricky. Easy because the person is quite intimate with the innumerable events that have quickly passed by and quietly slipping down the memory lane is the only way to gather them back, this is generally a pleasure. However, it becomes tricky because one cannot always lay down the pain and unpleasant facts and circumstances associated with such a task.

The book actually got conceived during my involvement as Organizing Secretary of the “National Conference on Conservation and Management of Faunal Diversity of Rajasthan” (NCCMFDR) held during August 11–13, 2006. Sponsored by the University Grants Commission (UGC)—the apex body governing the higher education sector in India and the Department of Science and Technology (DST).

Government of Rajasthan, deliberations of this meeting formed the basis of the need to bring out such a publication. The idea of compiling the faunal abundance of Rajasthan and aspects of its conservation management at one place arose from the fact that when I desperately searched for a book describing the fauna of Rajasthan, I was wonderstruck not to find one. I wish to humbly acknowledge Dr. A.K. Mathur, the then Principal, R.L. Saharia Government PG College, Kaladera (Jaipur), Rajasthan, India, for rendering his support while I organized the above conference.

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Apart from agreeing to write a chapter at a short notice, Dr. Jeffrey Snodgrass of Colorado University, USA rendered fruitful suggestions which helped in improving the manuscript; I gratefully acknowledge his inputs.

I feel greatly privileged to have received valuable contributions from eminent authors without whom this volume would not have seen the light of the day. I am fortunate that apart from experienced teachers and colleagues, I enjoyed the counsel of some very competent wildlife experts and conservationists during the preparation of this volume.

I take this opportunity to profoundly thank Professor Paul Harvey, FRS, Head, Department of Zoology, University of Oxford, for he penned the foreword despite other potential academic and professional commitments. Without expressing deep gratitude and thanks towards my scholarly co-editors, the thanks giving will not culminate whose active cooperation actually helped me to complete the book. Were it not for the encyclopedic knowledge of Dr. Rahmani and the hard work of Dr. Kulshreshtha, this volume would have lacked in substance.

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It is worthwhile to mention here that right from the call for papers and collection of manuscripts to the interactions with the publishers, editing and proof reading the entire work stretched over five long years. I owe much to my charming daughter Anushka, and son Divyam, who actually grew up with the preparation of this volume and most of the time witnessed me working in my study, enriched the result and remain a great source of comfort for me.

While writing the acknowledgements, my heart goes out to *Jugal Bhawan*—the 65-year-old ancestral house in Jaipur built by my grandfather (Late) Pt. Jai Nath Sharma where I was born with four siblings and lived as a joint family until the end of 2011. The building has been demolished only to be reborn as an apartment called *Jugal Enclave*. The place not only witnessed my upbringing but also my struggles and survival in connection with this writing project. In fact, majority of the work related to the book was completed in a quiet corner of this palatial bungalow.

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For the one person who supported me selflessly and out of the way while I was putting all my heart and soul into this book, working long hours and late nights despite occasional illness and loads of other commitments, she cheerfully stood beside me, I am short of words to wholeheartedly thank my spouse without whom, this mammoth task would not have reached fruition.

I must share with the readers that I had originally planned an almost 1,200 pages-long single volume entitled “*Faunal Heritage of Rajasthan, India: Ecology and Conservation of Vertebrates*” covering both ecology and conservation management under one cover. In order to make a hefty volume handy, Janet Slobodien suggested me to split this book into two volumes, rather two separate books titled “*Faunal Heritage of Rajasthan, India: General Background and Ecology of Vertebrates*” and “*Faunal Heritage of Rajasthan, India: Conservation and Management of Vertebrates*.” The splitting may have caused marginal delay in the publication of this work but I am sure, the readers and contributors would appreciate the need to do so.

Above all, I profusely thank God Almighty for giving me enough courage during the gestation and prolonged labor and as always for everything. I would be grateful



to the esteemed readers for their comments on the newborn twins. I hope the editors justify their aspirations; however, constructive criticism and suggestions are invited to further improve this volume in its future revisions. The only thing now left to be added is that responsibility for imperfections and failings, if any, are mine alone.

Jaipur, Rajasthan, India  
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Dr. B.K. Sharma  
Chief Editor

# Contents

## Part I Faunal Conservation as a Pragmatic Approach: Aspects and Challenges

<b>1</b>	<b><i>In Situ</i> and <i>Ex Situ</i> Conservation: Protected Area Network and Zoos of Rajasthan .....</b>	<b>3</b>
	B.K. Sharma, Seema Kulshreshtha, Shailja Sharma, Sonali Singh, Anita Jain, and Manoj Kulshreshtha	
<b>2</b>	<b>Climate and Other Environmental Factors Influencing Faunal Ecology of Rajasthan .....</b>	<b>67</b>
	A.S. Rao and B.K. Sharma	
<b>3</b>	<b>Impact of Altered Land Use Pattern on Small Mammalian Diversity of Hilly Tracts of Rajasthan, India .....</b>	<b>79</b>
	Himmat Singh, Partap Singh, and B.K. Sharma	
<b>4</b>	<b>Threats to Faunal Diversity of the Aravalli Hills with Special Reference to Kumbhalgarh Wildlife Sanctuary .....</b>	<b>93</b>
	A.K. Chhangani, Paul Robbins, S.M. Mohnot, and B.K. Sharma	
<b>5</b>	<b>Faunal Ecology and Conservation of the Great Indian Desert.....</b>	<b>113</b>
	C. Sivaperuman and Q.H. Baqri	
<b>6</b>	<b>Planning Conservation for Chambal River Basin Taking Gharial <i>Gavialis gangeticus</i> and Ganges River Dolphin <i>Platanista gangetica</i> as Umbrella Species .....</b>	<b>135</b>
	Syed Ainul Hussain, Ruchi Badola, Rishikesh Sharma, and R. Jagannath Rao	
<b>7</b>	<b>Reintroduction of Tigers in Sariska Tiger Reserve, Rajasthan.....</b>	<b>157</b>
	K. Sankar, Qamar Qureshi, P.K. Malik, Parag Nigam, P.R. Sinha, R.N. Mehrotra, and Rajesh Gopal	

<b>8 The Ramsar Sites of Rajasthan: Ecology and Conservation of Sambhar Salt Lake, Jaipur and Keoladeo National Park, Bharatpur .....</b>	<b>173</b>
Seema Kulshreshtha, B.K. Sharma, and Shailja Sharma	
<b>9 Impact of Mass Mortality of Gharial <i>Gavialis gangeticus</i> (Gmelin, 1789) on its Conservation in the Chambal River in Rajasthan.....</b>	<b>221</b>
Asghar Nawab, Dhruva Jyoti Basu, Sanjeev Kumar Yadav, and Parikshit Gautam	
<b>10 Conservation and Management of Wetland Birds in Rajasthan: Perspectives and Challenges .....</b>	<b>231</b>
Lalitha Vijayan and V.S. Vijayan	
<b>11 Conservation and Management of Demoiselle Crane <i>Anthropoides virgo</i> at Kheechan in Rajasthan.....</b>	<b>245</b>
Pushp Jain, Bhojraj Jeenagar, and Satya Narayan Rajpurohit	
<b>12 Distribution of Sarus Crane <i>Grus antigone antigone</i> in Rajasthan and People's Participation in the Protection of its Breeding Sites.....</b>	<b>261</b>
Jatinder Kaur, Anil K. Nair, and B.C. Choudhary	
<b>13 Conservation Prospects of Smooth-coated Otter <i>Lutrogale perspicillata</i> (Geoffroy Saint-Hilaire, 1826) in Rajasthan .....</b>	<b>273</b>
Asghar Nawab	
<b>14 Role of Local People and Community Conservation in Rajasthan.....</b>	<b>285</b>
Neema Pathak and Ashish Kothari	
<b>15 The Revival Model for Common Property Reserves in the Thar Desert of Rajasthan with Special Reference to their Faunal Components .....</b>	<b>299</b>
P.L. Kankane	
<b>16 Resource Dependency and Socio-economic Profile of Local Communities in Sariska Tiger Reserve, Rajasthan .....</b>	<b>309</b>
Tanushree Srivastava, K. Sankar, Qamar Qureshi, and P.R. Sinha	
<b>17 Nature Reverence does not mean Conservation in Tribal Rajasthan: Culture, Cognition, and Personal and Collective Commitments to the Environment.....</b>	<b>327</b>
Jeffrey G. Snodgrass, Satish Kumar Sharma, and Michael G. Lacy	

**Part II Ecological and Wildlife Tourism in Rajasthan:  
The Terra Incognita**

- 18 Ecotourism in Rajasthan: Prospects and Perspectives.....** 353  
Shailja Sharma, B.K. Sharma, Seema Kulshreshtha, and Smriti Johri

**Part III Vanguards of Wilderness**

- 19 Wildlife Conservation in Rajasthan: The Legal Framework  
Versus the Wildlife Trade .....** 401  
B.K. Sharma, B.S. Nathawat, Shailja Sharma,  
and Seema Kulshreshtha

**Part IV Management of Faunal Conservation in Rajasthan:  
A Synthesis**

- 20 Unfurling Conservation Strategies, Major Initiatives,  
and Gaps in Research: A Vision on the Future of the Fauna  
of Rajasthan under Current and Predicted Threats .....** 433  
B.K. Sharma, Seema Kulshreshtha, and Asad R. Rahmani

**Appendices .....** 469

**Glossary .....** 503

**Further Readings .....** 505

**Index .....** 507

**The Book and Its Audience .....** 521

**About the Editors .....** 523



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