

IMPACT OF CLIMATE CHANGE ON ANIMAL BEHAVIOR, HABITATS, AND BREEDING CYCLES IN INDIA: A REVIEW OF ZOOLOGICAL STUDIES

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Abstract

Climate change is rapidly altering natural ecosystems across India, posing serious threats to native animal species. This review paper synthesizes scientific findings from recent zoological studies to explain how rising temperatures, changing rainfall patterns, and extreme weather events directly impact Indian fauna. Key findings show that high-altitude mammals like the snow leopard (*Panthera uncia*) are losing their living space due to upward mountain range shifts, while endemic species such as the lion-tailed macaque (*Macaca silenus*) face habitat fragmentation. Changing monsoon patterns disrupt natural breeding timings, causing high tadpole mortality in rare amphibians like the purple frog (*Nasikabatrachus sahyadrensis*) and creating food shortages for nesting birds. In inland river systems, warmer water temperatures and fluctuating river flows disrupt the migration and spawning of freshwater fish species. Furthermore, heatwaves create timing mismatches between insect pollinators and native plants, threatening crop yields and insect diversity. Elevated sand temperatures also skew hatchling sex ratios toward females in Olive Ridley sea turtles (*Lepidochelys olivacea*). Additionally, rising temperatures accelerate vector-borne disease spread and allow invasive species like the African apple snail (*Achatina fulica*) to outcompete native wildlife. To protect India's rich animal diversity, this paper emphasizes the urgent need for contiguous forest corridors, river connectivity, local micro-climate tracking, disease surveillance, and flexible wildlife management strategies.

Keywords: Climate Change, Indian Zoology, Animal Behavior, Freshwater Fish, Insect Pollinators, Invasive Species, Breeding Cycles, Wildlife Conservation.

1. Introduction

Climate change is one of the biggest threats to wildlife and plants around the world (Intergovernmental Panel on Climate Change [IPCC], 2023). India is home to a massive variety of animals and four major natural areas called biodiversity hotspots: the Western Ghats, the Eastern Himalayas, Indo-Burma, and Sundaland (Bawa et al., 2024). Over the past few decades, average temperatures in India have been going up. At the same time, rainfall has become unpredictable, summer heatwaves are lasting longer, and ocean waters are getting much warmer. While many people know how weather changes affect plants, it is also very important to look at how animals are reacting (World Animal Protection, 2026). Animals rely on nature's signals—like warm weather or monsoon rains—to know when to move, hunt, or have babies (Sharma et al., 2024). When these weather cues become unreliable, animals lose their natural homes,

struggle to reproduce, and have to fight harder for food (Bhakuni & Joshi, 2024).

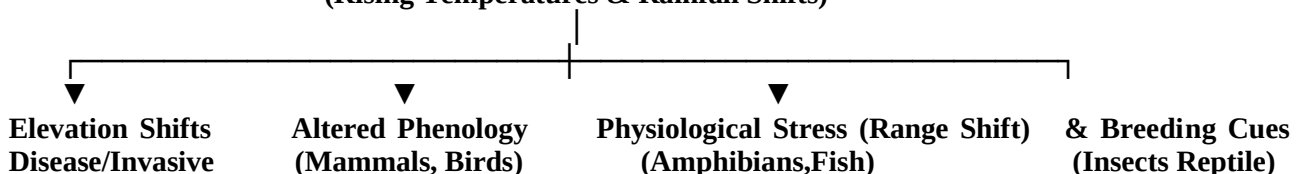
This review paper brings together findings from scientific studies to explain how climate change is affecting animals in India. It looks at how animals are moving to new areas, changing their breeding times, dealing with body stress, and what we can do to protect them.

2. Review Methodology

To write this review paper, scientific papers and environmental reports published between 2005 and 2026 were collected. The focus was on real field studies about Indian wildlife. Main research databases—like PubMed, Google Scholar, Web of Science, and Scopus—were searched using simple search terms like "climate change", "Indian wildlife", "zoology", "species shift", "breeding cycles", and "biodiversity India". Priority was given to long-term studies that tracked wild animals in their natural habitats (Galbraith et al., 2020).

3. Key Zoological Impacts Observed Across Indian Fauna

Climate Change Stressors (Rising Temperatures & Rainfall Shifts)



3.1 Loss of Homes and Moving to Cooler Areas

As low-lying areas get hotter, animals that prefer cool weather are moving higher up mountains to find comfortable temperatures (Auer & King, 2014).

- **Mountain Mammals:** Animals living high in the Himalayas—like the snow leopard (*Panthera uncia*) and the Himalayan ibex—are losing their living spaces. As forests grow further up mountain slopes, alpine grass fields shrink. This forces these animals into smaller areas where food is harder to find (Bawa et al., 2024).
- **Local Monkeys:** In South India, tree-living monkeys like the lion-tailed macaque (*Macaca silenus*) in the Western Ghats are losing their forest homes. As these forests get drier, canopy trees produce fewer fruits and seeds for monkeys to eat (Bawa et al., 2024).

3.2 Disruptions in Breeding and Nesting Cycles

Animals depend on seasonal cues like daylight hours, temperature drops, and rainfall to start breeding. When weather patterns change, these natural timings get broken (Sharma et al., 2024):

- **Frogs and Toads:** Amphibians need the monsoon rains to lay eggs. Delayed rains or sudden droughts cause water pools to dry up too fast, killing tadpoles before they can grow up (Gopal & Das, 2023). This is especially dangerous for rare species like the purple frog (*Nasikabatrachus sahyadrensis*).
- **Birds:** Local and migrating birds are changing their nesting times. In wetlands, baby birds are hatching too early or too late, missing the time when insects are most available for food (Both et al., 2006).

3.3 Aquatic Ecosystem Stress and Migratory Fish Impacts

Inland rivers and coastal waters are facing major changes due to extreme weather:

- **Freshwater Fish Disruption:** Indian river systems (such as the Ganga and Mahanadi basins) are seeing rising water temperatures and altered monsoon flood timings. Important migratory fish like Indian Major Carps (e.g., *Labeo rohita*) rely on specific flood currents to swim upstream and spawn. Irregular rains reduce river levels, causing breeding failures and pushing fish into deeper, cooler river stretches (ICAR-CIFRI, 2024).

3.4 Insect Pollinator Declines and Phenological Mismatches

Insects are cold-blooded creatures whose body functions depend heavily on ambient temperatures:

- **Pollinator Decline:** Wild bees (like *Apis dorsata*) and butterfly populations are declining in warming regions across India. Rising heat causes plants to flower earlier than usual, leading to a "timing mismatch" where insects emerge after peak flowering has already passed. This reduces insect survival rates and severely damages natural seed production (Nath et al., 2026).

3.5 Changes in Egg Temperatures and Body Stress

- **Reptile Gender Balance:** In many reptiles, the temperature of the sand or soil where eggs are buried decides if baby reptiles become male or female. On nesting beaches along the Odisha coast, hotter sand is causing Olive Ridley sea turtles (*Lepidochelys olivacea*) to hatch almost entirely as females, making it hard for the population to stay healthy (World Animal Protection, 2026).
- **Sea Life:** Hot ocean water in the Bay of Bengal and the Arabian Sea causes coral reefs to bleach and die. This destroys natural shelters for small fish and upsets the ocean food chain (IPCC, 2023).

3.6 Invasive Alien Species Expansion and Disease Spread

Warming temperatures and changing weather patterns create ideal conditions for invasive animals and disease-carrying vectors to thrive across Indian ecosystems:

- **Vector-Borne Diseases:** Higher global temperatures speed up the life cycles of mosquitoes, ticks, and parasites (Roy & Banerjee, 2025). This leads to frequent disease outbreaks among wild mammals and bird populations, especially in previously cooler mountain forest zones.
- **Invasive Species Advantage:** Invasive alien species, such as the African apple snail (*Achatina fulica*) and non-native freshwater tilapia, adapt to warm, degraded waters much faster than native animals. They aggressively outcompete local fauna for food, shelter, and breeding territories, further weakening native ecosystems (Roy & Banerjee, 2025).

4. Climate Impacts on Animal Groups

Animal Group	Main Climate Problem	Main Effect on Animals	Example Species
Mammals	Extreme heat & drought	Moving up mountains; changing travel paths	Snow leopard (<i>Panthera uncia</i>)
Amphibians	Unpredictable rains	Drying breeding pools; high tadpole death	Purple frog (<i>Nasikabatrachus sahyadrensis</i>)
Freshwater Fish	Warm water & erratic river flows	Broken migration routes; failed egg-laying	Indian Major Carps (<i>Labeo rohita</i>)
Insect Pollinators	Heatwaves & unseasonal bloom	Emergence timing out of sync with plant flowers	Rock honey bee (<i>Apis dorsata</i>)
Reptiles	Hot sand & soil	Mostly female babies hatching	Olive Ridley turtle (<i>Lepidochelys olivacea</i>)
Birds	Unseasonal weather	Confused flight paths; missing food for chicks	Migratory songbirds & ducks
Vectors & Invasive Fauna	Warmer weather & altered ecosystems	Rapid disease spread & loss of local food/shelter	African apple snail (<i>Achatina fulica</i>)

5. Simple Steps for Wildlife Protection

Connecting Natural Habitats (Wildlife Paths)

- Building Green Corridors: Joining separated patches of forests with trees and plants. This gives big animals like elephants and tigers a safe pathway to walk long distances to find food and cooler areas.
- Protecting Mountain Slopes: Keeping forest land unbroken from the bottom of mountains to the top. This lets cold-loving animals like snow leopards move higher up as lower areas get too hot.

Protecting Rivers, Lakes, and Oceans

- Keeping Rivers Flowing Normally: Releasing water from dams at the right times so rivers have natural water flows. This gives fish the signal they need to swim upstream and lay eggs.
- Saving Mangroves and Wetlands: Restoring coastal trees (mangroves) and lakes. They act as natural shields against huge sea waves, filter dirty water, and offer safe homes for fish and water birds.

Direct Help for Vulnerable Animals

- Cooling Down Nesting Beaches: Putting shade covers or light water sprays on turtle nesting beaches. This keeps the sand cool so baby sea turtles hatch as a healthy mix of males and females instead of only females.
- Creating Breeding Ponds for Frogs: Building small, shaded water pools in forests so rare frogs have a safe place to lay eggs even if the monsoon rains arrive late.
- Moving Species to Safer Places: Safely relocating small groups of endangered animals to cooler, stable forest areas if their original homes become too hot or dry to survive.

Local Community Work and Forest Management

- Removing Invasive Animals and Plants: Clearing out non-native weeds and invasive creatures (like foreign snails or aggressive fish) that steal food and shelter from local wildlife.
- Setting Up Local Weather Tracking: Placing basic temperature and moisture sensors in forest reserves to quickly find which areas stay cool and need extra protection.
- Involving Local People: Training local villagers and forest communities to guard wildlife and care for the forests, using their traditional knowledge to protect nature.

6. Conclusion

Climate change is a clear and direct danger to wild animals in India. Research shows that animals are already changing their habits, losing their traditional homes, and struggling to hatch healthy young. To protect them, we must shift from basic protection rules to active, flexible nature management that keeps forests and rivers connected and tracks animal health over time.

References

1. Auer, S. K., & King, D. I. (2014). Ecological and evolutionary responses of birds to global climate change. *Journal of Avian Biology*, 45(3), 221–230.
2. Bawa, K. S., Rai, S., & Sharma, R. (2024). Observed and projected impacts of climate change on biodiversity: Lessons from India and beyond. *International Journal of Biodiversity Conservation*, 26(2), 16–29.
3. Bhakuni, S., & Joshi, P. C. (2024). Climate change and its impact on zoological diversity and species distribution: A review. *Journal of Biodiversity and Ecological Studies*, 12(2), 45–58.
4. Both, C., Bouwhuis, S., Lessells, C. M., & Visser, M. E. (2006). Climate change and

- population declines in a long-distance migratory bird. *Nature*, 441(7089), 81–83.
5. Galbraith, H., Smith, J., & Turner, L. (2020). Review on climate change and its effect on wildlife and ecosystems. *Online Journal of Environmental Biology*, 6(1), 121–129.
 6. Gopal, A., & Das, A. (2023). *Habitat loss and microclimate disruption push endemic amphibians to the edge in the southern Western Ghats*. Mongabay Environmental Bulletin.
 7. ICAR-Central Inland Fisheries Research Institute. (2024). *Climate-induced changes in fish species distribution in Indian rivers*. National Mission for Clean Ganga Technical Report Series, 14(2), 50–65.
 8. Intergovernmental Panel on Climate Change. (2023). *Climate change 2023: Synthesis report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
 9. Nath, R., Kumar, A., & Swaminathan, K. (2026). Climate change and insect pollination: A review of consequences for pollination services and biodiversity in India. *Indian Journal of Entomology*, 88(4), 34–42.
 10. Roy, S., & Banerjee, P. (2025). Climate change as a driver of invasive species spread and vector-borne diseases in Indian ecosystems. *Journal of Applied Zoological Research*, 37(1), 88–101.
 11. Sharma, P., Kumar, V., & Singh, R. (2024). Phenological mismatches and range shifts in Himalayan fauna under warming scenarios. *Indian Journal of Ecological Sciences*, 39(1), 102–115.
 12. World Animal Protection. (2026). *How climate change is impacting wildlife and ecosystem resilience*. World Animal Protection Insights.