

Module Title: Man-Animal Conflict: Coexistence Strategies for a Sustainable Future

Learning Objectives:

By the end of this module, learners will be able to:

- Understand the concept and causes of man-animal conflict.
- Identify areas and species most affected.
- Analyze the ecological, social, and economic impacts.
- Evaluate strategies for conflict mitigation.
- Promote sustainable coexistence between humans and wildlife.

Course Duration: 10-12 hours (can be delivered over 2-3 days)

Format: Text, images, videos, quizzes

Target Audience:

- Undergraduate/postgraduate students (environmental science, zoology, forestry)
- NGO and community workers
- School eco-club leaders

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1. Introduction to Man-Animal Conflict

Definition of man-animal conflict.

Man-Animal Conflict (also referred to as human-wildlife conflict) is defined as situations where interactions between humans and wild animals result in negative consequences for both parties. These conflicts typically arise due to competition for limited resources, habitat encroachment by humans into wildlife territories, or environmental changes that force animals into human-dominated areas. Key impacts include threats to human safety, economic losses (e.g., crop destruction, livestock predation), and risks to animal populations through injury, retaliatory killings, or habitat fragmentation. Such conflicts pose significant challenges for biodiversity conservation, socio-economic stability, and sustainable coexistence between humans and wildlife.

The **historical context and evolution of human-wildlife conflict in India** is deeply intertwined with socio-economic changes, colonial policies, habitat transformation, and conservation efforts. Here's a chronological overview:

1. Pre-Colonial Era (Ancient to 18th Century)

- **Coexistence and Cultural Harmony:** Many communities lived in relative harmony with wildlife, influenced by cultural and religious beliefs (e.g., sacred groves, reverence for species like elephants, tigers, and snakes).
- **Low-Intensity Conflicts:** Conflicts were localized and infrequent due to sparse human populations, vast forest cover, and subsistence lifestyles.
- **Hunting Practices:** Royal hunts occurred but were regulated by traditions, limiting ecological disruption.

2. Colonial Era (19th–Mid-20th Century)

- **Forest Exploitation:** The British introduced commercial forestry (e.g., for timber, railways, and plantations), fragmenting habitats and displacing wildlife.
- **Agricultural Expansion:** Forests were cleared for tea, coffee, and cash crops, shrinking wildlife corridors.
- **Hunting as Sport:** British officials and Indian elites hunted tigers, leopards, and other species for sport, leading to population declines (e.g., near-extinction of cheetahs by 1952).
- **Emergence of Conflicts:** As forests shrank, encounters between humans and animals (e.g., crop raids by elephants, livestock predation by tigers) increased.

3. Post-Independence (1947–1970s)

- **Population Growth and Land Use:** Rapid urbanization, agriculture, and infrastructure projects (dams, roads) encroached on forests and wetlands.
- **Wildlife Depletion:** By the 1960s, species like tigers and lions were critically endangered due to habitat loss and poaching.

Conservation Awakening:

- **The Wildlife Protection Act (1972) and Project Tiger (1973)** marked a shift toward conservation. However, strict protection sometimes alienated local communities, who faced crop and livestock losses.
- **Habitat Fragmentation:** Protected areas (PAs) became islands, forcing animals like elephants to venture into farmlands for food.

4. 1980s–1990s: Rising Conflicts and Conservation Dilemmas

- **Green Revolution Impact:** Intensive agriculture expanded into wildlife habitats, increasing conflicts (e.g., crop raids by nilgai, wild boars).
- **Predator Rebound:** Conservation successes (e.g., tiger population recovery) led to more encounters with humans.
- **Retaliatory Killings:** Farmers and herders began poisoning or hunting "problem animals" like leopards and tigers.
- **Legal Framework:** The Forest Rights Act (2006) later aimed to balance tribal rights and conservation, but implementation challenges persisted.

5. 21st Century: Modern Challenges

- **Urbanization and Infrastructure:** Linear projects (roads, railways) and mining fragmented habitats (e.g., elephants killed on train tracks in Assam, highways cutting through tiger corridors).
- **Climate Change:** Altered rainfall and resource availability pushed animals into human areas (e.g., snakes entering villages during droughts).
- **Mega-Herbivore Conflicts:** Elephants and monkeys became major conflict species due to habitat loss. India records 500+ human deaths annually from elephant encounters.
- **Big Cat Conflicts:** Tigers and leopards increasingly roam human-dominated landscapes (e.g., leopards in Mumbai, tigers in Uttarakhand).
- **Invasive Species:** Wild boars and nilgai, thriving in farmlands, cause massive crop damage.

Key Evolutionary Drivers

- Habitat Loss: India has lost over 50% of its natural forests since 1900, forcing wildlife into human spaces.
- Policy Shifts: From exploitative colonial policies to conservation-focused laws, often without integrating community needs.
- Human-Wildlife Interface: Over 35% of India’s population lives within 5 km of forests, increasing interaction risks.
- Climate and Ecological Stressors: Drying waterholes, invasive plants, and erratic weather exacerbate resource competition.
- *Case Studies: Global Scenario and Tiger attacks in Sunderbans.*

Case Studies on Human-Wildlife Conflicts (GLOBAL SCENERIO)

Human-wildlife conflicts (HWC) vary widely across regions and species. Below are notable case studies that highlight diverse scenarios, mitigation strategies, and lessons learned:

1. Sundarbans Tiger-Human Conflicts (India/Bangladesh)

Context: The Sundarbans mangrove ecosystem faces frequent tiger attacks on fishermen and honey collectors due to shrinking habitats and prey depletion

Impact: Over 500 annual fatalities in the Indian Sundarbans, with survivors facing stigma as tiger widows

Mitigation: Early warning systems (SMS alerts, watchtowers), nylon fencing, and community-led patrols reduced attacks by 30% in high-risk zones like Jheela CD Block

2. Human-Elephant Conflicts in Uttarakhand, India

Context: Crop raids by Asian elephants near protected areas disproportionately affect women, who bear the economic and psychological burden

Mitigation: Compensation schemes and buffer zones were introduced, but delays in payments and lack of gender-sensitive policies limited effectiveness.

3. Baboon Conflicts in Urban South Africa

Context: Urban expansion into baboon territories led to property damage and safety risks. A study modeled conflict drivers, emphasizing waste management and community education

Insight: Solutions must address socio-economic factors (e.g., poverty-driven reliance on waste) alongside ecological ones

4. Jaguar-Livestock Conflicts in Latin America

Case Study: A range-wide analysis revealed that 80% of conflicts occurred in cattle ranching areas. Retaliatory killings threatened jaguar populations

Solution: Compensation programs and "predator-friendly" certification for ranchers reduced retaliatory killings by 40% in Brazil

5. Crocodile Attacks in Kenya's Maasai Mara

Context: Riverbank farming increased crocodile attacks. A study compared fenced vs. unfenced reserves, finding fewer conflicts in fenced areas

Challenge: Fencing disrupted wildlife migration, highlighting the trade-off between safety and ecological connectivity7.

Human-wildlife conflict in North Bengal:

North Bengal, a bio-diverse region in West Bengal bordering Bhutan, Nepal, and Bangladesh, is a hotspot for human-wildlife conflict due to its dense forests, tea estates, and proximity to critical wildlife corridors. Here are key examples:

1. Human-Elephant Conflict

Locations: Jalpaiguri, Alipurduar, Darjeeling, and the Dooars region.

Causes:

Habitat fragmentation: Tea gardens, highways (NH31), and settlements block traditional elephant corridors (e.g., the Chalsa-Madarihat corridor).

Crop raids: Elephants raid paddy, maize, and banana plantations, especially during harvest seasons.

Impacts:

Human deaths: 50–100 fatalities annually in North Bengal (highest in WB).

Elephant deaths: Collisions with trains (e.g., Alipurduar railway line kills 8–10 elephants yearly) and electrocution from illegal power lines.

Mitigation:

Early warning systems: Forest departments use SMS alerts and watchtowers.

Elephant-proof trenches and solar fences around villages.

2. Tiger and Leopard Encounters

Locations: Buxa Tiger Reserve, Jaldapara National Park, and fringe villages.

Causes:

Prey depletion and habitat loss push tigers/leopards into villages.

Livestock predation: Leopards target cattle and goats near forest edges.

Impacts:

Human attacks: In 2022, a leopard mauled 3 people in Alipurduar.

Retaliatory killings: Villagers sometimes poison or trap big cats.

Mitigation:

Rapid Response Teams (RRTs) to tranquilize and relocate animals.

Awareness campaigns to reduce panic.

3. One-Horned Rhino Conflict

Locations: Jaldapara National Park and Gorumara National Park.

Causes:

Habitat compression: Rhinos stray into villages during floods or to graze on crops.

Poaching threats: Despite protection, rhinos are targeted for their horns.

Impacts:

Crop damage: Rhinos destroy sugarcane and vegetable fields.

Human injuries: Occasional trampling incidents.

4. Wild Boar and Monkey Menace

Locations: Terai region, tea estates, and farmlands.

Causes:

Agricultural expansion: Wild boars thrive in crop fields; monkeys raid orchards.

Lack of natural predators: Boar populations surge unchecked.

Impacts:

Economic loss: Farmers lose 30–50% of crops annually in Jalpaiguri.

Human-wildlife tension: Farmers use firecrackers and night vigils.

5. Snakebite Incidents

Locations: Rural villages near wetlands and forests.

Causes:

Encroachment: Farming and housing expand into snake habitats.

Monsoon floods: Snakes enter homes for shelter.

Impacts:

Deaths: North Bengal reports ~500 snakebite deaths annually (highest in WB).

6. Gaur (Indian Bison) Conflicts

Locations: Neora Valley and Mahananda Wildlife Sanctuary.

Causes: Habitat shrinkage forces gaurs into tea estates and villages.

Impacts:

Property damage: Gaurs trample fences and huts.

Road accidents: Collisions on highways like NH10.

7. Fisheries and Crocodile Attacks

Locations: Rivers like Teesta and Mahananda.

Causes:

Overfishing: Mugger crocodiles compete with fishermen.

Riverbank farming: Crocodiles attack humans near water bodies.

Key Drivers in North Bengal

Tea Estates: Cover 70% of the Dooars, fragmenting forests.

Railway Lines: Alipurduar-Siliguri tracks bisect elephant corridors.

Climate Shocks: Erratic rainfall alters animal movement.

Community Responses and Innovations

Eco-tourism: Villages near Buxa and Jaldapara promote wildlife tourism to offset losses.

Compensation: West Bengal govt. provides ₹2–5 lakh for human deaths and crop damage.

Joint Forest Management: Locals collaborate with forest departments on patrols.

Recent Incidents (2022–2023)

A herd of 15 elephants raided crops in Malbazar, triggering a 3-day standoff.

A tiger from Buxa Reserve injured 2 villagers in Kalchini.

Wild boars destroyed 50 acres of maize in Dhupguri.

Conclusion

North Bengal's human-wildlife conflict stems from competing land uses, ecological fragility, and infrastructure projects. While mitigation efforts exist, sustainable solutions require corridor restoration, community inclusion, and balancing development with conservation in this ecologically vital region.

Activity: MCQs

1. What is the primary cause of human-wildlife conflicts?

- a) Climate change
- b) Habitat fragmentation
- c) Tourism
- d) Genetic mutations

****Answer**:** b) Habitat fragmentation

***Explanation*:** Habitat fragmentation due to agriculture, urbanization, and infrastructure forces wildlife into closer contact with humans.

2. Which of the following is NOT a common impact of human-wildlife conflicts?

- a) Crop damage
- b) Disease transmission
- c) Increased biodiversity
- d) Loss of human lives

****Answer**:** c) Increased biodiversity

***Explanation*:** Conflicts often reduce biodiversity by harming species populations.

3. Which animal is most associated with human-elephant conflicts in India?

- a) Bengal Tiger
- b) Indian Rhinoceros
- c) Asian Elephant
- d) Sloth Bear

****Answer**:** c) Asian Elephant

4. What is a "wildlife corridor"?

- a) A zoo pathway
- b) A protected route for animal movement between habitats
- c) A tourist trail in forests
- d) A veterinary clinic for wildlife

****Answer**:** b) A protected route for animal movement between habitats

5. Which region is infamous for tiger-human conflicts due to mangrove ecosystems?

- a) Western Ghats
- b) Sundarbans
- c) Thar Desert
- d) Himalayan Foothills

****Answer**:** b) Sundarbans

6. Which mitigation strategy involves compensating farmers for crop losses?

- a) Translocation
- b) Insurance schemes
- c) Culling
- d) Afforestation

****Answer**:** b) Insurance schemes

7. What is a major driver of human-wildlife conflicts in Africa?

- a) Desertification
- b) Poaching for ivory
- c) Competition for water and grazing land
- d) Overfishing

****Answer**:** c) Competition for water and grazing land

8. Which human activity increases the risk of crocodile attacks?

- a) Riverbank farming
- b) Cycling
- c) Mountain climbing
- d) Birdwatching

****Answer**:** a) Riverbank farming

9. What percentage of global human-wildlife conflicts involve large carnivores?

- a) 10%
- b) 25%
- c) 50%
- d) 75%

****Answer**:** b) 25%

Explanation: Large carnivores like tigers, lions, and leopards account for ~25% of conflicts.

10. Which organization works globally to mitigate human-wildlife conflicts?

- a) WHO
- b) WWF
- c) NASA
- d) UNESCO

****Answer**:** b) WWF (World Wildlife Fund)

11. Which animal is responsible for the highest number of human deaths in India?

- a) Tigers
- b) Elephants
- c) Snakes
- d) Leopards

****Answer**:** b) Elephants

Explanation: Elephants cause ~500 human deaths annually in India.

12. What is "retaliatory killing"?

- a) Legal hunting of invasive species
- b) Killing wildlife in response to damage/losses
- c) Euthanasia of sick animals
- d) Culling for population control

****Answer**:** b) Killing wildlife in response to damage/losses

13. Which technology is used to track animal movements and prevent conflicts?

- a) Blockchain
- b) GPS collars
- c) Solar panels
- d) Drones for pesticide spraying

****Answer**:** b) GPS collars

14. Which of these is an example of a non-lethal mitigation method?

- 15. a) Poisoning
- b) Electric fencing
- c) Trapping
- d) Shooting

****Answer**:** b) Electric fencing

15. Which factor makes urban areas prone to conflicts with leopards?

- a) High-rise buildings

- b) Waste management issues attracting prey
- c) Air pollution
- d) Traffic congestion

****Answer**:** b) Waste management issues attracting prey

16. What is "habitat enrichment"?

- a) Restoring degraded habitats to support wildlife
- b) Converting forests into farmlands
- c) Building highways through forests
- d) Introducing invasive species

****Answer**:** a) Restoring degraded habitats to support wildlife

17. Which country reports frequent polar bear-human conflicts?

- a) Canada
- b) Brazil
- c) Australia
- d) South Africa

****Answer**:** a) Canada

18. Which of these is a social impact of human-wildlife conflicts?

- a) Soil erosion
- b) Psychological trauma in communities
- c) Ozone depletion
- d) Coral bleaching

****Answer**:** b) Psychological trauma in communities

19. What role do "buffer zones" play in conflict mitigation?

- a) Separate human settlements from core wildlife habitats
- b) Promote industrial development
- c) Encourage deforestation
- d) Increase hunting quotas

****Answer**:** a) Separate human settlements from core wildlife habitats

20. Which Sustainable Development Goal (SDG) indirectly addresses human-wildlife conflicts?

- a) SDG 3 (Good Health)
- b) SDG 15 (Life on Land)
- c) SDG 7 (Affordable Energy)
- d) SDG 11 (Sustainable Cities)

****Answer**:** b) SDG 15 (Life on Land)

2. Causes of Conflict

Causes of Human-Wildlife Conflicts

Habitat Loss and Fragmentation are primary drivers of human-wildlife conflicts (HWC). As natural ecosystems shrink or break apart, wildlife is forced into closer contact with humans, triggering competition for resources and increased negative interactions.

1. **Habitat Loss** is the complete destruction or conversion of natural habitats (forests, grasslands, wetlands) into human-dominated landscapes. This is caused due to **agricultural expansion** of farmland for crops or livestock that replaces forests and grasslands. For example: In Kenya, 70% of elephant corridors have been lost to agriculture, forcing elephants to raid crops. **Urbanization** causes cities and settlements to encroach on wildlife territories. For example: Bengaluru (India) saw leopards entering residential areas due to shrinking forests. **Deforestation** for timber or fuelwood removes critical wildlife habitats. **Mining and extraction** industries destroy habitats (e.g., coal mining in Borneo displacing orangutans). **Climate Change** due to rising temperatures and sea levels degrade habitats (e.g., polar bears losing Arctic ice).
2. **Habitat Fragmentation** is the division of contiguous habitats into smaller, isolated patches due to human infrastructure or land-use changes. This is caused due to **roads and railways** that create barriers that split habitats and block animal movement. Example: Tigers in India avoid crossing highways, leading to genetic isolation. **Dams and Canals** fragment riverine ecosystems (e.g., gharials in Nepal's rivers). **Fences and Borders**, man-made barriers (e.g., veterinary fences in Botswana disrupt wildebeest migrations). **Industrial Plantations** like monoculture crops (palm oil, tea) fragment forests.
3. **Agricultural expansion and practices** are among the leading causes of human-wildlife conflict (HWC) globally and in India. As farming encroaches into natural habitats, it disrupts ecosystems, displaces wildlife, and forces animals into competition with humans for resources.
 - a) **Deforestation for Cropland:** Forests, grasslands, and wetlands are cleared to create farmland, destroying critical habitats and displacing wildlife. This results in loss of Corridors- Traditional wildlife migration routes are blocked by farms, forcing animals to traverse human-dominated landscapes. Example: In North Bengal (West Bengal), tea estates and paddy fields have fragmented elephant corridors between the Buxa Tiger



Roadways through Forest



Teesta Dam



Agricultural field



Human settlement



Railway through Duars

Reserve and Bhutan. Elephants now raid crops and villages while moving between isolated forest patches. Reduced Wild Prey like deer and wild boars pushes predators (e.g., tigers, leopards) to target livestock.

- b) **Monoculture Plantations:** Large-scale plantations (e.g., tea, coffee, oil palm, sugarcane) replace biodiverse ecosystems with single-crop systems. This results in loss of forage for animals like elephants and monkeys in the native vegetation, driving them to raid crops. Example, In Kerala's Wayanad district, elephants raid banana and coconut

plantations after native forests were replaced with cash crops. Chemical Pesticides and fertilizers pollute water sources, harming both wildlife and humans.

- c) **Encroachment into Protected Areas:** Farmers cultivate land up to the edges of national parks, sanctuaries, and buffer zones. This results in direct Encounters with Wildlife like rhinos (Kaziranga, Assam) and tigers (Sundarbans, West Bengal) stray into farms adjacent to protected areas and Edge Effects where Farmland creates "ecological traps" where animals face higher risks of poaching, roadkill, or retaliation.
- d) **Farming in Wildlife Corridors:** Marginal lands along rivers, hillsides, or seasonal migration paths are converted to agriculture. This results in blocked movement of elephants in the Terai Arc (Uttarakhand-Uttar Pradesh) clash with farmers cultivating crops in their ancient migratory routes. Increased Mortality being seen among animals like leopards in Maharashtra's Nashik district are killed while crossing farms to reach fragmented habitats.
- e) **Cultivation in Floodplains and Riverine Zones:** Fertile floodplains of rivers (e.g., Brahmaputra, Ganges) are intensively farmed, displacing species adapted to these ecosystems. This results in aquatic species decline like Fish-eating birds (e.g., herons) and reptiles (e.g., gharials) lose feeding grounds. Conflict with mega herbivores, Rhinos in Assam's Brahmaputra floodplains raid rice fields after losing grasslands to farming.
- f) **Crop Selection and Attractiveness to Wildlife:**
 - High-Nutrient Crops like sugarcane, maize, and rice are calorie-rich and attract wildlife. This results in crop raiding like wild boars, elephants, and monkeys target these crops, leading to economic losses. Example: In Tamil Nadu, wild boars destroy up to 30% of seasonal crops in districts bordering forests. Seasonal Conflict Peaks: Conflict escalates during harvest seasons when animals are drawn to ripe crops.
 - Fruit Orchards and Plantations: Fruit-bearing trees (e.g., mango, jackfruit) planted near forests lure primates and birds. This results in monkey menace, Rhesus macaques and langurs raid orchards in Himachal Pradesh and Uttarakhand, damaging crops.

4. Resource Competition and Alteration

- a) *Water Diversion for Irrigation:* Canals, borewells, and dams divert water from rivers and wetlands to irrigate farms results in drying waterholes, herbivores like deer and elephants are forced to approach human settlements for water. Example: In Karnataka's Bandipur Tiger Reserve, farmers and tigers compete for water from the same reservoirs.

- b) *Overgrazing by Livestock*: Expansion of grazing land reduces vegetation cover for wild herbivores. This results in predator shift, with fewer wild prey, carnivores like leopards and wolves attack livestock.

Example: In Gujarat's Gir Forest, lions increasingly prey on cattle due to declining populations of native ungulates.

5. Indirect Drivers Linked to Agriculture

- a) *Population Pressure*: Rural communities depend on farming for livelihoods, driving demand for more land. Example: West Bengal's agricultural land expanded by 18% between 1990–2020, encroaching into elephant habitats in Alipurduar and Jalpaiguri.
- b) *Government Policies*: Subsidies for water-intensive crops (e.g., rice, wheat) and irrigation infrastructure incentivize farming in ecologically fragile zones.
- c) *Climate Change*: Erratic rainfall and droughts push farmers to cultivate new areas, including forests. Example: In Odisha's Similipal Tiger Reserve, droughts have driven farmers to grow crops in core tiger habitats.

6. Urbanization is a major driver of human-wildlife conflict because it leads to the expansion of cities and towns into natural habitats. As urban areas grow, forests, grasslands, and other wildlife habitats are cleared to make way for housing, infrastructure, and industry. This has several effects:

- a) *Habitat Loss*: Wildlife lose their natural homes and are forced into smaller, fragmented areas where food and shelter are scarce.
- b) *Encroachment*: Humans begin living closer to wild animals, increasing the chances of direct encounters and conflict.
- c) *Competition for Resources*: Animals may venture into urban areas in search of food and water, leading to crop damage, attacks on livestock, or even human injuries.
- d) *Disruption of Migration Paths*: Urban development can block traditional animal migration routes, causing stress and disorientation among wildlife.
- e) *Attraction to Urban Waste*: Improper garbage disposal in cities attracts animals like monkeys, bears, or leopards, leading to frequent and sometimes dangerous interactions.

7. Poaching and illegal wildlife trade are significant contributors to human-wildlife conflict because they disrupt natural ecosystems and provoke dangerous interactions between humans and animals.

- a) *Disruption of Animal Populations:* Poaching targets specific species—like elephants for ivory or tigers for skins—which upsets the balance of ecosystems. When predators or key species are removed, other animal populations can grow uncontrollably or behave differently, increasing encounters with humans.
- b) *Increased Aggression and Fear:* Animals that have been hunted often become more aggressive or fearful of humans, leading to defensive attacks when they encounter people.
- c) *Retaliatory Killings:* When poaching incidents harm people or property, communities may retaliate by killing animals indiscriminately, further escalating the conflict.
- d) *Habitat Insecurity:* Poaching often involves entering protected or remote areas, disturbing animals and forcing them to move closer to human settlements where they feel threatened or stressed.
- e) *Fueling Black Markets:* The illegal wildlife trade creates financial incentives for more poaching, which increases pressure on endangered species and the likelihood of human-wildlife confrontations.

Case Study: North Bengal, West Bengal

Context: Tea estates, paddy fields, and settlements have fragmented forests in the Himalayan foothills.

Conflict Dynamics: Elephants: Herds raid crops (maize, bananas) while moving between the Buxa Tiger Reserve and Bhutan.

Leopards: Attack livestock and humans in villages near tea gardens.

Wild Boars: Destroy potato and vegetable crops in the Terai region.

Scale: Over 100 human deaths and 50+ elephant deaths annually due to conflicts (2022 data).

Reasons of human-wildlife conflict:

https://youtu.be/VCfb0dgq_b8?si=nxrA8Ewy62RKR5Iw

Man-Animal Conflict Mitigation Techniques

Fencing, Trenches, and Barriers: These are physical deterrents designed to restrict the movement of wild animals into human settlements, crop fields, or livestock grazing areas. They form the first line of defense in areas prone to frequent wildlife intrusions.

Types

1. Fencing

a. Electric Fencing

- Low-voltage, solar-powered fences are widely used to deter elephants, wild boars, and even big cats.
- Delivers a mild shock that is enough to scare but not harm.
- Usually installed around crop fields and forest peripheries.

Advantages: Eco-friendly, reusable, and effective.

Limitations: High initial cost; animals may learn to break weak points; needs regular maintenance.

b. Chain-Link or Barbed Wire Fences

- Useful against smaller herbivores like deer or nilgai.
- Common in buffer zones near forests or sanctuaries.

Limitations: Can injure animals and become ineffective if broken.

c. Stone or Concrete Walls

- Effective against predators like leopards or tigers in hilly or semi-urban areas.
- Often built around human habitations near forests.

Limitations: Expensive and not suitable in flood-prone zones.



Trenches

a. Elephant Trenches

- Deep (about 6–8 feet) and wide (up to 10 feet) to prevent elephants from crossing into farms.
- Dug along forest boundaries.
- Sometimes lined with stones or reinforced with concrete in erosion-prone areas.

- **Natural Appearance:** Blends with the environment and does not harm animals.

Challenges: Trench walls may collapse in rainy seasons; maintenance-intensive.



b. **Moats**

- Used near protected reserves or zoos.
- Water-filled or dry depending on terrain and species.

Case Study: Elephant Trenches and Solar Fencing in North Bengal (Dooars Region)

Location: Villages bordering the Gorumara National Park and Chapramari Wildlife Sanctuary, Jalpaiguri and Alipurduar districts, North Bengal. The Dooars region in North Bengal is one of the most conflict-prone zones in India for human-elephant interactions. Due to shrinking forest cover and fragmentation of elephant corridors, elephants frequently raid paddy fields, destroy homes, and sometimes cause human fatalities. These conflicts are most intense during the harvesting season.

Problem:

- Frequent crop raiding by wild elephants at night.
- Loss of human lives, homes, and agricultural income.
- Retaliatory attacks by villagers endangered both human and elephant lives.
- Traditional deterrents (firecrackers, beating drums) were no longer effective.

Intervention: The West Bengal Forest Department, in collaboration with WWF India and local community-based organizations, implemented the following:

- Installed **Solar-Powered Electric Fencing** around vulnerable farmlands. Powered by solar panels to ensure reliability in remote areas. Carried low-voltage current to repel but not injure elephants.
- Dug **Elephant Trenches** strategically along the periphery of villages close to forest edges. Trenches were about 6 feet deep and 8–10 feet wide. Served as a physical barrier preventing elephant entry during the night.
- **Community Watch Groups (Hula Parties):** Trained local youth to monitor elephant movements and activate alarms. Used flashlights, loud sounds, and coordinated response to redirect herds.

- Often accompanied by fences for added protection.

3. **Bio-fencing (Natural Barriers)**

- Using dense thorny bushes or cactus plants as live fences.
- Examples: Agave, Euphorbia, bamboo hedges.
- Eco-friendly and cost-effective in long run.

Benefit: Encourages biodiversity and prevents soil erosion.

Early Warning Systems

Early Warning Systems (EWS) are proactive, alert-based methods that help in predicting and informing communities about the approach or presence of wild animals—particularly large or dangerous species like elephants, leopards, or bears—before a conflict occurs.

Purpose:

- To alert communities in advance to take safety precautions.
- To minimize surprise encounters, especially at night or during seasonal migrations.
- To reduce human and animal casualties, crop damage, and property loss.

Components of Early Warning Systems:

a) Technological Systems:

1. **GPS Radio Collars:**
 - Placed on specific wild animals (e.g., elephants or tigers).
 - Sends real-time location data to forest officials.
 - When animals approach human settlements, automated SMS alerts are sent to villagers.
 - Example: Implemented in the forest ranges of North Bengal and parts of Karnataka.
2. **Camera Traps and Motion Sensors:**
 - Installed along forest boundaries or animal movement routes.
 - Detects movement and triggers alarm systems or flashes.
 - Useful in night-time intrusions.
3. **Tripwire-Linked Alarms:**
 - Thin wires installed across likely animal paths.
 - When an animal walks through, it triggers a siren or warning light.
 - Widely used in crop fields in Odisha and Chhattisgarh.

4. Mobile Apps and SMS Alerts:

- Apps developed by forest departments (e.g., "Gajraj" app in Assam).
- Provide live updates of animal movements.
- Allows community members to report sightings in real time.

b) Traditional/Manual Systems:

1. Community Watch Teams (Hula Parties):

- Trained villagers monitor forests, especially during crop seasons or full moon nights.
- Use torches, drums, whistles, and firecrackers to alert and drive away animals.
- Still very effective in regions with limited access to technology.

2. Watch Towers and Lookout Posts:

- Built at strategic high points near forests or fields.
- Equipped with spotlights and loudspeakers.
- Help in early visual detection of approaching herds or predators.

Advantages:

Prevention-focused: Avoids conflict rather than responding after damage.

Reduces panic and encourages calm, informed action.

Protects both humans and animals, avoiding retaliatory violence.

Cost-effective in the long run, especially if combined with community involvement.

Challenges:

Initial investment in technology (GPS collars, sensors) is high.

Requires regular maintenance and monitoring.

Technical training needed for local communities to use apps or devices.

Limited internet or network access in remote forest-edge villages can delay alerts.

Case Example – West Bengal (North Bengal Region):

In parts of Jalpaiguri and Alipurduar, forest departments deployed GPS-collared elephants and sent SMS alerts to villagers when they moved close to human habitation.

Volunteer groups and village youth formed night patrol teams, combining traditional methods with digital alerts.

Resulted in timely evacuation of fields, protection of life, and a drop in crop raids.

Compensation Schemes

Compensation schemes are financial or material reimbursements provided by the government or authorized agencies to people who suffer losses due to wildlife-related incidents, such as Crop damage, Livestock depredation, Property damage, Human injury or death.

These schemes aim to reduce negative attitudes toward wildlife and discourage retaliatory killings:

- To provide economic relief to affected individuals or families.
- To promote coexistence between humans and wildlife.
- To build trust between forest authorities and local communities.
- To act as a non-lethal response to conflict situations.

Types of Compensation:

a) Crop Damage Compensation

Provided when wild animals (like elephants, wild boars, deer, or monkeys) destroy standing crops. Amount depends on:

- Type of crop (paddy, maize, sugarcane, etc.)
- Area affected (in hectares or square meters)
- Assessment by forest officials or revenue officers.

Challenges:

- Accurate damage assessment.
- Delays in processing.
- Lack of awareness of claim procedures.

b) Livestock Loss Compensation

For loss of cattle, goats, sheep, poultry, etc., due to predation by leopards, tigers, wolves, etc. Often includes payment for:

- Full market value of the animal.
- Veterinary support for injured animals.
- In some cases, the forest department offers insurance-linked coverage.

c) Property Damage Compensation

- For destruction of homes, fences, huts, or storage units caused by elephants, bears, etc.
- Includes compensation for partial or complete damage.

- May include temporary shelter support in tribal areas.

d) Human Injury or Death Compensation

- Highest priority category.
- Compensation for:
 - Fatal attacks (fixed amount, often ₹5 to ₹10 lakhs).
 - Permanent disability.
 - Temporary injury (hospital bills, rehabilitation).
- Offered by both state forest departments and disaster relief funds in some cases.

Case Example – West Bengal:

In conflict-prone districts like Alipurduar, Jalpaiguri, and Darjeeling, the Forest Department offers:

- Up to ₹1 lakh for livestock loss by tigers or leopards.
- ₹5000 to ₹25,000 for minor crop damage.
- ₹10 lakh for human death due to elephant attacks.
- Awareness campaigns were conducted in North Bengal to help villagers register claims on time.

Impact of Compensation Schemes:

Benefit	Outcome
Reduces retaliation	Fewer cases of animals being killed in revenge
Builds trust	Better cooperation between villagers and forest staff
Economic security	Reduces the financial burden on marginalized communities
Conservation support	Encourages tolerance and understanding of wildlife needs

Challenges:

- Delayed or underpaid compensation can lead to dissatisfaction.
- Corruption or bias in damage assessment.
- Illiteracy and lack of documentation hinder claim processing.
- Exclusion of certain animals (e.g., monkeys, porcupines) from compensation lists in some states.

Suggestions for Improvement:

- Use of mobile apps and digital platforms for fast claim registration.
- Simplify claim procedures and increase community awareness.
- Include all conflict-prone species under eligible categories.
- Encourage insurance-based models with government support.
- Establish independent grievance redressal cells at the village level.

Compensation schemes are a vital social safeguard in human-wildlife conflict zones. When executed transparently and efficiently, they promote empathy, reduce hostility, and create a foundation for peaceful coexistence between rural communities and wildlife.

Habitat Management

Habitat management involves improving, restoring, or conserving natural wildlife habitats so that wild animals get adequate resources—such as food, water, shelter—within forest areas, thus reducing their need to venture into human settlements.

Purpose:

- To minimize wildlife movement into villages and farmlands.
- To maintain ecological balance and protect natural prey and plant species.
- To prevent habitat degradation due to deforestation, mining, and encroachment.
- To sustain long-term coexistence by addressing the root cause of conflict.



Strategies in Habitat Management:

a) Restoration of Water Sources

- Construction or revival of:
 - Waterholes, check dams, and artificial ponds within forests.
 - Salt licks to attract herbivores inward.
- Particularly effective for species like elephants, gaur, and deer during dry seasons.
- Prevents animals from entering human areas in search of water.



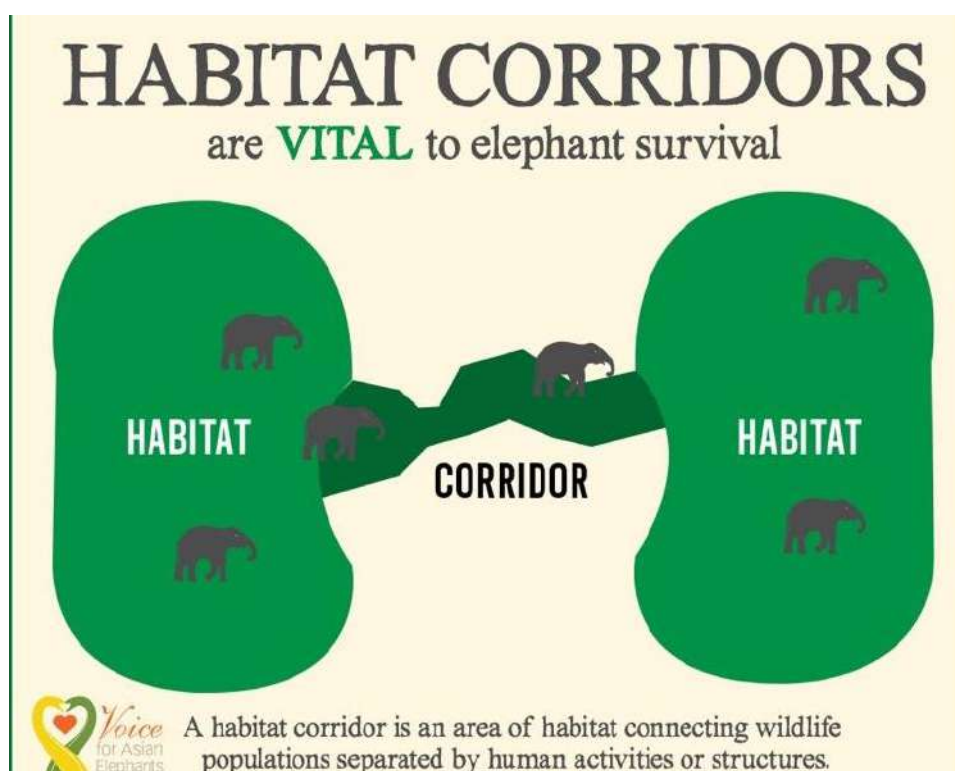
Removal of weed and invasive species

b) Food Availability Enhancement

- Plantation of fruit- and fodder-bearing trees (e.g., bamboo, jackfruit, ficus) inside degraded forests.
- Promotion of grasslands and meadows for herbivores like deer, sambhar, and elephants.
- In tiger reserves, focus on restoring prey populations to reduce livestock predation.

c) Protection and Restoration of Wildlife Corridors

- Corridors are natural pathways used by animals to migrate between forest patches.
- Due to urbanization and infrastructure (roads, railways), many corridors are blocked or degraded.
- Habitat management includes:
 - Demarcating and protecting corridors from human activity.
 - Creating wildlife overpasses or underpasses along highways and rail tracks.
 - Relocating villages from key corridors with adequate compensation and rehabilitation.



d) Invasive Species Management

- Removal of non-native plants like Lantana camara or Eupatorium, which choke native vegetation.
- These invasive species reduce fodder availability for herbivores and force them out of forests.

e) Minimizing Human Pressure on Forests

- Encourage use of alternative fuels (e.g., LPG, biogas) to reduce firewood collection.

- Develop eco-development programs that offer income options outside the forest (handicrafts, tourism).
- Controlled grazing zones and stall-feeding methods for livestock near forest edges.

f) Habitat Zoning

- Dividing the forest landscape into:
 - Core Zones: Strictly protected, no human activity allowed.
 - Buffer Zones: Limited, regulated community use.
 - Transition Zones: Promote sustainable development with community involvement.
- Helps balance conservation and livelihoods.

Case Example – Buxa Tiger Reserve, North Bengal:

Forest officials restored old salt licks and grasslands in the Chilapata forest.

This improved habitat for elephants and herbivores, reducing their crop raids in nearby villages.

Local NGOs involved in replanting native species and monitoring wildlife use of restored zones.

Benefits of Habitat Management:

Aspect	Impact
Ecological	Restores food chains, improves biodiversity
Social	Reduces dependency on forests, promotes coexistence
Economic	Saves crop loss, reduces compensation costs
Conflict Reduction	Decreases animal movement into human areas

Challenges:

- Encroachment and illegal logging in forest zones.
- Difficulty in relocating villages from critical habitats.
- Climate change impacts such as drought or floods reducing resource availability.
- Coordination issues among government departments and local communities.

Recommendations:

- Long-term monitoring of habitat use by wildlife using camera traps, drone surveys.
- Participatory forest management involving local communities.

- Integration of habitat management into state and national forest policies.
- Encourage eco-restoration projects under MGNREGA or CSR programs.

Habitat management addresses the root cause of many human-wildlife conflicts by ensuring that animals can survive within forest boundaries without encroaching upon human spaces. When combined with community participation and sustainable development, it becomes a powerful tool for long-term conservation and coexistence.

Relocation of Problem Animals

Relocation (or translocation) of problem animals refers to the capture and transfer of individual wild animals that repeatedly enter human habitations, attack livestock or humans, or cause persistent damage—to deeper forest zones or protected areas away from human settlements.

Purpose:

- To protect human lives and property from repeated attacks.
- To minimize retaliation or killing of wild animals by angry locals.
- To safeguard the animal by moving it to a more suitable and undisturbed habitat.
- To break the cycle of conflict by removing a known offender.

Relocation is considered only when:

- An animal habitually strays into villages despite deterrents.
- It has attacked or killed livestock or humans multiple times.
- Non-lethal mitigation (like fencing or alarms) has failed.
- The animal is injured, orphaned, or isolated.
- It poses an immediate threat to public safety.

Species Commonly Relocated:

- Elephants (individual bulls or herds)
- Leopards and tigers (particularly if they enter towns or hunt livestock)
- Bears (sloth bears in Central India, Himalayan black bears in North India)
- Crocodiles or snakes (from water bodies in populated areas)

Success Stories – North Bengal Example:

In Darjeeling and Kalimpong, leopards entering tea gardens and towns have been successfully tranquilized and released deep inside Mahananda Wildlife Sanctuary.

Elephants causing damage in Alipurduar district have been tranquilized and shifted to Buxa Tiger Reserve.

Advantages of Relocation:

Benefit	Explanation
Saves human and animal lives	Reduces chances of lethal encounters
Builds public support	Shows government's action to protect communities
Preserves endangered species	Avoids unnecessary killing of protected wildlife
Useful in emergencies	Quick solution in case of urban animal entry

Challenges:

- Homelessness and Disorientation:
- Animals often try to return to their original territory.
- May fail to adapt to the new area or conflict with resident wildlife.
- Stress and Injury During Capture:
- Relocation can cause high stress to animals, affecting survival chances.
- Improper handling can lead to injuries or death.
- Genetic and Ecological Imbalance:
- Moving animals between regions can disturb local population dynamics.
- Risk of disease transmission to native wildlife.

Alternatives to Relocation:

- Habitat improvement to keep animals within forest.
- Eco-friendly deterrents like beehive fences or chili rope.
- Community awareness and coexistence models.
- Captive care in extreme cases (only if release is not possible).

Relocation of problem animals is a critical but complex tool in wildlife conflict mitigation. When done scientifically, ethically, and sparingly, it can save lives—both human and animal. However, it is not a permanent solution and should always be accompanied by habitat management, community participation, and landscape-level planning.

Eco-Friendly Deterrents

Eco-friendly deterrents are non-lethal, nature-based, and community-friendly methods designed to discourage wild animals from entering human habitats or farmlands—without harming the animals or the environment.

These deterrents are often low-cost, sustainable, and locally adaptable, making them highly effective in rural and forest-fringe communities.

Purpose:

- To repel or discourage wild animals from intruding into farms and villages.
- To avoid direct confrontation or injury to humans and animals.
- To promote coexistence by reducing conflict without resorting to force or violence.
- To encourage community-driven conflict management.

Types of Eco-Friendly Deterrents:

A. For Elephants

1. Chili Rope Fences

- Ropes soaked in a mixture of crushed chili, engine oil, and grease are strung along the farm perimeter.
- The smell and irritation caused by chili deters elephants from crossing.
- Locally made, low-cost, and biodegradable.

2. Beehive Fences

- Beehives are suspended along fences around fields.
- Elephants fear bees, particularly in sensitive areas like the eyes and trunk.
- Disturbing the fence triggers bee swarms, naturally driving elephants away.
- Also promotes honey production for livelihood.



3. Thunder Flashes and Crackers (Eco-Safe Types)

- Sound-based deterrents that create loud booms and flashes to scare elephants.
- Now used in eco-safe formats (less pollution, less fire hazard).
- Often used by trained forest staff or community patrols.

B. For Carnivores (Leopards, Tigers, Wolves)

4. Livestock Protection Measures

- Predator-proof livestock pens with strong fencing and roofing for night shelter.
- Use of community herders and trained guard animals (like dogs).
- Pens made with bamboo, mesh wire, or recycled material.

5. Motion-Activated Lights or Sounds

- Solar-powered lights or sirens that activate when motion is detected.
- Startles animals like leopards or jackals.
- Can be combined with flashlights and reflectors.

C. For Herbivores (Wild Boar, Deer, Nilgai, Monkeys)

6. Reflective Ribbons or CDs

- Old CDs or metallic tape hung along field edges shimmer in sunlight and scare off animals.
- Movement and reflections create visual disturbance.
- Works best for birds and small herbivores.

7. Solar-Powered Buzzers or Radios

- Emit intermittent noise that simulates human presence.
- Effective for wild pigs and nilgai in certain regions.

8. Bio-Fencing with Thorny or Bitter Plants

- Dense hedges of agave, cactus, bamboo, or euphorbia planted along fields.
- Act as living fences—difficult to cross and unpalatable to animals.
- Helps with soil retention and biodiversity, too.

Advantages of Eco-Friendly Deterrents:

Benefit	Explanation
Non-lethal and humane	Do not harm animals physically or emotionally

Benefit	Explanation
Low-cost and replicable	Affordable for small farmers and tribal communities
Environmentally safe	No chemical or long-term ecological harm
Builds community participation	Encourages self-reliance and ownership in mitigation
Additional income opportunities	(e.g., honey from beehive fences, bamboo from bio-fencing)

Challenges:

- Effectiveness may reduce if used without rotation or change.
- Animals can adapt over time to certain fixed deterrents.
- Needs regular maintenance and community discipline.
- Requires training and awareness for proper use.

Suggestions for Improvement:

- Combine multiple deterrents to keep animals uncertain and cautious.
- Include women and youth groups in preparation and monitoring.
- Provide financial and technical support from forest departments or NGOs.
- Integrate with early warning systems and compensation schemes.

Eco-friendly deterrents are a practical, ethical, and community-centered solution to man-animal conflict. When adopted creatively and supported institutionally, they build resilience among forest-edge communities and foster harmonious coexistence with wildlife.

Community Awareness and Training

Community awareness and training involve educating, informing, and empowering local people—especially those living near forests—to understand wildlife behavior, adopt preventive measures, and respond safely and responsibly during man-animal conflict situations.

Purpose:

To reduce panic and fear during wildlife encounters.

To prevent aggressive or retaliatory responses against animals.

To promote coexistence by changing perceptions and attitudes toward wildlife.

To ensure early detection, safe intervention, and timely reporting of conflict incidents.

To create informed, proactive communities who can collaborate with forest authorities.

Focus Areas of Community Awareness and Training:

A. Understanding Wildlife Behavior

Educating locals on

- Animal movement patterns (seasonal, nocturnal behavior).
- Territorial instincts and warning signs (e.g., elephant rumble, bear growl)
- Non-aggressive ways to respond to animal sightings
- Helps people distinguish between threatening and non-threatening behavior.



B. Safe Practices in Conflict Zones

- Do's and Don'ts during animal encounters:
- Do not chase or surround wild animals.
- Do not feed or provoke wildlife.
- Avoid moving alone at night near forest edges.
- Keep livestock secured at night.
- Promoting group movement, using torches, and avoiding noise pollution in forests.

C. Training in Deterrent Use and Monitoring

Practical training on:

- How to set up and maintain chili fences, beehive fences, and bio-barriers.
- Using solar lights, alarms, and reflectors effectively.
- Operating community-based Early Warning Systems.
- Encourages local innovation using available resources.

D. Legal and Policy Awareness

- Educating people about:
- Wildlife Protection Act, 1972—what is legal and what is punishable.
- How to claim compensation for crop or livestock loss.
- Importance of protected areas and corridors.

- Helps reduce illegal trapping, poisoning, or habitat encroachment.

E. Emergency Response Training

- Formation and training of Rapid Response Teams or Hula Parties (volunteer youth groups).
- Providing basic first aid, reporting methods, and coordination with forest officials.
- Encouraging women's participation in night watch teams in tribal villages.

F. School and Youth Programs

- Including wildlife education in village schools through:
- Puppetry, street plays, wildlife films.
- Drawing competitions, storytelling, quizzes on local animals.
- Cultivates a culture of empathy and responsibility from an early age.

Approaches Used:

Method	Description
Street theatre and folk songs	Culturally relevant storytelling about animals and conflict
Poster campaigns and wall art	Easy to understand safety instructions in local languages
Audio-visual presentations	Wildlife behavior shown via documentaries or animations
Forest-village interaction meets	Dialogue between officials and villagers for mutual trust
Local champions or ambassadors	Influential villagers trained to spread awareness

Case Example – North Bengal:

In villages near Gorumara and Chapramari Wildlife Sanctuaries, NGOs and the Forest Department conducted awareness campaigns on:

- How to react during elephant raids.
- Safe livestock sheltering practices.
- Importance of reporting instead of retaliating.

Formed trained village squads that helped reduce panic and injury during conflict.

Impact of Community Awareness and Training:

Benefit	Outcome
Reduced panic	More organized, calm response during animal intrusions
Lower animal mortality	Fewer incidents of lynching, poisoning, or injury
Increased cooperation	Villagers report sightings, help monitor animal movements
Better use of compensation	More people file timely, correct claims
Cultural shift toward coexistence	Wildlife seen as part of community landscape

Challenges:

- Language and literacy barriers in tribal and remote regions.
- Skepticism or mistrust toward forest departments.
- Need for repeated sessions as seasonal migration and conflict patterns change.
- Limited funding and personnel for ongoing training.

Recommendations:

- Develop customized content in local languages using simple visuals.
- Engage local school teachers, women's groups, and village elders.
- Use mobile vans or community radio to reach remote areas.
- Integrate awareness into MGNREGA or CSR initiatives for wider reach.

Community awareness and training are foundational to conflict mitigation and conservation success. When communities are informed, equipped, and involved, they shift from being victims of conflict to protectors of both people and wildlife.

Zoning and Land Use Planning

Zoning and land use planning refer to the strategic allocation of land areas for specific purposes—such as conservation, agriculture, settlement, or industry—to ensure that human activities and wildlife habitats are properly separated or harmonized. This helps minimize overlap between human and animal space, thereby reducing conflict.

Purpose:

- To designate specific zones for wildlife, agriculture, human settlements, and development.
- To ensure safe corridors and buffer zones for wildlife movement.
- To prevent encroachments and fragmentation of forests.

- To facilitate sustainable land development in conflict-prone landscapes.

Zones in Wildlife-Land Use Planning:

Zone Type	Description
Core Zones	Strictly protected areas—no human activity allowed; includes national parks, sanctuaries.
Buffer Zones	Areas surrounding core zones—limited human activity allowed with conservation rules.
Eco-sensitive Zones (ESZs)	Transitional zones around protected areas—development activities are regulated.
Wildlife Corridors	Linear patches that connect core habitats—critical for migration and breeding.
Multiple Use Zones	Forest-fringe zones with regulated agriculture, grazing, or tourism.
No-Development Zones	Areas prone to frequent animal movement—development strictly restricted.

Planning Tools and Strategies:

A. Mapping and Monitoring

- Use of GIS (Geographic Information Systems) and satellite imagery to:
 - Identify animal migration paths and conflict hotspots.
 - Detect encroachments, deforestation, and land-use changes.
 - Helps planners make evidence-based zoning decisions.

B. Regulation of Land Use

- Prohibiting or strictly controlling:
 - Human settlement in wildlife corridors.
 - Agriculture with high-conflict crops (e.g., bananas, sugarcane near elephant habitats).
 - Quarrying, road construction, or industrial setups in sensitive zones.
- Promoting land use that complements conservation:
 - Agroforestry, silvopasture, and community woodlots near forests.

C. Relocation from High-Risk Zones

- Voluntary or incentivized relocation of villages located deep within protected forests.
Example: In Buxa Tiger Reserve (North Bengal), some hamlets were relocated to reduce human-tiger encounters.
- Compensation includes:
New homes, farmland, livelihood support, schools, and healthcare.
Helps both people (safer life) and wildlife (undisturbed habitat).



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D. Integration with Development Planning

- Ensuring wildlife considerations are included in:
- Urban and rural development masterplans
- Disaster management plans
- Irrigation and road infrastructure projects
- Example: Wildlife overpasses and underpasses on highways in tiger corridors (like NH-44 in Madhya Pradesh).

Case Study – West Bengal (North Bengal Region):

In Dooars and Terai zones, the Forest Department worked with local planners to:

- Identify elephant movement corridors between Buxa, Jaldapara, and Gorumara.
- Marked high-conflict villages and restricted crop types.
- Prevented new resorts and urbanization within 5 km of protected forests (Eco-Sensitive Zone notifications).
- Result: Fewer conflict incidents in managed areas and more informed land use policies.

Benefits of Zoning and Land Use Planning:

Benefit

Impact

Reduces habitat fragmentation Maintains healthy ecosystems and wildlife corridors

Benefit	Impact
Minimizes conflict zones	Limits overlap between human and wildlife spaces
Informs safe infrastructure	Prevents roads or industries from disrupting animal paths
Encourages smart agriculture	Promotes crops less attractive to wild animals
Supports long-term coexistence	Harmonizes development with conservation

Challenges:

- Pressure from population growth and development demands.
- Resistance from communities in relocation or land-use restrictions.
- Inadequate coordination between forest, revenue, and urban planning departments.
- Illegal land use (encroachments, mining) still occurs in sensitive areas.

Recommendations:

- Integrate zoning in district-level development plans and Gram Panchayat plans.
- Strengthen legal protection for corridors and eco-sensitive zones.
- Encourage community participation in land-use decisions.
- Provide incentives for conservation-compatible farming and construction.
- Develop cross-state corridor management plans, especially in regions like North Bengal-Assam.

Zoning and land use planning offer a landscape-level, long-term solution to human-wildlife conflict. When done inclusively and based on sound ecological data, it ensures both development and conservation can move forward together—protecting people, property, and wildlife for generations to come.



Mitigating Human-wildlife cc

Final Assessment

Format: Scenario-Based MCQs

Duration: 45 minutes

Total Marks: 25

Passing Score: 75%

Q1. Which of the following is a major cause of human-wildlife conflict?

- A) Biodiversity
- B) Habitat Loss
- C) Climate Adaptation
- D) Forest Plantations

Q2. A strip of land connecting two wildlife habitats is called:

- A) Buffer zone
- B) Wildlife corridor
- C) Core area
- D) Agro-patch

Q3. The act of killing wild animals in revenge is known as:

- A) Eco-defense
- B) Retaliatory Killing
- C) Poaching
- D) Habitat Restoration

Q4. Beehive fences are used to deter:

- A) Leopards
- B) Wild boars
- C) Elephants
- D) Birds

Q5. The Wildlife Protection Act was enacted in:

- A) 1972
- B) 1986
- C) 2006
- D) 1965

Q6. Which zone surrounds a protected area and permits limited human activity?

- A) Core Zone
- B) Refuge Area

- C) Buffer Zone
- D) Conflict Zone

Q7. What does an Early Warning System (EWS) do?

- A) Tracks rainfall
- B) Monitors crops
- C) Alerts about approaching animals
- D) Identifies poachers

Q8. Conflict species are those that:

- A) Are extinct
- B) Are invasive
- C) Often interact negatively with humans
- D) Are protected fully

Q9. Which of these is a non-lethal deterrent?

- A) Poison bait
- B) Firearm
- C) Chili fence
- D) Tranquilizer dart

Q10. Human-animal interface refers to:

- A) Internet-based wildlife monitoring
- B) Places where humans and animals interact
- C) Technology used in animal tagging
- D) Protected bird nesting zones

Q11. A trench dug to prevent elephants from entering villages is called:

- A) Elephant barrier
- B) Earth wall
- C) Electric moat
- D) Elephant proof trench

Q12. A GPS collar helps in:

- A) Reproduction of wildlife
- B) Monitoring animal movements
- C) Legal animal trade
- D) Tree planting

Q13. Wildlife corridors are essential for:

- A) Trapping animals

- B) Eco-tourism
- C) Animal migration
- D) Preventing rainfall loss

Q14. Which species is commonly involved in crop-raiding in North Bengal?

- A) Tigers
- B) Sloth bears
- C) Elephants
- D) Peacocks

Q15. What type of planning divides land for specific uses to reduce conflict?

- A) Urban zoning
- B) Land fragmentation
- C) Zoning and land use planning
- D) Population planning

Q16. Bio-fencing involves:

- A) DNA tracing of wildlife
- B) Using natural plants as fences
- C) Computer tracking of animals
- D) Artificial laser barriers

Q17. An Eco-Sensitive Zone (ESZ):

- A) Allows full-scale farming
- B) Surrounds protected areas with development restrictions
- C) Is inside national parks
- D) Encourages mining

Q18. Which committee supports eco-livelihoods in fringe villages?

- A) Village Council
- B) Biodiversity Board
- C) Eco-Development Committee
- D) Panchayat

Q19. A man-animal conflict hotspot is:

- A) A conflict-free zone
- B) A frequently disturbed area
- C) A wildlife sanctuary
- D) Any agricultural zone

Q20. Human encroachment leads to:

- A) Better tourism
- B) Habitat loss and conflict
- C) Increased forest cover
- D) Wildlife breeding

Q21. Which of the following is a sustainable farming approach in conflict zones?

- A) Slash-and-burn
- B) Mono-cropping
- C) Agroforestry
- D) Industrial farming

Q22. Compensation schemes are meant to:

- A) Reward hunters
- B) Encourage poaching
- C) Provide relief for damage caused by wildlife
- D) Fund zoo construction

Q23. What is the primary goal of conflict mitigation?

- A) Animal domestication
- B) Preventing legal cases
- C) Reducing negative human-wildlife interactions
- D) Increasing tourism revenue

Q24. Conflict Mapping is useful to:

- A) Erase forest boundaries
- B) Set up industries
- C) Identify conflict-prone zones
- D) Build water bodies

Q25. Which of the following best describes coexistence?

- A) Human dominance over nature
- B) Elimination of wildlife
- C) Mutual tolerance and shared space with wildlife
- D) Legalizing hunting

Answer keys

1	B
2	B

3	B
4	C
5	A
6	C
7	C
8	C
9	C
10	B
11	D
12	B
13	C
14	C
15	C
16	B
17	B
18	C
19	B
20	B
21	C
22	C
23	C
24	C
25	C

Glossary of Terms

1. Human-Wildlife Conflict (HWC)

Interaction between humans and wild animals that leads to negative impacts on either side—such as injury, death, crop or livestock loss, or animal displacement.

2. Conflict Species

Wild animals that are frequently involved in conflict situations with humans.

Examples: elephants, leopards, tigers, wild boars, bears, monkeys.

3. Crop Raiding

Destruction or consumption of cultivated crops by wild animals, leading to economic losses for farmers.

4. Livestock Predation

Killing of domestic animals (like goats, cattle, or poultry) by wild carnivores such as leopards or wolves.

5. Habitat Fragmentation

Breaking up of continuous natural habitats into smaller, isolated patches due to human activities like roads, farming, or construction.

6. Wildlife Corridor

A strip of natural habitat that connects two or more larger wildlife areas, allowing animals to move and migrate safely.

7. Buffer Zone

An area surrounding a protected forest or reserve where limited human activity is permitted to reduce pressure on the core area.

8. Core Zone

The innermost, strictly protected area of a national park or sanctuary where no human activity is allowed.

9. Eco-Sensitive Zone (ESZ)

A notified area around protected forests or sanctuaries where development is regulated to minimize negative impacts on wildlife.

10. Bio-Fencing

Use of natural plants (like cactus, bamboo, agave) as living fences to block or discourage wild animals from entering human areas.

11. Early Warning System (EWS)

Technology or community-based tools that alert villagers about approaching wild animals (like elephants or leopards), allowing timely preventive action.

12. Radio Collar / GPS Collar

A device placed on wild animals that tracks their movements using satellites, often used in monitoring and EWS.

13. Compensation Scheme

Government program that reimburses people for loss of crops, livestock, property, or life due to wildlife attacks.

14. Relocation (of Animals)

The capture and transfer of a conflict-causing animal to a safer forest area or rescue center to prevent future conflict.

15. Zoning

Dividing land into specific areas (e.g., core, buffer, agriculture) to regulate land use and reduce human-wildlife conflict.

16. Hula Party / Rapid Response Team (RRT)

A village-level group, often trained, that patrols at night and helps chase away or report wild animals during conflict situations.

17. Deterrent

A method or object used to scare or prevent wild animals from entering a particular area. Examples: chili fences, beehive fences, loud sounds, lights.

18. Man-Animal Interface

The zone where human activities and wildlife habitats overlap, often leading to conflict.

19. Habitat Degradation

Loss of the quality or availability of natural habitat due to pollution, deforestation, or overuse.

20. Coexistence

A conservation goal where humans and wild animals share the landscape with minimal conflict, through mutual respect and sustainable practices.

21. Conflict Hotspot

A geographic location where frequent or severe HWC incidents occur over time. These are priority areas for mitigation interventions.

22. Carrying Capacity

The maximum number of individuals (animals or humans) that an ecosystem can sustainably support without degradation.

23. Human Encroachment

Illegal or unregulated expansion of human settlements, agriculture, or industry into designated forest or wildlife areas.

24. Landscape-Level Planning

An approach that considers the entire habitat mosaic (villages, forests, corridors) to plan for coexistence and connectivity.

25. Participatory Forest Management (PFM)

Involves local communities in the planning, protection, and sustainable use of forests, aiming to reduce pressure and promote stewardship.

26. Translocation (of Communities)

Moving entire villages or households out of core wildlife zones to reduce conflict and enable forest regeneration—done voluntarily and with compensation.

27. Retaliatory Killing

When villagers kill wild animals (e.g., by poisoning, trapping, or shooting) in revenge for loss of crops, livestock, or life.

28. Agroforestry

A sustainable land use system where trees and crops/livestock are grown together—used as a buffer land-use in HWC zones.

29. Landscape Fragmentation

Breaking up of large, continuous ecosystems into isolated patches, making it hard for wildlife to migrate or find food.

30. Wildlife-Friendly Farming

Agricultural practices designed to reduce crop loss and attract less conflict-prone species, like switching to chili or ginger in elephant areas.

31. Rapid Assessment Survey

A short-term, quick data collection method used in conflict zones to gather facts on species, damage, and community impact.

32. Human Casualty Protocol

Standard procedures followed when a human is injured or killed by wildlife, including reporting, medical aid, and compensation.

33. Ex-Gratia Payment

A government relief payment (outside of legal obligation) provided to victims or families affected by wildlife conflict.

34. Rescue and Rehabilitation Centre

Facilities where injured, orphaned, or conflict-prone animals are treated, observed, and either released or kept in permanent care.

35. Wildlife Conflict Mitigation Plan (WCMP)

A formal document outlining prevention, preparedness, and response strategies for conflict-prone areas—prepared by forest departments or conservation agencies.

36. Sentinel Species

Species like elephants or leopards that, when in conflict, signal broader ecological imbalances or land-use issues in the region.

37. Traditional Deterrents

Locally developed, indigenous knowledge-based tools (e.g., fire torches, drum-beating, chili smoke) used historically to protect crops or homes.

38. Compensation Ceiling

The maximum amount payable under government compensation rules for specific damage types (e.g., ₹10 lakh for human death by elephant).

39. Invasive Species

Non-native plants or animals (e.g., *Lantana camara*) that disrupt natural habitats, leading to decreased food for native herbivores.

40. Seasonal Conflict Pattern

Variation in conflict incidents depending on agricultural seasons, animal migrations, or weather (e.g., more elephant raids during harvest months).

41. Community Conserved Areas (CCAs)

Areas conserved and managed by local communities based on traditional practices, often recognized for their role in biodiversity and conflict prevention.

42. Species-Specific Mitigation

Customized strategies designed to deal with conflict based on the behavior of a particular species (e.g., monkey-proof bins, leopard-safe livestock pens).

43. Conflict Mapping

The process of identifying and documenting conflict zones using GIS tools, community reports, or satellite data to target interventions.

44. Conservation Conflict

A situation where conservation goals clash with human interests, such as when wildlife protection laws restrict local livelihood practices.

45. Human Dominated Landscape

Regions where human infrastructure, agriculture, and settlements outweigh natural vegetation, often leading to squeezed wildlife spaces.

46. Night Guarding Camps

Temporary shelters or platforms constructed for farmers to monitor and protect their crops during peak conflict seasons (e.g., harvest time).

47. Conflict Early Detection Network

A community- and technology-based alert system (e.g., elephant movement SMS alerts, WhatsApp groups) to inform people before animals reach human areas.

48. Wildlife Refuge Area

A small forest patch or waterbody within human areas that shelters displaced or roaming wildlife—often hotspots of minor conflict.

49. Community-Based Monitoring

Involving trained villagers or local youth in regularly reporting animal sightings and conflict incidents to forest authorities.

50. Human-Animal Coexistence Model

A proactive conservation philosophy that focuses on sharing space with wildlife through mutual tolerance, land-use adjustment, and awareness.

51. Land Tenure Conflict

Disputes or confusion over land ownership or usage rights near forest fringes, complicating mitigation efforts and relocation planning.

52. Eco-Development Committees (EDCs)

Community institutions formed under forest department programs to implement joint forest management and eco-livelihood schemes in fringe villages.

53. Elephant Proof Trenches (EPTs)

Wide, deep ditches dug along forest borders to physically block elephant entry into human settlements.

54. Wildlife Mortality Data

Records of wild animal deaths (due to road hits, poisoning, electrocution, etc.) maintained to analyze conflict trends and response effectiveness.

55. Transboundary Wildlife Management

Coordinated management of migratory or wide-ranging animals across state or international borders to ensure continuity of mitigation efforts.

56. Sentinel Villages

Strategically located villages used as first alert zones to monitor and report wildlife movements approaching human areas.

57. Human Shielding

When a group of humans gathers or forms a barrier (e.g., in panic or protest) around a wild animal, making it difficult for rescue or safe passage.

58. Conservation Incentives

Non-cash benefits or rewards (e.g., community halls, roads, solar lights) provided to local populations who actively participate in wildlife protection.

59. Wildlife Rescue Squad

A specialized team of forest staff, veterinarians, and trained rescuers deployed for capturing, tranquilizing, or relocating conflict animals safely.

60. Human-Wildlife Conflict Index (HWCI)

A scoring or classification tool used by researchers and forest departments to quantify the severity and frequency of conflict in a particular area.

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