



Current wildlife crime (Indian scenario): major challenges and prevention approaches

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Received: 30 August 2022 / Revised: 11 February 2023 / Accepted: 3 March 2023 /
Published online: 20 March 2023

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Abstract

The constant depletion of wild flora and fauna in India due to uncontrolled human activities, natural habitat destruction and covert poaching activities is threatening the ecological balance. The poaching and trafficking of wild species in the lure of money as well as fashion has wiped out a range of wildlife species that call for critical attention to tackle this menace. There are many transit routes through the states of Uttar Pradesh, Karnataka, West Bengal, Rajasthan, Madhya Pradesh, and Assam, which are major hubs for wildlife trafficking in India, in both domestic and international markets. The poaching of wild animals and plants slowly erases biodiversity, which in turn affects the survival of humans and other living species. Therefore, there is an urgent need to check ongoing wildlife crimes, raise the number of endangered species, rehabilitate exotic/extinct species and restore natural ecosystems. In this article, we collected wildlife crime data from web portals of various stakeholders, government agencies and authentic news sources, and discuss the current crime trends, challenges, and prevention approaches required to control and restore wildlife biodiversity in India.

Keywords India · Wildlife · Wildlife crime · Trend of wildlife crime · Major challenges · Crime management and prevention

Introduction

Wildlife includes both flora (plants) and fauna (animals) in its natural habitat, which is incredibly important for biodiversity and ecological balance on Earth (Dorst 1991; Zhou et al. 2016). Illegal and unauthorized hunters of wild species, particularly poachers, pose

Communicated by Anurag Chaurasia.

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a significant threat to wildlife and nature. As a part of environmental crime, wildlife crime is defined as an illegitimate exploitation of natural resources, such as poaching elephants, uprooting of rare orchids or unauthorized logging of trees (Carter et al. 2016; Gore et al. 2016). It further includes subsequent acts, such as the manufacturing of products from wild species, their export and import activities, selling to customers, and, most importantly, their possession, since such crimes would not occur if there is no demand for wildlife products (Toland et al. 2020). The soaring inflation in India, lure of easy money, recent hit of the pandemic (COVID-19), related job loss and surging unemployment, mythological beliefs (sorcery and totem), traditional medicine, lack of patience, rising man-animal territorial conflicts due to rising human population, international socio-economic inequalities, and even adrenaline rush are being cited as reasons for the existing tendency of wildlife crimes (Anagnostou et al. 2021; Gulati et al. 2021; Karanth et al. 2013; Liew et al. 2021). This review article focuses on the current scenario of wildlife crime in India from a global perspective and discusses the key challenges and prevention strategies. The facts and figures of wildlife seizure incidents presented here are from state-wise geographical regions extracted from leading newspapers and cross checked with contemporary news and stakeholders' online social networking activities. Annual datasets from the portal of the National Crime Records Bureau (NCRB) website were used to correlate the past and current trends in wildlife crime in the major crime-hub states of India. In addition, a systematic literature survey was carried out to highlight the major wildlife crimes and their issues, newer strategies used by poachers and prevention strategies that can be implemented in India to reduce the depletion of natural biodiversity.

Wildlife crime is a global problem, and the protected flora and fauna are impetuously affected by poacher activities, such as live trade, body part trade, or selling of processed products (Anagnostou et al. 2021; Wilson-Wilde 2010). Currently the most urgent threat to wildlife in the world is to a handful of highly vulnerable animal species: elephants (African: *Loxodonta africana*, Asian: *Elephas maximus*), rhinos (Indian: *Rhinceros unicornis*, Javan: *Rhinoceros sondaicus*), tigers (*Panthera tigris*) and pangolins (Patel et al. 2015; Gaubert et al. 2017). The burgeoning demand and trade of elephant ivory, rhino horns, tiger products and pangolin scales in the world market is leading to the poaching of these animals, particularly in Asia and Africa. With an annual trade of \$7–23 billion (Tow et al. 2021) and as per the record of the United Nations Office on Drugs and Crime (UNODC), it is considered the fourth most illegal trade after arms, drugs and human trafficking (Doody et al. 2021). In this multibillion dollar industry, of > 31,500 terrestrial bird, mammal, amphibian, and squamate reptile species, ~24% (N=7638) of these are traded globally driving them towards extinction (Scheffers et al. 2019). On the other hand, the annual legal trade in wildlife is 20–50 times higher than illegal trade via commercial fishing at \$180 billion, timber at \$227 billion and fashion at \$2.5 billion (Hughes 2021).

The UNODC agency with the support from International Consortium for Combating Wildlife Crimes (ICWC) have made available seizure database “World WISE” which currently contains 180,000 seizures from 149 different countries as per year 2020 (UNODC 2020). ICWC collects data submitted to the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) and Customs Enforcement Network (CEN). Rhinoceros populations have decreased remarkably in the past 25 years, and their numbers remain critically low, with less than 30,000 rhinos (which includes nearly 18,000 white rhinoceros from Africa) of any species left in the world, whereas Indian forests have nearly 3600 (Nabeshima et al. 2022). Regarding the elephant population in the world, there has been a sharp decline from ~ 10,000,000 to just ~ 500,000 over a span of ~ 100 years (Shaffer et al. 2019), of which ~ 30,000 are residing in India (~ 50% in the forests of Karnataka,

Assam, and Kerala) (Goswami et al. 2019). India has the largest number of tigers (estimated to cross the 3000 mark in 2022, 50% of which are in Madhya Pradesh, Karnataka, and Uttarakhand), and the rest of the world has just around 1500 or even less tigers. However, there are frequent cases of tiger poaching, with very high incidence in the states of Maharashtra, Karnataka, Tamil Nadu, and Assam, as well as in the border regions of north-east and Mumbai (Nittu et al. 2022).

The Wildlife (Protection) Act, 1972 of India prohibits the trade of over 1800 species of wild animals, plants, and their derivatives (GoI MoEFCC 1972). The wildlife trade is expanding rapidly, driven by the demand for rare species, species with ornamental parts, and species with medicinal properties (Hughes 2021). The animals are smuggled alive or as body parts to Asia (China, Southeast Asia and Gulf), Europe, and North America (USA and Canada) (Patel et al. 2015). The wild animals and their parts that are smuggled out of India are turtles and tortoises (family Testudinidae), pangolins (*Manis crassicaudata*), sea horses (*Hippocampus spp.*), tokay gecko (*Gekko gecko*), sea cucumber (class Holothuroidea), parakeets (order Psittaciformes), mynas (*Acridotheres tristis*) and munias (*Lonchura punctulata*) skins, wild boar (*Sus scrofa*), bones of tiger (*P. tigris*) and leopard (*P. pardus*), ivory, bear (*Melursus ursinus*) bile, horns of deer (family Cervidae) and one-horned rhinoceros (*R. unicornis*), mongoose (family Herpestidae) hair, snake venom and skins, musk (*Moschus leucogaster*) pods, red sander (*Pterocarpus satalinus*) timber and medicinal plants. Although there is frequent campaigning to protect wildlife of India such as “Wild for Life” by UN Environment Goodwill Ambassador, Dia Mirza as well as by Wildlife Crime Control Bureau (WCCB), the highly organized wildlife trafficking crime urgently requires support and intervention of Forest conservationists and investigation/forensic agencies. There is no denying that human-wildlife conflicts have grown and shaped to such an extent that humans have only dominated wildlife, perpetually destroying both flora and fauna everywhere in the planet (Beisner et al. 2014; Gulati et al. 2021; Karanth et al. 2013; Naha et al. 2021; Shaffer et al. 2019). As per the Red List data available from the International Union for Conservation of Nature (IUCN), the number of threatened species currently assessed for India is 1392 which are further categorized as Vulnerable (VU, #622), Endangered (EN, #521), and Critically Endangered (CR, #249). The threatened species listed in the CR category (Supplementary Table 1) are on the verge of extinction (123 animal species and 126 plant species), which requires special attention from various wildlife stakeholders and local communities close to such species to actively participate in conservation activities.

Current trend of wildlife crime in India

The insatiable human greed and their rampant poaching activities cause loss to the indigenous and endangered species of flora and fauna in forest ranges; in particular, many vertebrates are on the verge of extinction (Ceballos et al. 2017; Karanth et al. 2010). According to data available from the WCCB and attached police authorities, over 9253 poachers were arrested in different poaching cases during 2012–2018 in India, but the rate of conviction was just 2%. In the last eight years, the wildlife crime data from the NCRB report (NCR Bureau 2014–2021) shows that the seven Indian states where a high number of wildlife crime cases has been registered are Uttar Pradesh, Rajasthan, Maharashtra, Assam, West Bengal, Madhya Pradesh, and Karnataka (Fig. 1). The overall 8-year data show a decreasing trend in wildlife crime cases since 2016, in contrast to

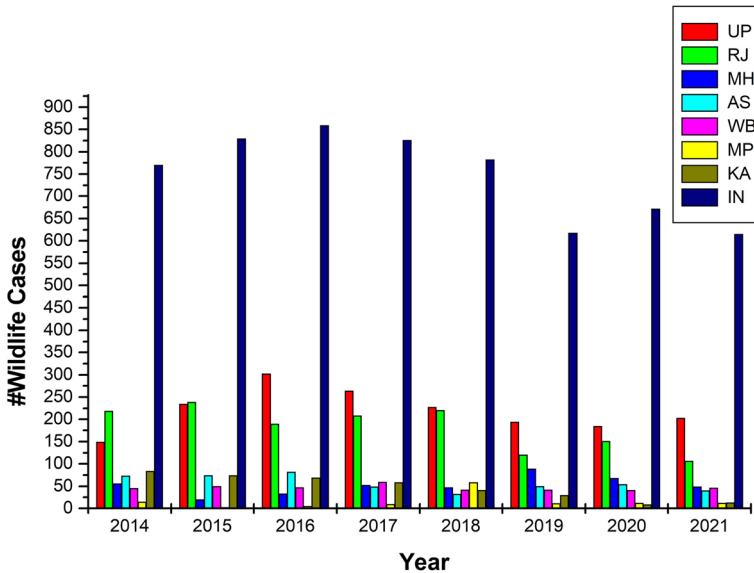


Fig. 1 The Indian states registering large number of wildlife cases in the last 8 years (2014–2021). According to the NCRB annual report, the states of Uttar Pradesh (UP), Rajasthan (RJ), Maharashtra (MH), Assam (AS), West Bengal (WB), Madhya Pradesh (MP), and Karnataka (KA) have witnessed higher wildlife crime cases than the rest of the Indian states. The states of Uttar Pradesh and Rajasthan have registered majority of the wildlife cases in the last 8 years (2014–2021). During this period, India (IN) registered the highest number of cases (859) in 2016, which has gradually decreased to 615 by 2021

the World Wildlife Crime increasing graph from 2016 published by UNODC in 2020. However it is still an alarming, considering the number of species smuggled/poached in a single case. In 2016, 50 tigers were poached, the highest number in the past decade. While 37,267 turtles were seized between 2015 and 2016, meaning that the government seized an average of 100 turtles every day. In the past 3 years (2018, 2019, and 2020) more than two thousand cases were registered across India for the killing or trafficking of wild animals, which resulted into the arresting of nearly four thousand accused for various wildlife crime. The number of cases registered and the persons arrested in the years 2018, 2019 and 2020 were 648:1099, 805:1506, and 601:1231 respectively, which indicate that either wildlife crime is committed alone or by a small organized group. In July 2020, exotic species viz. red kangaroo (*Macropus rufus*), aldabra tortoise (*Aldabrachelys gigantea*), blue macaws (*Anodorhynchus hyacinthinus*) and capuchin monkey (*Cebus capucinus*) were seized from Lailapur, Assam, for which there is no provision of punishment according to Wildlife (Protection) Act, 1972 Act and the poachers are using this amnesty route to smuggle-in these non-native species into India for money. For the exotic species trafficking, airways are the most commonly used route by poachers in India. As per Traffic-India report, more than 70,000 native as well as exotic species weighing ~4000 kg were trafficked from 2011 to 2020. The list of exotic species includes red-eared slider turtle (*Trachemys scripta elegans*), iguana (*Iguana iguana*), marmoset (*Callithrix jacchus*), squirrel-sized Tamarin Monkey (*Saguinus* spp.), Tricolour Squirrel (*Callosciurus prevostii*), and several exotic birds. Similarly, many plant species, including Agarwood (*Aquilaria malaccensis*), Red Sanders (*Pterocarpus*

santalinus) Sandalwood (*Santalum album*), and medicinal and aromatic plants parts such as Kuth (*Saussurea costus*) roots, which were seized at various airports of India. In the last seven years from 2014 to 2021, the WCCB has conducted 717 joint operations, resulting in the arrest of 1488 wildlife criminals and profiling of 3248 wildlife offenders. There were large seizures of ivory, rhino horns, tiger skins/body parts/ bones, leopard skins, pangolins, turtles, mongoose hair, monitor lizards (*Varanus* spp.), shark (*Sphyrna mokarran*) fins, sea horses, and others.

Poachers employ various means and strategies (timing, networking, traps, nets, gunning down, poisoning, bombing, etc.) (Naveen et al. 2021; Radhakrishnan 2018) to bring the wild animals to the market in disguise, convert the parts of the wild animals into finished products (statues, decorates, and ornaments), and sometimes paint them to hide their observable identity in order to bring them into the open market for sale. Buyers use animals/animal products for passion, fashion, medicine, sorcery and so on. The WCCB team along with police department wings (SSB, CID, STF, DFO, CCF) in almost all states and borders (Bureau 2013) are actively involved in nabbing the poachers and seizing the wild species and their products from various states of India includes star tortoise (*Geochelone elegans*), sea horses, pangolin and their scales, tiger/lion/leopard bones and skin, elephant tusk, deer and rhino horn, vomit of whale (*Balaenoptera musculus*) called ambergris, bile of bear, musk of blackbuck deer (*Atelope cervicapra*), chinkara (*Gazella bennettii*), spotted deer—chital (*Axis axis*), blue bull—nilgai (*Boselaphus tragocamelus*), venom of snake, hemipenises of monitor lizard, sea fans (*Gorgonia* spp.), porcupine (*Hystrix indica*) quills, mongoose hair, guard hair called shahtoosh of Tibetan antelope (*Pantholops hodgsonii*) used in fabrics/shawls, parakeets etc.

Northern India

In North India, the state of Uttar Pradesh the prime hub for poachers has registered the highest wildlife crime cases since 2016, accounting for more than 25% of the country's cases. According to the NCRB report (NCR Bureau 2014–2021), out of the 859 cases registered in the country under the Wildlife (Protection) Act, 1972 in 2016, 190 were registered in Rajasthan, while Uttar Pradesh alone witnessed 302 cases. On January 11, 2017, the STF of the Uttar Pradesh police seized over 6000 endangered soft shell and flap shell turtles (weighing over 4 tons) from a house in the Amethi District in a largest wildlife haul. The state of Uttarakhand also harbours a rich diversity of wildlife, and there are reports of wild animal trafficking through Indo-Tibetan border, which has led to the creation of two seven-member Wildlife Crime Control Units (WCCU) for its administrative divisions of Garhwal and Kumaun to control the activity of the poachers. In the local market of Uttarakhand, the sale of monitor lizard penises has been reported in the disguise of *Hatha Jodi* (*Martynia annua*), a plant root kept at home for good-luck charm, that was confirmed through mitochondrial DNA sequencing (Rajpoot et al. 2018). The state of Uttarakhand has registered most of the leopard poaching cases since 2011, especially snow leopards inhabiting in the high-altitude Himalayas. The hunting of elephants for their tusks is another major crime frequently seen in the Uttarakhand region.

Western India

In West India, Rajasthan is the major hub of wildlife crime, which registered the highest cases in 2014–2015 and in subsequent years it registered the second highest

number of cases just after Uttar Pradesh. To control wildlife crime in the state of Rajasthan, control rooms have been setup in Ranthambore National Park and Sariska Tiger Reserve in 2020. In Gujarat, a total of 1,531 cases were registered under the Wildlife (Protection) Act, 1972 between July 2018 and June 2021 with a rising trend. The highest number of cases (358) was registered in the Gir Somnath region during this period, followed by Junagadh (315). Gujarat is well recognized for the Asiatic lion, and the total number of Asiatic lions (*P. leo persica*) found in the Gir National Park of Gujarat is more or less stable to a figure of ~650. In the year of 2022 in Maharashtra, tigers poaching were registered from the Arjuni-Morgaon Forest Range and Pench Tiger Reserve, and ambergris seizures (vomit product of sperm whale) were reported from the Nagpur division forest belt. On October 6, 2022, the Mumbai unit of the Directorate of Revenue Intelligence (DRI) recovered 665 exotic animals from Air Cargo Complex. The DRI recovered these exotic animals (pythons, lizards, and turtles) in Mumbai, which was smuggled-in from Malaysia in the guise of the aquarium fish. In the nearby state of Goa, the poachers sell wild animal meat from monitor lizards, sambars, wild boars etc. which are brought there from other states. Besides meat, blood and oil of monitor lizards are used as a part of traditional oriental medicine for the treatment of many ailments. The boa snakes (*Eryx johnii*) are trafficked to Maharashtra, where they are used for sorcery and black magic.

North-East India

Northeast India, comprising eight states that also encompass two biodiversity hotspots of the world (Himalayas and Indo-Burma) (Chitale et al. 2014), serves as a transit route for the trafficking of flora and fauna to many countries of North and South-east Asia. Trafficking of wild mammals, reptiles, amphibians and birds is frequently reported in news from the northeastern states. The rhino state of Assam (with ~70% of the rhino population of India) alone witnessed 191 poaching cases over a span of 22 years (2000–2021); however zero poaching activity was recorded in 2022. Rhino horn powder has been traditionally used as a Chinese/Vietnamese medicine to treat various ailments such as cancer, gout, food poisoning, fever, hangover etc., and is also used as an aphrodisiac agent (Vu et al. 2018). Another endangered species from the Northeast, Tokay geckos (*Gekko gecko*), which is a nocturnal lizard, is widely traded for medicinal use (aphrodisiac and energy drinks to treat ailments such as diabetes, cancer, HIV/AIDS etc.) and space study (Barabanov et al. 2019; Lim 2017; Tang et al. 2015). In the past decade, it has been observed that wildlife seizures in the state of Assam are often connected with the state of West Bengal and vice-versa which shows the existence of wildlife nexus and inter-state racket. In addition to inter-state smuggling, transnational smuggling is also rampant from Northeast states due to the porous international boundary. In May 2022, Mizoram's Champhai police seized 468 exotic wildlife species, which included 442 lizards, 11 snakes, 4 tortoises, 4 three-toed sloths (*Bradypus tridactylus*), 4 pottos (*Perodicticus potto*), 2 beavers (*Castor fiber*) and 1 wild cat. In July 2020, the Assam Forest officials seized a red kangaroo, six hyacinth macaw (*Anodorhynchus hyacinthinus*), two capuchin monkeys from South Africa and three giant tortoises from a truck near the state's border with Mizoram. In the states of Manipur in January 2021, two critically endangered exotic species, radiated tortoise (*Astrochelys radiata*) and an aldabra tortoise were seized by Assam Rifles in Chandel District.

Eastern India

Eastern Indian states include West Bengal, Bihar, Jharkhand and Odisha. In June 2018, the WCCB, DRI, and a Special Task Force (STF) established by the West Bengal Forest Department, together seized hornbill (*Ocyrceros birostris*), rosella bird (*Platycircus eximius*), concure (*Pyrrhura molinae*), exotic macaws (*Ara macaw*), pygmy falcon (*Polihierax insignis*), eclectus (*Electus rotatus*), hoolock gibbon (*Hoolock leuconedys*), Tokay gecko, and palm squirrel (*Funambulus palmarum*). In May 2017, Sashastra Seema Bal (SSB) and Customs of West Bengal seized snake venom worth Rs 70 crore from Siliguri and in the same year in September, Bengal CID and Border Security Force (BSF) seized snake venom worth Rs 100 crore from Barasat in the North 24 Parganas District. In China, there is a huge demand for animal parts, especially the Bengal tiger, for medicinal uses. Bengal has become the hub of wildlife trade (exports and imports) as exotic foreign species such as African pigmy falcon (*Polihierax semitorquatus*) and macaw have been seized there. In Odisha, three leopard skins were seized near Jyoti ITI in Bangripasi, Similipal and seven poachers-cum-traders were caught red handed with the skins in December 2014, however all accused were acquitted by the Court, Baripada, as the Forest Department failed to provide the required evidences due to procedural errors in the investigation documents. Similarly, in May 2015, a man was caught red-handed with a leopard skin in Rangamatia, Similipal, and had admitted his crime; however he was acquitted by the Court, Baripada, due to discrepancies in evidence of official witnesses. In another instance, in the Balipatna range, a person accused of killing a Hyena (*Hyaena hyaena*) which is listed in Schedule-III of Wildlife (Protection) Act, 1972 was denied bail, but in the case of killing a Jungle cat (*Felis chaus*) listed under the Schedule-II of Wildlife (Protection) Act, 1972 in the Khordha Range, the accused was granted bail. Fresh water turtles are being poached in large number for smuggling to other states and abroad. In eight recorded seizures in the last 1.5 years, mostly by railway authorities and police, nearly 2900 fresh water turtles were seized. A large seizure of four leopard skins occurred in Kuchinda, Sambalpur District, on March 15, 2019 by the Crime Branch. The pangolin, the most trafficked wild animal in the world, is also rampantly smuggled from Odisha and Jharkhand for their scales and meat. In June 2018, the Crime Branch of Odisha seized five kilograms of pangolin scales near Daspalla, Nayagarh District, from the house of Shamsuddin Khan, the most popular wildlife smuggler. It is in high demand in China for its aphrodisiac and medicinal value, and remains at a high threat in the country, with over 100,000 pangolins captured illegally every year. There are few reports of wildlife crimes in the state of Bihar such as the sale of rare birds from Sonepur mela. However, the Indo-Nepal border is porous and well connected with land routes providing a lucrative bed for illegal wildlife traders to smuggle illegal wildlife products. Of the ~3000 estimated Gangetic River dolphins (*Platanista gangetica*) in the Ganges–Brahmaputra–Meghna River system in India, almost half are found in Bihar, which are under constant threat due to pollution, river traffic, riverfront construction and sometimes hunted for fishing-bait for their oil (Kolipakam et al. 2020; Singh et al. 2021). However, the adjoining southern state called Jharkhand, which was separated from Bihar on November 15, 2000, is rich in forest area and wildlife as compared to Bihar. As per the NCRB report of 2021, Jharkhand reported 265 cases related to the Forest Act, registering an increase of 82.76% compared to the previous year. In August 2019, five sloth bears were rescued from poachers transporting them from Nepal to the Deoghar District of Jharkhand through the Indo-Nepal border. In November 2022, 10

pieces of elephant ivory were seized at Chaibasa (West Singhbhum) from five poachers who hailed from three different states, Bihar–Jharkhand–Odisha, who were involved in inter-state racket of illegal ivory trade.

Central India

The state of Madhya Pradesh has the largest cover of forest area (77,493 km²) in India which also boasts the largest number of national parks and the most abundant wild animals including tigers, leopards, gharials (*Gavialis gangeticus*), vulture (*Gyps indicus*) and wild Indian wolf (*Canis lupus pallipes*). However, recent reports of rising human-wildlife conflicts with tigers, leopards, elephant, bears, chinkara, nilgai, blackbuck etc. some of which attack humans and some venture into residential area/harvest area is a sign of depletion/damage to the forest area (Gulati et al. 2021; Karanth et al. 2012). There are also several reports of human-sloth bear conflict regarding space and food (Dhamorikar et al. 2017). The state of Madhya Pradesh tops the list of blackbuck poaching cases; with at least 170 poaching cases currently pending under trials since 1972. Also in this so called ‘Tiger State’ as many as 34 tigers died in 2022, due to natural causes and unknown reasons. In October 2021, six people (including two teachers) were arrested when they caught selling a leopard hide and its nails near Jhabua District in Madhya Pradesh. In a recent incident (December 2022), foresters from the Aron forest range arrested two poachers in connection with the poaching of a nilgai for meat.

The adjoining state of Chhattisgarh, which was carved out on November 1, 2000, from Madhya Pradesh, also boasts of the third-largest forest area, covering 59,772 km². In 2020, four people were arrested in May for allegedly poaching spotted deer in Chhattisgarh’s Mahasamund District, whereas in July, two smugglers were arrested in Gariaband for leopard skin. There are also unchecked poaching cases of pangolins from the forest area of Chhattisgarh, involving officials such as a sub-inspector of the Central Industrial Security Force (CISF), who was arrested for allegedly smuggling pangolin scales in Raipur in September 2021. In February 2022, the forest department in the Bastar division seized 19 kg pangolin scales, four star tortoises and six leopard nails while detaining five persons under the Wildlife (Protection) Act, 1972. It has been observed that the decrease in the number of pangolins that feed on ants and termites, leads to hollowing of the ground, which causes damage to trees and plants in the forests.

Southern India

According to the NCRB annual records (NCR Bureau 2014–2021), the rate of wildlife crime in the southern states of India has decreased since 2014, except Kerala has recently witnessed a 100% surge in wildlife crime (2018: 61 cases, 2019: 151 cases, 2020: 303 cases). Of the 615 reports of wildlife crime in 2021, only 21 incidents of illegal wildlife trade were reported from the southern states (Andhra Pradesh-4, Karnataka-13, Kerala-3, Tamil Nadu-0 and Telangana-1), while this figure stood at 103 in 2014. The prime hub of wildlife crime in southern states of India is Bengaluru, the capital of Karnataka. In 2021, 52 rose-ringed parakeets (*Psittacula krameri*) were found dead on March 29, while 571 star tortoises (90% of them live) were seized in the state capital of Karnataka over a span of three days (November 13–16, 2021). In August 2021, the police from Mysuru District (southern Karnataka) recovered 8.25 kg of ambergris and arrested three people. Other cases in that year include seizure of 9 kg of pangolin scales on October 22, the arrest of

three poachers from Chikkaballapur on November 16, for slaughtering a deer for venison (deer meat), and the recovery of 20 pairs of antlers or deer horns on November 18 by the Bengaluru police. In the case of illegal exports, red sanders, shark fins, mongoose, pangolin, star tortoise, and sea cucumber are purportedly smuggled out from south India via Chennai, as reported by Traffic-India.

Major challenges in tackling wildlife crime in India

Human coexistence and conflict with wildlife

According to the 2021 demographic estimate, ~65% of the Indian population (i.e., approximately 900 million) lives in rural regions that share space with protected areas (national parks, wildlife sanctuaries and biosphere reserves), which is approximately 5% of the total geographical surface area and three times lower than the world average of ~16% (Carroll et al. 2021). This has created an atmosphere of competition for space and food mainly between marginal rural households and wildlife (Gulati et al. 2021), which is worsened by the lack of wildlife education, lack of other livelihood alternatives, poor governance, deficient conservation policies, unemployment and socio-economic inequalities (Duffy et al. 2015; Smith et al. 2003). The human-wildlife conflict costs crop/livestock losses and human casualties; the latter when exacerbated, the carnivore is declared a man-eater as per the standard guideline and eliminated. Conservationists and various stakeholders of wildlife must work together with the local rural communities (community-based approach) (Kiffner et al. 2020), motivate them to participate in wildlife protection, provide incentives as a reward for ecosystem maintenance and associated biodiversity (Nelson et al. 2010), prevent wildlife hunting/atrocities and spread awareness among rural masses for ideas such as sustainable development and one health mission (Buttke et al. 2014). The idea of one health approach is to build global health security by focusing on the interaction at the human-animal-ecosystem interface to address health concerns such as transmissible diseases, drug resistance and food safety (Mackenzie et al. 2019; Sinclair 2019).

Shortage of wildlife laboratories, workforce and funding

There is a need to set up wildlife laboratories in every state near forested areas to conserve wildlife and detect wildlife crimes. There is also a shortage of manpower in existing laboratories, such as state forensic laboratories, wildlife laboratories, and laboratories of Zoological/Botanical Surveys of India. Beside routine detection of wildlife species or their products, the laboratories should also carry out research work to develop indigenous wildlife kits. For example, there is a lack of molecular kits for the detection of various Indian snake venoms that are smuggled for billions of rupees (worth approximately Rs 100 crores were seized in West Bengal in 2016 and 2017). Therefore there is a need for proper research oriented training of the existing workforce with sensitive and specific molecular technologies. The budget for the Ministry of Environment, Forests and Climate Change (MoEFCC) has increased to a value of Rs 3030 crore in the last financial year (2022–2023) from its previous year budget of Rs 2520 crore (2021–2022), more of which needs to be channelized to wildlife projects, since rampant poaching remains a big challenge that may have an impact on the extra burden of wildlife management on police organizations.

Dynamism of crime and international politics

There are various types of wildlife crimes (illegal trade of live animals and plants, dead animal and plant parts and ornamental animal/plant parts) committed by poachers, mediators and consumers that need to be thoroughly addressed and checked. Some crimes are politically motivated; these are usually associated with international trade of alien species that escape the current legislative and scientific tools of nations (Hulme 2021). While plant trade is encouraged under the Biological Diversity Act 2002, some invasive plant species such as *Senna spectabilis* and *Lantana camara* are devastating for the ecosystem and create havoc in other countries (Anoop et al. 2021; Singh et al. 2014). *L. camara* which was brought in India for scientific purpose has infested much of the forest area. Another invasive species in India that threatens other plant species is *Mimosa pudica* which was imported to increase the nitrogen content in tea lands (Melkonian et al. 2013). As per the record of Environmental Information System of Ministry of Environment and Forest (BSIENVIS), other than the above species, there are more than 150 invasive and exotic species in India, such as *Alternanthera philoxeroides*, *Cassia uniflora*, *Chromolaena odorata*, *Eichhornia crassipes*, *Parthenium hysterophorus*, *Prosopis juliflora* and others. The Wildlife (Protection) Act, 1972 has neither provisions of laws to stop invasive species nor any laws to regulate trade of exotic species that are smuggled across borders.

Unlicensed trade, disguised marketing and prosperity charm

There are several unlicensed and open markets in India where animals, birds and plants are sold as food, pets, ornamental plants and medicines. Since such trade is openly available in India, while some are licensed and legalized, sellers can furtively sell (offline/online) some endangered species according to customer demand, with spurious names (Sharma et al. 2018), it is often difficult to confiscate and segregate them from wild species. Several illegal wildlife activities are undermined and ignored around the seller's profit and buyer's charm. Parakeets (*Psittacidae*) are the most traded birds in the world (Chan et al. 2021), and can be seen very frequently in Indian markets for sale along with their cages. Parakeets are protected in India under Schedule IV of the Wildlife (Protection) Act, 1972 and therefore, their sale or possession is illegal in India. In addition to parakeets, some villagers close to the jungle and some affluent people of India surreptitiously keep wild and rare animals such as tortoises, turtles, snakes, bears, deers, peafowl etc. for prosperity charm or good-luck which should be prohibited by forest officials.

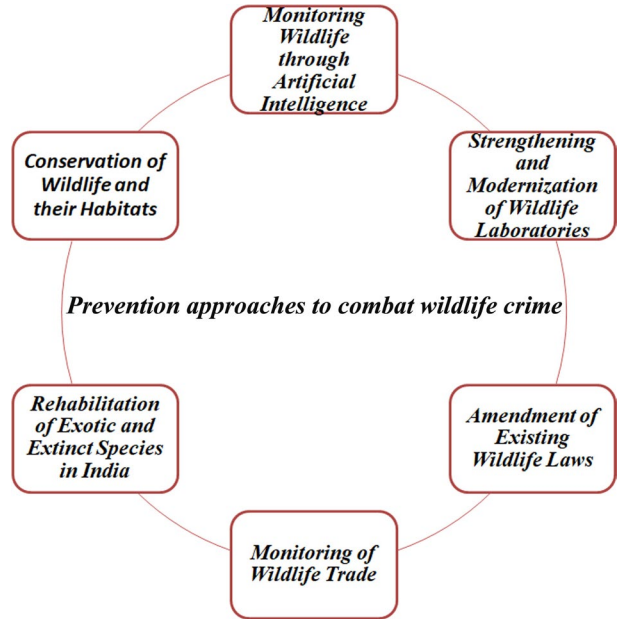
Prevention approaches to combat wildlife crime

In the present scenario of wildlife crime in India, poachers use various means, routes and systems for commission of wildlife crime in a highly sophisticated and organized way. To address these well-groomed poachers, various technological, scientific and managerial approaches (Fig. 2) are discussed below.

Monitoring wildlife through artificial intelligence

Artificial Intelligence (AI) has influenced its impact on every sphere of human life and is highly useful in monitoring wildlife and wildlife crime prevention (Gonzalez et al. 2016).

Fig. 2 Prevention approaches to combat wildlife crime. The various scientific and preventive approaches listed here are required to curb wildlife crimes



India is one of the global leaders in the IT (Information Technology) sector and can help in setting up AI-based monitoring of wildlife, which can be useful to trace movement of wildlife in real-time and solve crimes quickly in a way similar to how cellular phones are being used in tracing and cracking personal crime cases. Various AI based methods can be used in check wildlife crime which include Global Positioning Systems (GPS), micro-chipping of wild animals, drone based surveillance, infrared cameras (which can see animals at night), sensors, acoustics (animal noises, gun fires, chainsaw), cyber trackers and Spatial Monitoring and Reporting Tool (SMART) (Norman 2008).

Strengthening and modernization of wildlife laboratories

There is a need to establish modern wildlife laboratories in nearby sensitive areas of every state and strengthening existing state forensic science laboratories for wildlife crime investigation, where at least basic tests facilities (morphometry, microtomy, hair examination, blood/tissue tests) (Nishant et al. 2017; Sahajpal et al. 2009) can be carried out. Further efforts should be made to have advanced test (genetic based identification) facilities which include multiplex PCR and mitochondrial DNA analysis (*Cytb*, 12 S rRNA, 16 S rRNA) sequencing (Gupta et al. 2005; Kumar et al. 2018; Vermeulen et al. 2016; Yang et al. 2014) in every state laboratory. Environmental DNA (e-DNA) released from wild animals in water, soil, vegetation, or even air of forest areas should be routinely examined through metagenomics analysis or metabarcoding study (Bohmann et al. 2014; Lynggaard et al. 2022) especially for monitoring wild animals that are not easily reachable. There should also be expansion and allocation of wildlife health facilities in various veterinary hospitals of India to include hospitality and treatment of common diseases and also to investigate the causes of wildlife mortality incidents (Kirkwood 1993; Lanfranchi et al. 2003). The central and respective state governments are required to setup exclusive funding schemes for

wildlife conservation, wildlife welfare and for appropriate training program to be imparted to existing staff from time to time.

Amendment of existing wildlife laws

Currently, only native species are included in the Wildlife (Protection) Act, 1972, therefore, there is an imperative need to make changes to the existing six schedules (I–VI) to list alien/exotic species and to add penalty and punishment sections for wildlife defaulters involved in exotic wild/pet species trade. Any dealing with the tail feathers of peacocks (*Pavo cristatus*) is also exempted from the Wildlife (Protection) Act, 1972, which needs to be amended or should be brought under sections of the Prevention of Cruelty to Animals Act, 1960. In December 2022, The Wildlife (Protection) Amendment Bill, 2022 was finally passed from both houses of parliament which includes a new schedule of exotic species (Schedule IV) listed under CITES and imposes enhanced penalties for wildlife defaulters. In addition, it also empowers the Central Government to appoint Management and Scientific Authority to administer and provide guidance in the export/import of live plants/animals, especially exotic/alien species. However, there are issues of incomplete list in the first three schedules (I–III) of the current Bill and may require region specific zoologist/botanists from pan India to add more endangered/vulnerable species. The issues of human-wildlife conflict, eco-sensitive zone rule, etc., are missing from the amendment Bill of 2022. Since India has a long coastline (7516.6 km), there are reports of wildlife crimes from coastal and marine regions, for which there is no provision in either Wildlife (Protection) Act, 1972 or Wildlife (Protection) Amendment Bill, 2022. The relevant sections of the Custom Act of 1962 pertaining to wildlife offences should also be redefined to address the trade/smuggling of exotic species across Indian borders.

Monitoring of wildlife trade

The foresters and police officers in-charge should closely and coordinately monitor wildlife trade in open markets (including online markets) as well as clandestine markets (Sharma et al. 2018) to put a check on illegal wildlife trade (IWT) with special force and using the latest technology. Many of the IWT activities are usually driven by socio-economic inequalities, such as ill-education, unemployment and poverty, and therefore the wildlife stakeholders should also engage local community to stop wildlife poaching (Roe et al. 2019). In the rhino state of India (Assam), zero poaching of rhino was achieved in 2022, which was due to multi-coordinated efforts of the Special Rhino Protection Force (forest officials), 22-member task force (half of which were senior police officials of SP rank), use of technology (CCTV including night vision, drones, sniffer dogs), deployment of armed commandos, mapping past and present activities of poachers, sensitizing people near the forest and conservation efforts from NGOs such as Centre for Wildlife Rehabilitation and Conservation (CWRC). Besides monitoring of wildlife trade, the consumption or undue experimentation, especially of exotic species, should be under high vigilance considering the COVID pandemic as a consequence of possibly tinkering with animals such as intermediate horseshoe bats (*Rhinolophus affinis*) (Liu et al. 2020; Scanlon Ao 2021; Temmam et al. 2022; Yang et al. 2020). To counteract this grave issue, the Indian government offered one time amnesty through MoEFCC to 32,645 persons who voluntary declared possession of exotic live species from June to December 2020. This

is a wonderful example of Government–Public Cooperation to address the issue of various zoonotic diseases and to improve compliance with CITES.

Rehabilitation of exotic and extinct species in India

Rehabilitation activities include treatment, care and release of diseased wild animals to their natural wild habitat as well as reintroduction of extinct species in a region from another abundant territory (Grogan et al. 2013). The reintroduction of the extinct wild cat, Cheetah (*Acinonyx jubatus*) in India (last seen in 1947) under the ‘Project Cheetah’ at the Kuno National Park, Madhya Pradesh on September 17, 2022 which were imported from Namibia, Africa, is an eco-structuring step by the Government of India. Such a step taken in western USA, almost three decades ago in 1995, that was the reintroduction of wolves (*Canis lupus*) in Yellowstone National Park, has been quite helpful in rehabilitation and restructuring of its ecosystem (Dobson 2014). The wolves (top predator) were brought in to bring down the rising elk (*Cervus elaphus canadensis*) population, which had been overgrazing much of the park vegetation, but their effect went far beyond that, such as restoration of the natural food-chain and buffering of the climate change (Wilmers and Getz 2005; Wilmers et al. 2020).

Conservation of Wildlife and their habitats

The Union environmental ministry (MoEFCC) has set up several wildlife conservation projects over the past years for tigers (1973), crocodiles (1975), elephants (1992), red pandas (1994), rhinoceros (2005), vultures (2006), snow leopards (2009), Great Indian Bustards (2013), Gangetic River dolphins (2019), etc. which should be expanded to other critically threatened species (especially those on the verge of extinction), as listed in Supplementary Table 1. The 2022 estimate of tiger population is more than 3000, which is gradually increasing since the inception of ‘project tiger’ in 1973 (~268 in 1973, ~1411 in 2006, ~1706 in 2010, ~2226 in 2014), which shows that the ‘project tiger’ has been highly successful. Besides wildlife species projects, parallel focus should be placed on habitat conservation through the implementation of effective land and water use policies (Lemly et al. 2000; Mattison et al. 2005) and minimal human intervention in wildlife habitats (Mekonen 2020). The Central Empowered Committee (CEC) appointed by the Supreme Court of India recently released a report to the MoEFCC to review guidelines under the Forest (Conservation) Act, 1980 and Wildlife (Protection) Act, 1972, which forbids the establishment of zoos and safaris within tiger reserves and wildlife sanctuaries and discourages tourism in wildlife habitats. The implementation of such a conservation step will have a mitigating effect on human-wildlife conflict, which is escalating day by day (Cui et al. 2021). Also, every citizen should take responsibility for participating in wildlife conservation by adopting cultures such as planting wild trees in their garden, releasing captive species from their house to the wild, helping threatened species when they travel, avoiding wild meat consumption, boycotting wooden and plastic products and supporting the organizations involved in wildlife conservation.

Conclusions and remarks

Despite the wildlife law provisions and several wildlife projects put forth by the Government of India, wildlife offences are not significantly decreasing; rather, the incidence of poaching, sales of animal and plant, smuggling of their parts and product especially

endangered plants and animals are on an alarming rate (Duffy et al. 2015; Kamminga et al. 2018). According to NCRB reports, 20% lower wildlife crime cases have been registered in 2021, compared to the average of the previous seven years (2014–2020) cases, however the number of animals seized in many cases is startlingly high. There are still alarming wildlife crime cases that have been reported from the states of Uttar Pradesh, Rajasthan, Assam, West Bengal, Maharashtra, Karnataka and Madhya Pradesh. This is due to some notorious elements in the society as well as slack behaviour of wildlife agencies; therefore, automation and audit are equally required to make the officials responsible and not leave any loophole for wildlife defaulters.

Stricter measures are needed to amend the prevailing laws related to wildlife crime to include punishment for sophisticated ways of poaching, such as online sale, trafficking through airways and poaching of exotic and hybrid wildlife species of flora and fauna. Wildlife crime cases should be addressed with scientific approaches under the aegis of administrative support to nab the offenders (Gonzalez et al. 2016; Pires et al. 2022). As per Article 51 A(g) of the Constitution of India, it is a fundamental responsibility of every citizen to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures. Another Constitutional Article 48 A directs the state (i.e., the government) to protect and improve the environment and safeguard wildlife and forests. The active participation of folks in campaigning and spreading awareness (Jordanna et al. 2022), cooperation with police officers and various national and international stakeholders are necessary steps to identify poaching activities, prohibit illegal trade and find preventive solutions. To combat poachers and prevent transnational trade of animal parts, wildlife experts from INTERPOL, who form the Wildlife Crime Working Group (WCWG), frequently initiate operations that help to capture criminals, seize poached items, and dismantle the organized networks responsible for wildlife crime (Neme 2010). Wildlife crime should be observed as a real-world problem from the perspective of green criminological activity under environmental crime, in which the scope of dealing with environmental security, illegal trading, species justice, transnational crime and corporate wrongdoing should scrutinized by mainstream criminal and wildlife laws (Nurse 2015).

Owing to various uncontrolled anthropogenic activities, the global climate is changing drastically, affecting human survival (Kerr 2012; Post et al. 2019). The global temperature has increased by 2°C and the water level in the ocean has risen by 0.5 m in 100 years (Post et al. 2019). This climatic change to a large extent can be largely circumvented by an increase in forest area (Malhi et al. 2020) which can be accomplished by following the maxim “*optimal wild infusion and minimal human intrusion*”. India is the largest democratic country with almost 18% of the world’s population and accounts for nearly 7–8% of the world’s recorded species, the survival of which depends largely on controlled human activity and eco-friendly planning. The ministry should make strategic plans to protect and increase forest area, conserve and expand flora and fauna and enhance funding for wildlife and the environment. The expansion of the natural habitats of wild animals (including national parks, wildlife sanctuaries as well as zoos), has a direct growth effect on the size and diversity of wildlife (Aerts et al. 2011; Symes et al. 2018). The conservation of forest areas (wild habitats) and wildlife must be cooperatively conducted with joint efforts from local communities close to the forest, wildlife agencies as well as scientific laboratories working with wildlife. The protection of wild habitats relies on government policies, and scientific laboratories should focus on developing conservation strategies for endangered species through population genomic studies, selection and breeding to form sustainable ecosystems (Chai et al. 2022; Greggor et al. 2019; Hohenlohe et al. 2020; Zhou

et al. 2016). The conservation of wildlife has a direct effect on human wellbeing and global health (Alves et al. 2007; Buttke et al. 2014; Mackenzie et al. 2019; Sleeman et al. 2019), and therefore it urgently calls for an critical attention to protect and conserve the threatened wildlife species which are on the verge of extinction, through various scientific and preventive approaches to sustain a long-term healthy human race on Earth.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10531-023-02577-z>.

Author contributions AKR: Inception and Supervision, Data curation, Writing—Original draft preparation. NK: Collected and organised data.

Funding No funding source available.

Declarations

Competing interests The authors certify that there is no academic or financial interest accrued to anyone and no other conflicts of interest exists whatsoever.

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