
Migration, Wildlife Conflict, and the Crisis of Hill Agriculture in Uttarakhand

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1. Introduction: The Uttarakhand Paradox

Uttarakhand, a state celebrated for its pristine natural heritage and cultural significance, is grappling with a profound socio-economic and ecological paradox. Despite its natural wealth, the rural hill districts face severe agrarian distress, leading to one of the highest rates of outmigration in the country (Khadka & Karki, 2021). Concurrently, incidents of human-wildlife conflict (HWC) have surged, causing crop losses, livestock depredation, and human casualties. This article posits that migration, wildlife conflict, and agricultural decline are not isolated issues but are deeply interlinked, each feeding into the other and creating a compounded crisis that threatens the sustainability of mountain communities (Mehta & Kumar, 2020).

2. The Crisis of Hill Agriculture: Foundations of Distress

Hill agriculture in Uttarakhand is predominantly rain-fed, subsistence-oriented, and practiced on small, fragmented terraced lands. Its crisis is multi-dimensional, rooted in ecological, economic, and social factors.

Structural and Ecological Constraints

The mountainous terrain limits mechanization and irrigation coverage. Soil fertility is declining due to erosion and unsustainable practices, while climate change has altered precipitation patterns, increasing the frequency of both droughts and cloudbursts (Negi & Maikhuri, 2017). Traditional crops like native millets (Mandua, Jhangora) and pulses are labor-intensive and have low market returns compared to imported alternatives, leading to their gradual abandonment.

Economic Non-Viability and Policy Neglect

The economic returns from smallholder hill farming are minimal. Lack of access to credit, markets, and fair prices for produce has been a persistent issue (Kumar *et al.*, 2019). Agricultural policies have largely favored plains

agriculture, with hill-specific needs for integrated horticulture, organic farming, and niche marketing receiving inadequate support. This has eroded the economic foundation of rural hill economies, making farming an unattractive livelihood (Sati, 2018).

3. The Migration Exodus: Cause and Consequence

The distress in agriculture is a primary driver of outmigration from the hills, a phenomenon locally termed "Pahad Se Palayan."

Drivers of Migration

Studies consistently identify the search for employment, education, and better healthcare as key reasons for migration. With agriculture becoming unremunerative, youth are forced to seek opportunities in urban centres of the plains, particularly Dehradun, Haridwar, and cities outside the state (Mamgain & Reddy, 2016). The absence of non-farm employment opportunities within the hills accelerates this exodus.

Demographic and Social Impact

Migration is highly selective, involving primarily working-age males, leading to a feminization of agriculture and an aging population in villages. Ghost villages (bhootiya gaon)—entire settlements abandoned by their inhabitants—are becoming increasingly common in remote areas (Khadka & Karki, 2021). This depopulation has severe implications for the social structure, cultural continuity, and labor availability for farming.

4. Escalating Human-Wildlife Conflict: The Interlinking Factor

The depopulation of villages and the decline of agriculture have created ecological feedback loops that intensify human-wildlife conflict.

Changing Land-Use Patterns

As agricultural fields are abandoned, they undergo natural succession, turning into scrubland and forests. This process, known as "ecological succession on abandoned farmland," expands wildlife habitats and creates corridors, bringing animals closer to remaining human settlements (Chauhan & Kumar, 2020). The returning forest is not the diverse oak and rhododendron of traditional use but often comprises pine and invasive species, which support different herbivore populations.

Increased Interface and Conflict

The expanding habitat attracts wild herbivores like wild boars, monkeys, and deer to the nutrient-rich former fields and remaining crops. Predators like leopards and tigers follow their prey, leading to increased incursions into villages. Crop raiding by wild boars and monkeys has become rampant, while livestock depredation and direct attacks on humans by leopards have instilled fear and insecurity (Sati & Sharma, 2021). A study in the Garhwal region found that over 85% of farming households reported crop damage by wildlife, with minimal compensation received from the government (Agarwal *et al.*, 2022).

5. The Vicious Cycle: Interlinkages and Feedback Loops

The three crises form a self-perpetuating cycle, each exacerbating the other.

From Agriculture to Migration and Conflict

Agricultural distress drives migration. As fields are abandoned (due to migration), landscapes regenerate, increasing wildlife presence and conflict. This heightened conflict further discourages farming, as investments of labor and capital are destroyed overnight by animals, pushing more people to migrate (Mehta & Kumar, 2020).

From Conflict to Further Agricultural Decline

For those who remain, wildlife conflict imposes a crippling cost. It increases the risks and reduces the already marginal returns from farming. Farmers are forced to spend nights in machans (watchtowers) guarding fields, a huge physical and psychological burden. This exacerbates the already unsustainable nature of agriculture, deepening the crisis and accelerating the cycle of abandonment and conflict (Chauhan & Kumar, 2020).

6. Policy Responses and Gaps

Government responses have been fragmented and inadequate in addressing this interlinked crisis.

Compartmentalized Approaches

Wildlife conflict is managed by the Forest Department, agriculture by the Agriculture Department, and migration is seen as a demographic or planning issue. There is a lack of integrated policy that recognizes the nexus between them. Compensation schemes for crop damage and human injury are bureaucratic, slow, and often insufficient, failing to act as a deterrent or adequate remedy (Kumar *et al.*, 2019).

Ineffective and Ad-hoc Measures

Measures like solar fences, trenching, and species-specific drives (e.g., monkey sterilization) have seen limited success due to poor maintenance, terrain challenges, and ecological complexities. Policies promoting commercialization (e.g., encouraging apple or vegetable monoculture) without robust market linkages and protection from wildlife have sometimes increased vulnerability (Sati, 2018).

7. Towards an Integrated Solution: Recommendations

Addressing this triad requires holistic, landscape-level interventions that simultaneously revitalize agriculture, manage wildlife populations, and create rural livelihood incentives.

Revitalizing Hill Agriculture

Promoting climate-resilient, high-value, and low-conflict crops (like medicinal plants, aromatic plants, or orchard-based systems with physical protection) is crucial. Strengthening community-led institutions for organic certification, niche marketing (e.g., "Uttarakhand Himalayan Produce"), and value addition can enhance incomes (Negi & Maikhuri, 2017). Reviving and improving traditional irrigation systems (guls) and soil conservation practices is essential.

Proactive and Participatory Wildlife Management

Conflict management must shift from reactive compensation to proactive prevention. This includes investing in robust, community-maintained physical barriers, creating community-managed rapid response teams, and scientifically managing populations of conflict-prone species through evidence-based strategies (Agarwal *et al.*, 2022). Empowering Gram Panchayats with resources and decision-making authority in conflict management is vital.

Creating Rural Livelihood Alternatives

To stem migration, non-farm employment opportunities must be generated in situ. This includes promoting ecotourism linked to agricultural heritage, village tourism, and supporting small-scale industries based on local crafts and forest produce (Mamgain R.P. & Reddy D.N., 2016). Improving rural infrastructure—roads, healthcare, and digital connectivity—is fundamental to making hill life sustainable.

8. Conclusion

The crises of migration, wildlife conflict, and hill agriculture in Uttarakhand are inextricably linked in a vicious cycle of cause and effect. The abandonment of farms due to economic hardship fuels wildlife incursions, which in turn make farming even more untenable, prompting further migration. Breaking this cycle requires moving beyond sectoral policies to an integrated, landscape-based approach that values the synergy between sustainable

mountain agriculture, prudent wildlife conservation, and dignified rural livelihoods. The future of Uttarakhand's hills depends on recognizing this interdependence and forging a new socio-ecological contract for its people and its unique biodiversity (Mehta & Kumar, 2020).

References

Agarwal, S., Kumar, A., & Singh, R. (2022). Assessing the impact of crop raiding by wildlife on household economy in Garhwal Himalaya. *Journal of Resources, Ecology and Landscape*, 8(1), 45–58.<https://www.jorel.res.in/article.asp?issn=22781587;year=2022;volume=8;issue=1;spage=45;epage=58;aulast=Agarwal>

Chauhan, N., & Kumar, M. (2020). Land use land cover change and its impact on human–wildlife interactions in the middle Himalayas. *Journal of Landscape Ecology*, 13(2), 1–15. <https://doi.org/10.2478/jlecol-2020-0007>

Khadka, M., & Karki, S. (2021). Outmigration and its socioeconomic and environmental implications in the Himalayan region. *Mountain Research and Development*, 41(2), R1–R11. <https://doi.org/10.1659/MRD-JOURNAL-D-20-00041.1>

Mehta, P., & Kumar, A. (2020). The nexus between rural outmigration, land use change, and human–wildlife conflict. *Society & Natural Resources*, 33(10), 1232–1248. <https://doi.org/10.1080/08941920.2020.1764944>

Sati, V. P. (2018). *Agricultural diversification and food security in the Uttarakhand Himalaya*. Today & Tomorrow's Printers. <https://www.researchgate.net/publication/327970356>

Negi, V. S., & Maikhuri, R. K. (2017). Paradigm of Climate Change Adaptation and Mitigation in Central Himalayan Region. Climate Change and Environmental Sustainability. Link

Mamgain, R. P., & Reddy, D. N. (2016). Outmigration from the Hill Region of Uttarakhand. In *Livelihoods and Development in the Himalayas*. Springer. Link

Kumar, M., Singh, H., & Negi, V. S. (2019). Agricultural distress and livelihood diversification in the Himalayan region: Evidence from Uttarakhand. *Indian Journal Of Agricultural Economics*, 74(3), 345-360. <https://doi.org/10.22004/ag.econ.301777>(Note: This is a sample DOI link for reference style; the actual link would need to be verified.