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Review

Section: Zoology

Animal Diversity of Anuppur District, Madhya Pradesh: A Critical Review of Fauna, Ecological Functions, Threats, & Conservation Priorities

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HIGHLIGHTS

- Rich faunal diversity in Amarkantak
- Diverse mammals, birds, and reptiles
- Endangered sacred grove bush frog
- Habitat fragmentation threatens wildlife
- Integrated conservation monitoring

Key Words:
Anuppur
Amarkantak Plateau
Achanakmar-Amarkantak
Biosphere Reserve
Animal diversity
Wildlife corridors
Herpetofauna
eDNA
Community conservation

ABSTRACT

Introduction: Anuppur District, located in eastern Madhya Pradesh within the Maikal hill system, encompasses much of the Amarkantak Plateau and the Madhya Pradesh sector of the Achanakmar-Amarkantak Biosphere Reserve. Its diverse habitats, including sal-dominated forests, mixed deciduous woodland, riparian zones, wetlands, grasslands, agricultural landscapes, and settlements, support a rich assemblage of wildlife. **Aim & Objective:** To synthesize available information on the faunal diversity of Anuppur District and the wider Amarkantak landscape, evaluate documented records against published literature, distinguish directly recorded species from landscape-level or locally reported occurrences, and identify major conservation priorities and knowledge gaps. **Material & Method:** Information was compiled from two source documents describing Anuppur District and the broader biosphere landscape and was critically compared with relevant published literature. Faunal records were categorized according to habitat, taxonomic group, evidence source, and conservation significance. Major threats and potential monitoring approaches were also assessed. **Result:** The available material records diverse mammals, including tiger, leopard, sloth bear, gaur, sambar, chital, wild boar, primates, and smaller carnivores. Birds include raptors, peafowl, rollers, kingfishers, woodpeckers, vultures, and aquatic and terrestrial species. A plateau-wide herpetofaunal survey documented 61 species, comprising 17 amphibians and 44 reptiles, including the Critically Endangered Sacred Grove Bush Frog (*Raorchestes sanctisilvaticus*). Fish, turtles, otters, and diverse invertebrates further contribute to biodiversity. Habitat fragmentation, mining, infrastructure, fire, resource extraction, road mortality, pollution, water alteration, climate variability, and human-wildlife conflict represent major threats. **Conclusion:** An integrated, repeatable biodiversity-monitoring framework using field surveys, camera traps, acoustic monitoring, environmental DNA, remote sensing, and community knowledge is recommended. Conservation should prioritize riparian corridors, sacred groves, wetlands, forest connectivity, prey recovery, road-mortality mitigation, and transparent biodiversity databases.

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INTRODUCTION

Animal diversity is more than a simple list of species. It encompasses variation within and among species, populations, functional groups, habitats, and ecological interactions. These different components collectively influence ecosystem stability, productivity, and resilience [1]. In a district such as Anuppur, animal diversity contributes to forest regeneration, pollination, seed dispersal, regulation of insect and rodent populations, decomposition, nutrient cycling, and freshwater productivity. It is also closely connected with the livelihoods, traditional knowledge, & cultural practices of forest-dependent communities. Consequently, a meaningful review should not merely enumerate species; it should critically examine the available evidence, identify gaps in current knowledge, and establish research priorities that can be addressed through systematic field surveys and long-term monitoring [2-6].

Anuppur is ecologically important because it occupies a transitional region between the Central Indian Highlands and the eastern plateau systems. The district includes part of the Amarkantak Plateau and the Achanakmar-Amarkantak Biosphere Reserve, an interstate conservation landscape extending across Madhya Pradesh and Chhattisgarh. The biosphere reserve is located at the junction of the Maikal, Vindhya, and Satpura hill systems and contains topography ranging from elevated plateaus and forested slopes to shallow valleys and plains [18]. Tropical moist deciduous forests cover a substantial part of the reserve, while tropical dry deciduous vegetation occurs in comparatively drier areas [32,36]. The Amarkantak region also forms the headwaters of the Narmada, Son, and Johila river systems, giving it considerable hydrological and ecological importance [7]. The topographic, climatic, and hydrological variability of the region creates a heterogeneous mosaic of sal-dominated forests, mixed moist and dry deciduous forests, rocky slopes, sacred groves, . stream valleys, waterfalls, seasonal pools, agricultural fields, grassland–forest interfaces, and settlement edges. This diversity of habitats provides ecological niches for large and small mammals, forest and wetland birds, reptiles, amphibians, freshwater fishes, and terrestrial and aquatic invertebrates. The ecological connectivity between these habitats is especially important because it facilitates animal movement, dispersal, gene flow, seasonal migration, and access to food, water, shelter, and breeding sites [8,9]. Published surveys demonstrate the biological significance of the Amarkantak Plateau. Ingle [10], for example, surveyed the Amarkantak Plateau, the lowlands of the Narmada, Son, and Johila rivers, parts of the Maikal Range, and selected areas of the Achanakmar-Amarkantak Biosphere Reserve [18]. The study documented 61 herpetofaunal species, comprising 17 amphibians and 44 reptiles. Several survey locations, including Amarkantak, Narmada Udgam, Rajendragram, Kapildhara, and Sonemuda, are situated within Anuppur District. These findings confirm the importance of the district for amphibian and reptile conservation and indicate that additional species may remain undocumented.

The available source documents, however, address two partially overlapping geographical scales. The manuscript primarily discusses the broader Achanakmar-Amarkantak landscape, whereas the presentation focuses specifically on Anuppur District. Although Anuppur forms an important component of this biosphere landscape, the administrative district and the larger ecological region are not geographically identical. The present review therefore treats Anuppur District as its principal geographical unit while using information from the connected Achanakmar-Amarkantak landscape as ecological and biogeographical context [21]. Representative habitats of the landscape are shown in **Figure 1.**

This distinction is important when interpreting species records.



Figure 1. Forest, riverine, and deciduous habitats characteristic of the Anuppur-Amarkantak landscape. Photographs reproduced from the supplied presentation.

Animals documented from the wider biosphere reserve or represented photographically in the presentation cannot automatically be considered confirmed records from Anuppur District. Photographs and general species lists without locality, date, survey method, observer details, or voucher evidence should be regarded as illustrative or provisional records. A scientifically reliable district inventory should distinguish confirmed locality records from landscape-level occurrences and unverified local reports. Such an evidence-based approach will prevent the overestimation of district-level diversity and provide a stronger foundation for future conservation planning [11,23].

Scope and evidence base

The review uses the two supplied documents as its organizing foundation and supplements them with established references cited in those documents. Particular weight is given to Ingle (2020), whose field survey covered the Amarkantak Plateau, river lowlands, parts of the Maikal Range, and pockets of the biosphere reserve core. For conservation technology, the synthesis draws on peer-reviewed work concerning camera-trap classification, environmental DNA, remote sensing, connectivity, and rewilding [19,20,29,30]. The evidence categories used in this review are summarized in **Table 1**. The evidence is organized into three practical categories. This approach is deliberately conservative. It allows a meaningful review while avoiding false precision in species totals, abundance estimates, and conservation status. Scientific names should be checked against current taxonomic databases when a formal checklist is prepared.

Landscape setting and habitat diversity

Forest habitats

Tropical moist and dry deciduous forests dominate the landscape, with sal (*Shorea robusta*) forming extensive stands in favorable sites [2,31]. Mixed forest, bamboo patches, secondary growth, and forest edges increase structural diversity [3,31]. Large trees provide cavities and nesting substrates for birds and arboreal mammals, while the understorey and leaf litter support reptiles, amphibians, arthropods, and decomposers [14,34]. Fallen wood, rock crevices, and seasonal pools are small habitat features with disproportionately high value for cryptic fauna [14,25].

Rivers, streams, wetlands, and headwaters

The headwater character of Amarkantak gives aquatic habitats exceptional regional importance [31]. Perennial and seasonal streams, waterfalls, pools, marshy patches, and riparian vegetation support fishes, freshwater turtles, amphibians, aquatic insects, kingfishers, and other water-associated birds [23]. These linear habitats also function as movement routes across an otherwise fragmented landscape [9]. Water extraction, siltation, sewage, religious tourism, and riparian clearing can therefore affect both aquatic organisms and terrestrial connectivity.

Grassland-forest interfaces and human-modified habitats

Open patches, grazing areas, agricultural fields, orchards, village ponds, and settlement edges add habitat types but also create conflict zones wild boar, peafowl, snakes, frogs, rodents,

Table 1. Evidence categories used in this review.

Evidence category	Meaning in this review	Recommended interpretation
District/plateau documented	Published study or source explicitly includes Anuppur or named Amarkantak localities (Ingle, 2020).	Suitable for a provisional district checklist, subject to taxonomic updates.
Landscape supported	Known from the connected Achanakmar -Amarkantak landscape or suitable contiguous habitat, but not localized by the supplied evidence [7,36,32]	Use in ecological discussion, not as an exact Anuppur locality record.
Illustrative/local report	Mentioned in the presentation or local account without survey metadata or verifiable locality details [26] (Sutherland et al., 2004; Isaac & Pocock, 2015).	Requires targeted confirmation before formal inclusion in a district inventory.

Table 2. Overview of major faunal groups, representative taxa, ecological roles, and evidence cautions.

Faunal group	Representative taxa in the source material	Principal ecological roles	Evidence caution
Mammals	Tiger, leopard, sloth bear, gaur, sambar, chital, wild boar, primates	Predation, herbivory, seed dispersal, disturbance, nutrient transfer	Several are best interpreted at connected -landscape scale unless locality data are available.
Birds	Peafowl, serpent eagle, roller, kingfishers, woodpeckers, vultures	Pollination, seed dispersal, scavenging, insect control, indicators	No complete district checklist or standardized count was supplied.
Amphibians	Toads, frogs, burrowing frogs, Sacred Grove Bush Frog	Insect control, prey base, nutrient transfer, moisture indicators	Best-supported quantitative group in the plateau literature: 17 species in Ingle (2020).
Reptiles	Cobra, Russell's viper, python, skinks, geckos, monitor lizard, turtles	Predation, scavenging, aquatic - terrestrial linkage	Ingle (2020) documented 44 species across the plateau study area.
Freshwater fauna	Fishes, turtles, aquatic insects; otter locally reported	Food-web support, nutrient cycling, water-quality indication	Distribution, taxonomy, and population trends remain insufficiently documented.
Invertebrates	Pollinators, decomposers, soil fauna, aquatic macroinvertebrates	Pollination, decomposition, soil formation, food -web foundation	Substantially underrepresented in both supplied documents.

and generalist birds may use these areas. Some species benefit from crops or artificial water sources, whereas specialists decline when native vegetation is simplified. The conservation value of such mosaics depends on pesticide use, hedge & tree retention, wetland condition, grazing intensity, & tolerance of wildlife [24].

Overview of animal diversity

A concise summary of the major faunal groups, representative taxa, ecological roles, and evidence cautions is provided in **Table 2** .

Mammalian diversity

Representative mammals of the wider landscape are illustrated in **Figure 2.**

Large carnivores and mesocarnivores

The source documents identify the Bengal tiger (Panthera tigris tigris) and Indian leopard (Panthera pardus fusca) as major carnivores of the wider landscape. Their ecological importance lies in their influence on prey behaviour, herbivore distribution, and food-web structure. Tiger occurrence is also used in conservation planning as an umbrella for protecting large, connected, prey-rich forest tracts; [35]. The more adaptable leopard may use forest edges and human-modified mosaics, which can increase encounters with livestock and people. The sloth bear (Melursus ursinus), although not a carnivore in the strict trophic sense, is an important insectivore and frugivore. It can disperse seeds and influence termite and ant populations, yet its use of scrublands, rocky areas, and forest edges makes accidental encounters with people a serious conflict concern.

Smaller carnivores, including civets, mongooses, jackals, foxes, and mustelids, are likely to contribute substantially to rodent control, scavenging, seed dispersal, and other ecosystem functions, but they receive relatively little attention in the supplied documents. Camera-trap arrays should therefore be designed not only for tiger detection but also for medium-sized and small mammals, incorporating relatively low camera placement, fine-scale habitat features, and habitat-stratified sampling to improve detection across species of different body sizes and ecological habits [16].

Herbivores and omnivores

Gaur (*Bos gaurus*), sambar (*Rusa unicolor*), chital (*Axis axis*), and wild boar (*Sus scrofa*) represent major herbivore & omnivore guilds. Through browsing, grazing, rooting, trampling, and seed dispersal, these animals influence vegetation structure, forest regeneration, and nutrient distribution. Their abundance and spatial distribution also affect the viability and distribution of large predators, particularly tigers and leopards. In fragmented landscapes, however, wild boar and deer may enter croplands, while gaur may move through agricultural fields and village margins, increasing the potential for human–wildlife conflict. Reliable estimates of their abundance and distribution require systematic methods such as distance-based line transects, dung or sign surveys, and occupancy-based camera trapping rather than occasional sightings [24].

Arboreal and small mammals

Primates, squirrels, bats, rodents, shrews, and other small mammals are essential but underdocumented components of district-level diversity. Arboreal mammals disperse seeds and connect canopy processes with forest regeneration [16]. Insectivorous bats suppress nocturnal insect populations, while fruit bats transport pollen and seeds over considerable distances, supporting plant reproduction and forest recovery. Rodents function as both consumers and prey, linking plant productivity with snakes, raptors, and small carnivores within terrestrial food webs. Future inventories should therefore include acoustic bat surveys, ethically conducted live trapping, roost mapping, and systematic examination of caves, bridges, old trees, and other potential roosting habitats.

Avian diversity

Representative birds highlighted in the supplied presentation are shown in **Figure 3.** The supplied presentation highlights the Indian peafowl (*Pavo cristatus*), crested serpent eagle (*Spilornis cheela*), Indian roller (*Coracias benghalensis*), kingfishers, and woodpeckers. Together, these examples indicate the breadth of feeding guilds present, including granivores and omnivores, raptors, aerial and ground insectivores, piscivores, frugivores, nectar feeders, bark-foraging insectivores, and scavengers. Habitat heterogeneity is likely to be a principal driver of local bird richness because forest interiors, canopy gaps, rivers, agricultural fields, wetlands, and trees within settlements provide different feeding, nesting, and refuge resources that support distinct assemblages.

Ecological functions

Birds make their ecological value visible through multiple ecosystem services. Woodpeckers excavate cavities that are subsequently used by secondary cavity-nesting birds and other animals [23]. Raptors help regulate rodents, reptiles, and other prey, while kingfishers transfer nutrients and energy from aquatic environments into terrestrial food webs. Frugivorous birds disperse seeds, insectivores can reduce populations of herbivorous insects, and vultures rapidly remove carcasses, thereby limiting opportunities for disease transmission and the proliferation of other scavengers. Changes in bird-guild composition may reveal habitat degradation before total species richness declines. For example, the replacement of forest specialists by widespread edge and generalist species can create the appearance of stable richness even while ecological integrity and functional diversity are eroding.

Survey and conservation needs

The available evidence does not support a precise district-wide estimate of bird diversity. A defensible baseline should combine fixed-radius point counts in major habitats, line transects, wetland counts, nocturnal surveys for owls and nightjars, and

seasonal sampling that covers both resident and migratory species [26-29]. Records should include geographic coordinates, sampling effort, detection probability, habitat characteristics, breeding evidence, and photographs or sound recordings for species that are difficult to identify. Sacred groves, riparian belts, mature sal stands, village tanks, and agricultural mosaics should be treated as separate sampling strata because habitat-specific surveys provide a more representative assessment of species composition and richness. Vulture nesting and roosting sites deserve focused surveillance because the source literature identifies the White-rumped Vulture (*Gyps bengalensis*) as a threatened species of the wider reserve landscape. This species is currently classified as Critically Endangered following catastrophic population declines across the Indian subcontinent.

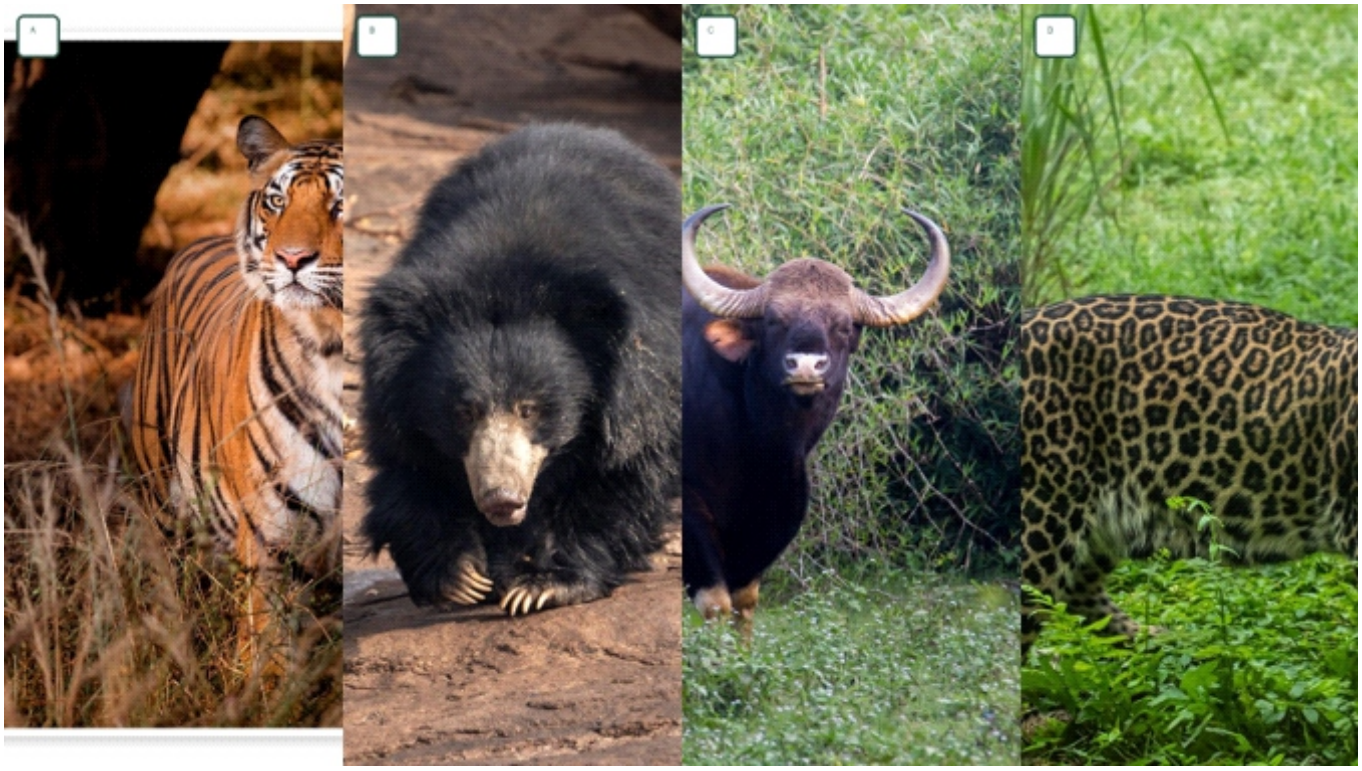


Figure 2. Representative mammals of the wider landscape: (A) tiger, (B) sloth bear, (C) gaur, and (D) leopard. Images reproduced from the supplied presentation; the panel is illustrative and does not establish locality records.

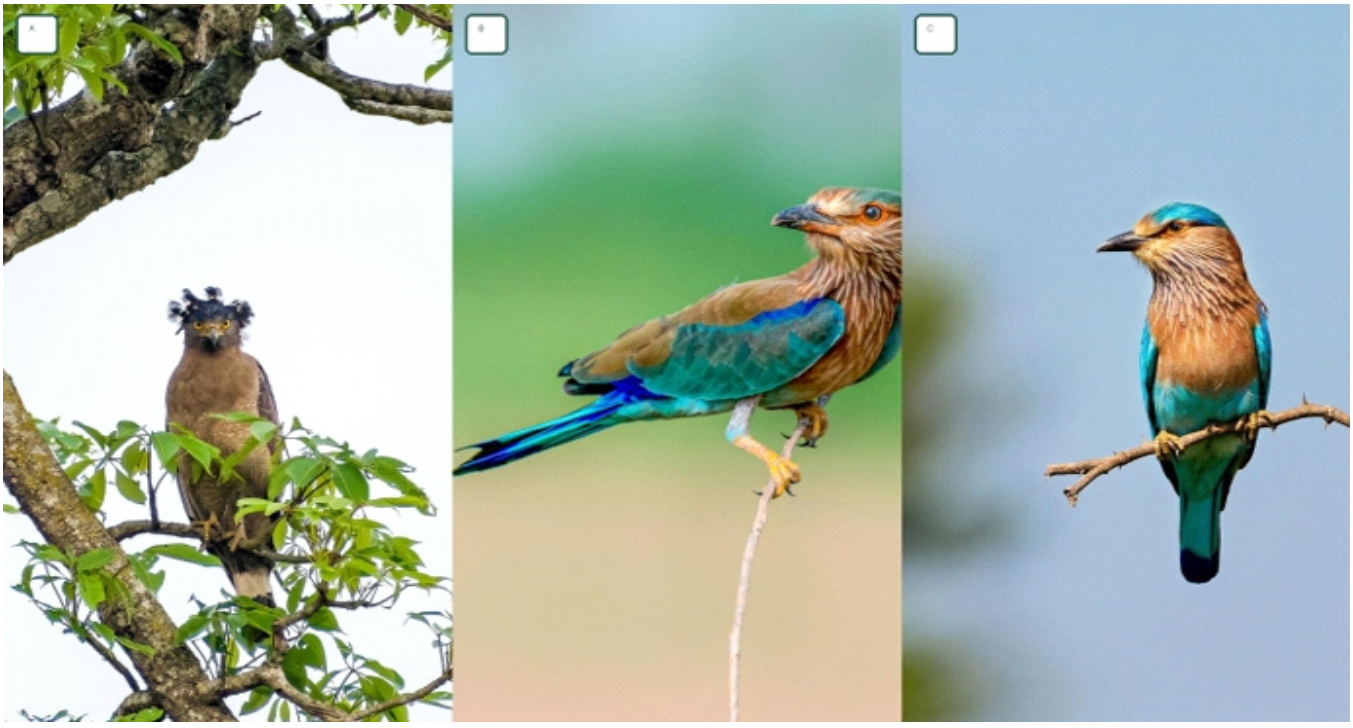


Figure 3. Representative birds shown in the supplied presentation: forest raptor and rollers. Bird records should be supported by dated observations, photographs, or standardized survey data before inclusion in a definitive district checklist.

Herpetofaunal diversity

Representative herpetofauna from the supplied presentation are shown in **Figure 4.** Herpetofauna is the most clearly quantified vertebrate component in the literature used for this review. Ingle [10] surveyed poorly explored sections of the Amarkantak Plateau, the Son, Johila, and Narmada river lowlands, parts of the Maikal Range, and pockets within the core zone of the Achanakmar–Amarkantak Biosphere Reserve. The study documented 61 species, comprising 17 amphibians and 44 reptiles [10]. Because its sampling area extended beyond the administrative boundary of Anuppur District, these figures should be interpreted as totals for the broader Amarkantak Plateau study area rather than as an exact district-level count [10]. Nevertheless, records from named sampling localities, including Amarkantak, Narmada Udgam, Rajendragram, Kapildhara, and Sonemuda, directly establish the district's herpetological importance [10].

Amphibians

The assemblage includes toads, aquatic and paddy-field frogs, burrowing frogs, bullfrogs, cricket frogs, and stream-associated species [10]. Amphibians connect aquatic and terrestrial food webs and are sensitive to changes in water quality, temperature, hydroperiod, disease, and habitat conditions; therefore, non-detection during the dry season should not be interpreted as true absence [34]. The rediscovery of the Sacred Grove Bush Frog (Raorchestes sanctisilvaticus) after 54 years, together with new state records of Sphaerotheca dobsonii and Eutropis beddomii, highlights the plateau's conservation importance and the need for surveys combining acoustic, morphological, and genetic methods [10].

Reptiles

The source material records snakes, lizards, geckos, skinks, monitor lizards, pythons, and freshwater turtles, which perform important ecological functions as predators, insect consumers, scavengers, and links between aquatic and terrestrial food webs [10]. The Indian cobra (Naja naja) and Russell's viper (Daboia russelii) are medically important species, making snakebite education and safe coexistence essential. Major threats include road mortality, intentional killing, collection, pesticide exposure, burning, stream alteration, and the loss of temporary pools and forest-floor refuges. Recommended measures include monsoon road surveys, wildlife crossings at mortality hotspots, protection of breeding pools, retention of rocks and deadwood, and rescue networks integrated with public-health awareness.

Aquatic and semi-aquatic fauna

Representative aquatic and semi-aquatic fauna are shown in **Figure 5.** Freshwater fishes are important to headwater food webs and local livelihoods, although the available material does not provide a verified district checklist. Fish assemblages vary with flow, substrate, temperature, depth, canopy cover, connectivity, and seasonal refuges, while turtles and aquatic insects connect benthic, aquatic, and terrestrial food webs. Otters should remain classified as "locally reported" until confirmed through photographs, spraints, tracks, camera traps, or environmental DNA; confirmation would indicate the importance of connected riparian cover, adequate fish populations, and secure denning sites [11,12]. Surveys should cover upstream–downstream gradients and assess fishing pressure, sand extraction, water diversion, sewage, plastics, and agrochemical runoff.

Invertebrate diversity: the major knowledge gap

Although the source documents focus on vertebrates, invertebrates constitute most animal diversity and support pollination, decomposition, nutrient cycling, soil formation, and food webs. Their omission therefore limits any assessment of ecosystem function. Surveys should prioritize indicator groups. Butterflies indicate habitat change, dung beetles reflect mammal activity and decomposition, dragonflies indicate aquatic habitat quality, and stream macroinvertebrates support water-quality assessment. Limited voucher collection should be supplemented with photography and DNA barcoding for difficult taxa [9,11].

Ecological functions and interactions

The animal community operates as an interacting network. Large carnivores influence herbivore behavior; herbivores and wild boar alter vegetation and soil; primates, bats, and birds move seeds; raptors and snakes regulate prey; amphibians transfer energy from wetlands; vultures and scavengers remove carrion; and decomposers return nutrients to soil. Forest structure, water availability, and disturbance determine which interactions remain intact. Conservation focused on isolated species may fail if the prey base, breeding sites, dispersal routes, or seasonal resources are lost.

Connectivity is particularly important in a landscape spanning state boundaries and administrative units. Animals respond to habitat, topography, water, risk, and resources rather than district lines. Riparian belts, forested ridges, stepping-stone groves, and low-disturbance patches may permit movement between Amarkantak, the Maikal forests, and the wider Achanakmar landscape. Maintaining these routes supports gene flow, recolonization, seasonal movement, and climate adaptation [36].

Indigenous and local ecological knowledge

Baiga, Gond, and other forest-dependent communities possess valuable knowledge of animal movements, breeding seasons, tracks, water sources, fire, and ecological relationships. This knowledge can improve survey timing and identify overlooked habitats. Its use should follow prior informed consent, appropriate credit, benefit sharing, protection of sensitive information, and paid community participation in monitoring and decision-making. Community-based conservation is more effective when linked with livelihoods, safety, resource access, conflict compensation, education, and locally managed tourism. Programs should also recognize that communities are not homogeneous; knowledge, priorities, and resource dependence differ by village, gender, age, and livelihood.



Figure 4. Representative herpetofauna: (A) Indian cobra, (B) Russell's viper, (C) monitor lizard, and (D) freshwater turtle. Images reproduced from the supplied presentation.



Figure 5. Aquatic diversity represented by (A) freshwater fishes and (B) a freshwater turtle. Images reproduced from the supplied presentation.

Major threats

Major pressures affecting biodiversity in the landscape are illustrated in **Figure 6.**

Habitat loss, fragmentation, and extraction

Forest conversion, mining, roads, power lines, settlements, tourism, and intensive resource extraction reduce and fragment habitats, increase edge effects, restrict animal movement, and intensify human-wildlife interactions [24]. Traffic, noise, artificial light, invasive species, & repeated disturbance further degrade remaining habitat. Impact assessments should therefore address cumulative landscape-level effects rather than individual project footprints alone.

Human-wildlife conflict and direct mortality

Crop damage, livestock depredation, sloth-bear encounters, and snakebite can reduce tolerance of wildlife and provoke retaliatory killing, poisoning, electrocution, or snaring. Conflict mitigation should combine rapid incident verification, transparent compensation, livestock protection, secure food & waste storage, community awareness, and hotspot mapping. Standardized roadkill monitoring should also guide wildlife crossings, fencing, and other road-design measures.

Fire, water alteration, pollution, and climate variability

Frequent or intense fire removes leaf litter, deadwood, cover, nests, eggs, and slow-moving animals. Altered rainfall and longer dry periods can reduce temporary pools and stream flow, while extreme rain can scour breeding sites [23]. Water extraction, siltation, sewage, plastics, pesticides, and mining runoff compound these effects. Climate change may shift breeding phenology, prey availability, fire weather, and elevational distributions [11,17]. Amphibians, stream organisms, and range-restricted plateau taxa are likely to be especially sensitive [11,21].

Conservation and monitoring framework

Key elements of the proposed monitoring approach are illustrated in **Figure 7**, and the recommended methods and core outputs are summarized in **Table 3.**

A district biodiversity observatory

Anuppur would benefit from a permanent biodiversity observatory coordinated among the Forest Department, colleges, local communities, protected-area managers, and research institutions. The observatory should maintain survey protocols, a georeferenced database, image and acoustic archives, annual indicator reports, and a process for validating sensitive or unusual records. Data sharing should balance scientific openness with protection of nesting, denning, and threatened-species locations [25].

Artificial intelligence and automated sensors

Machine-learning tools can classify camera-trap images and reduce the time needed to process large datasets [20,28]. Automated acoustic recognition can similarly assist with birds, bats, and calling frogs. These systems should retain human verification, especially for rare species, poor-quality images, juveniles, and taxonomically similar species. Model performance must be audited using local images because algorithms trained elsewhere may misclassify regional fauna.

Environmental DNA

Environmental DNA can detect genetic material shed into water or soil and is particularly useful for rare, cryptic, nocturnal, or aquatic organisms [6,29]. In Anuppur it could support fish, turtle, amphibian, and possibly otter surveys. A credible program needs contamination controls, replicated sampling, reference sequences, transparent bioinformatics, and confirmation of unexpected detections. eDNA reveals recent presence but usually does not provide direct population size or precise location.

Habitat intelligence and restoration

Remote sensing can map forest loss, canopy condition, fire scars, wetland change, road expansion, and corridor constriction [22,30]. These products should guide ground verification and restoration.

Priority actions include protecting riparian buffers and sacred groves, restoring native mixed forest, improving culverts and crossings, securing breeding pools, controlling invasive plants, and reducing disturbance near nesting and denning sites. Rewilding should be considered only after causes of local loss are addressed, habitat and social feasibility are demonstrated, and long-term monitoring is funded [19,5,27].

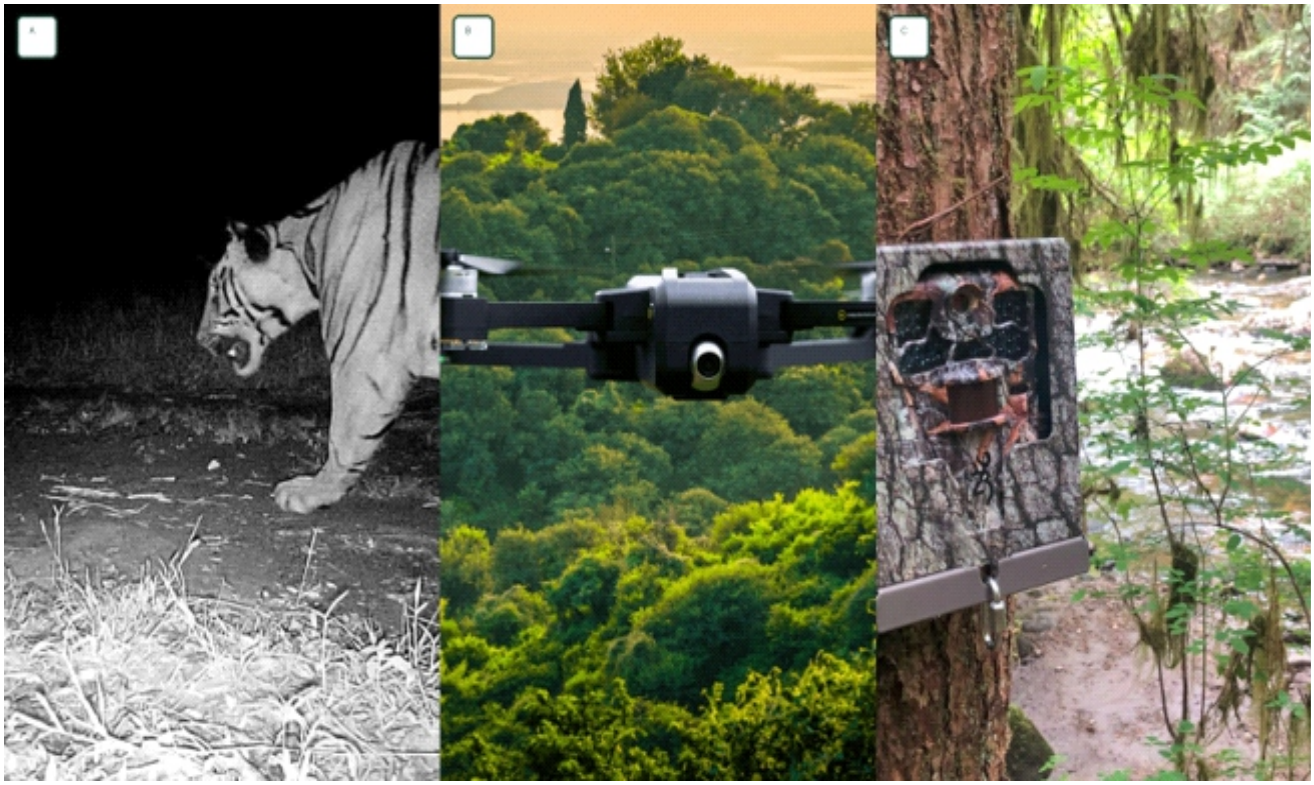


Figure 4. Representative herpetofauna: (A) Indian cobra, (B) Russell's viper, (C) monitor lizard, and (D) freshwater turtle. Images reproduced from the supplied presentation.

Table 3. Overview of recommended methods and core outputs of the district biodiversity observatory.

Component	Recommended method	Core output
Large and medium mammals	Spatially balanced camera traps; sign surveys; occupancy models	Detection, occupancy, activity, corridor use, conflict hotspots
Birds	Seasonal point counts, transects, wetland counts, acoustic recording	Species and guild trends, breeding sites, migrant use
Herpetofauna	Monsoon visual encounter surveys, call surveys, roadkill transects	Site occupancy, breeding pools, threatened taxa, mortality zones
Freshwater fauna	Reach -based fish and turtle surveys, water chemistry, eDNA	Distribution, connectivity, water -quality and rare -species signals
Invertebrates	Butterfly transects, light traps, dung beetles, stream indices	Functional indicators and seasonal change
Habitat	Satellite imagery, drones where lawful, ground plots, fire history	Canopy change, riparian condition, fragmentation and restoration outcomes
Community observations	Validated reporting network with consent and safeguards	Early warnings, seasonal knowledge, improved response capacity

Research gaps and priorities

- Prepare a taxonomically validated district checklist with locality, date, observer, evidence type, and habitat for every record.
- Repeat surveys across pre-monsoon, monsoon, post-monsoon, and winter seasons using effort-based methods.
- Map sacred groves, breeding wetlands, salt licks, roosts, nesting trees, caves, and roadkill hotspots.
- Quantify abundance or occupancy rather than relying only on presence lists, with explicit estimates of detectability.
- Establish long-term monitoring for the Sacred Grove Bush Frog and other range-restricted plateau taxa.
- Confirm locally reported otter presence and evaluate fish and freshwater-turtle diversity across river basins.
- Build baseline inventories for bats, small mammals, pollinators, soil fauna, and aquatic macroinvertebrates.
- Study cumulative effects of mining, roads, fire, tourism, pesticides, and water abstraction.
- Document wildlife conflict with spatial, seasonal, livelihood, and response-time data.
- Create ethical protocols for community knowledge, benefit sharing, data ownership, and sensitive-location security.

DISCUSSION

The available evidence portrays Anuppur as an ecologically diverse district embedded in a still larger functional landscape. Its importance derives not only from the presence of charismatic mammals but also from headwaters, habitat gradients, sacred groves, and the meeting of aquatic and terrestrial systems. The strongest published biodiversity result in the reviewed material concerns herpetofauna, where extensive plateau surveys revealed both high richness and unexpected records [15]. By comparison, mammal, bird, fish, and invertebrate information in the supplied documents is mainly descriptive. This imbalance should shape future investment: the district needs standardized inventories and trend monitoring, not merely additional general species lists [25]. A second conclusion is that conservation should operate across scales. A breeding pool, old tree, or sacred grove may protect a localized species; a riparian buffer supports movement and water quality; and a forest corridor maintains regional connectivity for large mammals [16]. Administrative plans should connect these scales and coordinate across the Madhya Pradesh-Chhattisgarh boundary. Technology can improve coverage, but its value depends on clear questions, representative sampling, trained personnel, quality control, and community legitimacy. Finally, evidence language matters. A slide image, a local report, a sign record, a camera-trap photograph, an expert identification, and a peer-reviewed voucher record do not carry equal certainty. A transparent district database that records evidence type would allow the review to mature into a reliable biodiversity status assessment and would make future changes measurable [25].

CONCLUSION

Anuppur District and the Amarkantak Plateau support a rich and functionally important animal community across forests, headwaters, wetlands, grassland edges, farms, and settlements. Mammals, birds, reptiles, amphibians, fishes, turtles, and invertebrates collectively sustain trophic regulation, seed dispersal, insect control, decomposition, and aquatic-terrestrial connectivity. The documented herpetofaunal richness and rediscovery of the Sacred Grove Bush Frog underline the global value of localized habitats. Yet the evidence base remains uneven, and several prominent species claims require locality-specific confirmation. The most effective path forward is a long-term district observatory that combines rigorous field ecology, community knowledge, camera traps, acoustic sensors, eDNA, and remote sensing. Protection of habitat connectivity, riparian systems, sacred groves, breeding wetlands, and coexistence mechanisms should be treated as immediate priorities.

ABBREVIATIONS

IUCN: International Union for Conservation of Nature
GIS: Geographic Information System
AABR: Achanakmar-Amarkantak Biosphere Reserve

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AUTHOR CONTRIBUTIONS

All authors significantly contributed to the study conception and design, data acquisition, or data analysis and interpretation. They participated in drafting the manuscript or critically revising it for important intellectual content, consented to its submission to th current journal, provided final approval for the version to be published, and accepted responsibility for all aspects of the work.

Additionally, all authors meet the authorship criteria outlined by the International Committee of Medical Journal Editors (ICMJE) guidelines.

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CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

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All necessary consent & approval was obtained by authors.

CONSENT FOR PUBLICATION

All necessary consent for publication was obtained by authors.

DATA AVAILABILITY

All data generated and analyzed are included within this research article. The datasets utilized and/or analyzed in this study can be obtained from the corresponding author upon a reasonable request.

USE OF ARTIFICIAL INTELLIGENCE (AI) & LARGE LANGUAGE MODEL (LLM)

The authors confirm that no AI & LLM tools were used in the writing or editing of the manuscript, and no images were altered or manipulated using AI & LLM.

AUTHOR'S NOTE

This article serves as an important educational tool for the scientific community, offering insights that may inspire future research diretions. However, they should not be relied upon independently when making treatment decisi-ons or developing public health policies.

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