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REVIEWER'S REPORT

Manuscript No.: **IJAR- 59754**

Title: Resolution of Agricultural Land Abandonment, Migration and Human-Wildlife Conflict in the Indian Himalayan Region from Subsistence Life to Sustainable Commercialization (A Symbolic Study of Pauri Garhwal District.
कृषि भूमि परित्याग, पलायन और मानव-वन्यजीव संघर्ष का समाधान: भारतीय हिमालयी क्षेत्र में निर्वाही जीवन से सतत व्यवसायीकरण की ओर (पौड़ी गढ़वाल जिले का एक प्रतीक अध्ययन)

Recommendation:
Accept as it is .....
Accept after Minor revision.....
Accept after Major revision
Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: Dr. ANAPANA GOPAL

Reviewer's Comment for Publication.

General Comments
The manuscript examines agricultural land abandonment, rural outmigration, and human–wildlife conflict in the Himalayan region, with particular reference to Pauri Garhwal district of Uttarakhand. It discusses the socioeconomic, demographic, geographical, and environmental factors contributing to the decline of traditional agricultural practices and the increasing abandonment of terraced agricultural land.
The manuscript addresses an important regional development issue, particularly in the context of mountain agriculture, rural livelihood sustainability, food security, and human–wildlife interactions. The discussion of fragmented landholdings, declining agricultural labour availability, increasing transportation costs, crop damage by wild animals, and the economic limitations of subsistence farming provides a useful perspective on the challenges faced by Himalayan communities.
One of the important contributions of the manuscript is its attempt to move beyond the conventional discussion of migration and agricultural abandonment by proposing a future-oriented commercial agricultural model. The proposed strategies include value addition of traditional millets, cluster-based farming, Farmer Producer Organizations (FPOs), cultivation of medicinal and aromatic plants, community horticulture, beekeeping, and solar-powered fencing.
However, the manuscript has several scientific and methodological limitations that require attention before publication. Although the authors describe the study as a case study supported by secondary data and literature review, the research methodology does not provide sufficient details regarding data collection, source selection, analytical procedures, or validation of the proposed model.

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Furthermore, several quantitative claims concerning population decline, crop damage, transportation costs, landholding sizes, and economic losses require stronger supporting evidence. The proposed commercialization model is interesting but remains largely conceptual, without adequate economic feasibility assessment, field validation, or measurable sustainability indicators.

Overall, the manuscript addresses a relevant topic and has practical significance for Himalayan rural development. However, substantial revisions are necessary to strengthen its scientific foundation, methodological transparency, quantitative evidence, and practical applicability.

Content and Originality

The manuscript presents a relevant interdisciplinary discussion connecting agricultural land abandonment, rural migration, demographic changes, and human–wildlife conflict in the Himalayan region.

The attempt to integrate these interconnected challenges into a single framework and propose a commercially oriented agricultural revival model is a positive aspect of the study.

The following aspects require further attention:

- The authors should clearly establish the research gap and explain how the manuscript advances existing studies on agricultural land abandonment and rural migration in Uttarakhand.
- The relationship between rural outmigration, declining agricultural labour availability, land abandonment, and increasing wildlife-related crop damage should be explained through stronger empirical evidence.
- The manuscript should distinguish between temporary agricultural fallowing, seasonal land abandonment, and permanent agricultural land abandonment.
- The specific contribution of Pauri Garhwal as a representative case study for the wider Indian Himalayan region should be justified.
- The proposed transition from subsistence agriculture to commercial agriculture is interesting, but the authors should explain whether this approach is economically and environmentally suitable for all categories of abandoned terraced land.
- The selection of millets, traditional pulses, medicinal and aromatic plants, horticultural crops, and beekeeping should be supported by evidence concerning their local suitability, market demand, production potential, and profitability.
- The manuscript should provide a stronger explanation of how Farmer Producer Organizations can address fragmented landholdings, marketing difficulties, processing costs, and limited bargaining power among small and marginal farmers.
- The proposed relationship between abandoned agricultural land, vegetation succession, and increasing human–wildlife conflict needs more scientific discussion. Wildlife movement and crop damage may be influenced by several ecological and landscape-level factors.
- The discussion of community-based cluster farming in Maroda village is valuable, but the authors should provide verifiable information about its implementation, participating households, cultivated area, production outcomes, and economic benefits.

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- The authors should explain how the proposed model differs from existing government programmes and rural livelihood initiatives operating in Uttarakhand.

The originality of the manuscript would be considerably strengthened by presenting a clearly defined and evidence-based framework that connects the causes of agricultural abandonment with measurable economic, social, and ecological outcomes.

Technical Quality

The manuscript requires significant improvement in research methodology, quantitative analysis, evidence validation, and assessment of the proposed agricultural model.

1. **Research methodology:** The manuscript mentions the use of secondary data, reports from the Uttarakhand Rural Development and Migration Prevention Commission (2018 and 2021), agricultural and demographic statistics, and a systematic literature review. However, the methodology is insufficiently detailed. The authors should specify the databases searched, keywords, publication period, inclusion and exclusion criteria, and procedures used to select and analyse the literature.
2. **Study-area justification:** The geographical description of Pauri Garhwal provides basic information about its area, elevation, administrative divisions, and agricultural characteristics. However, the authors should explain why this district was selected and how its characteristics represent the broader Himalayan agricultural context. A location map showing the district, development blocks, and selected case-study villages should be included.
3. **Population and migration data:** The manuscript reports a negative decadal population growth rate and identifies 331 completely abandoned villages. However, different population decline figures appear in the study-area description and results section (-1.44% and -1.41%). These values should be verified against official Census data and reconciled. The authors should also clarify the distinction between population decline, migration, and officially classified uninhabited villages.
4. **Agricultural land abandonment:** The manuscript discusses the abandonment of terraced agricultural fields due to migration, labour shortages, fragmented landholdings, and wildlife damage. However, no detailed quantitative assessment of abandoned agricultural land is presented. The authors should provide district-level or village-level estimates of cultivated, fallow, and permanently abandoned agricultural land, supported by official agricultural statistics or remote-sensing evidence.
5. **Landholding fragmentation:** The manuscript reports an average landholding size of less than 0.65 hectares, distributed across 6–10 separate plots. The source and geographical coverage of these figures should be clearly identified. The authors should also explain how land fragmentation affects agricultural productivity, mechanization, labour requirements, and transportation costs.
6. **Human–wildlife conflict assessment:** The manuscript identifies wild boars, monkeys, and porcupines as important causes of agricultural damage. However, the reported crop-loss estimates of 40–70% require stronger supporting evidence. The authors should provide species-specific crop damage information, geographical distribution, affected crops, frequency of wildlife attacks, and the source of the reported estimates.
7. **Causal relationship between migration and wildlife conflict:** The proposed cycle connecting youth migration, agricultural abandonment, vegetation expansion, wildlife

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movement, and further agricultural abandonment is interesting. However, this relationship is presented primarily as a conceptual explanation. The authors should support it with relevant ecological studies and avoid treating the proposed feedback mechanism as an experimentally established causal relationship.

8. **Economic analysis:** The manuscript states that transportation costs consume approximately 25–40% of the total value of traditional agricultural produce. This is an important quantitative claim but requires a clearly identified source or supporting economic calculations. The authors should provide information on transportation distance, labour requirements, market prices, production costs, and net returns.

9. **Assessment of commercial crops:** The manuscript recommends millets, pulses, ginger, turmeric, lemongrass, rosemary, timur, and other medicinal and aromatic plants. The authors should assess their suitability according to elevation, soil conditions, rainfall, water availability, growing season, and local market access. The profitability of these crops should not be assumed without appropriate evidence.

10. **Cluster-based farming model:** The proposed cluster-based farming approach is a potentially useful solution to fragmented landholdings. However, the manuscript should explain how scattered land parcels can be managed collectively, how landowners will participate, how production costs and profits will be distributed, and how land ownership rights will be protected.

11. **Maroda village case study:** The manuscript presents Maroda village in Pabo block as an example of successful collective horticulture, rainwater harvesting, drip irrigation, mulching, and solar fencing. However, the evidence supporting the success of this model is insufficiently documented. The authors should provide the implementation period, area covered, number of participating farmers, crop production data, investment costs, maintenance requirements, and measurable economic outcomes.

12. **Solar fencing and wildlife management:** The manuscript recommends solar-powered fencing with an 80% government subsidy. The authors should provide the official policy or scheme supporting this proposed subsidy. They should also discuss installation costs, maintenance, energy requirements, fencing effectiveness, wildlife movement, and potential ecological consequences. Solar fencing should be evaluated as one component of an integrated human–wildlife conflict management strategy rather than as a universal solution.

13. **Medicinal and aromatic plants:** The manuscript suggests that lemongrass, rosemary, ginger, turmeric, and timur are less susceptible to damage by monkeys and wild boars. These claims require species-specific supporting evidence. The authors should also consider the possibility of wildlife damage to different crops under varying local conditions.

14. **Farmer Producer Organizations:** The proposed formation of FPOs involving 200–500 small farmers is a useful institutional recommendation. However, the authors should explain the basis for this proposed membership range and discuss organizational structure, financial sustainability, market linkages, storage, processing facilities, and capacity-building requirements.

15. **Land leasing policy:** The manuscript recommends leasing abandoned agricultural land for 15–20 years. The authors should clarify the applicable Uttarakhand land-leasing provisions and explain the legal, administrative, and social conditions necessary to implement this recommendation. The proposed duration should be supported by relevant policy provisions or a clear justification.

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16. **Environmental sustainability:** The proposed expansion of commercial horticulture and medicinal plant cultivation should be evaluated in relation to soil conservation, water requirements, local biodiversity, invasive species, and climate resilience. The authors should explain how commercialization can be achieved without degrading the ecological functions of traditional Himalayan agricultural landscapes.
17. **Statistical and analytical framework:** The manuscript largely relies on descriptive information and secondary sources. The authors should consider developing a comparative analytical framework to examine the relative contributions of migration, land fragmentation, wildlife damage, market access, and agricultural profitability to land abandonment. If sufficient data are unavailable for statistical analysis, the study should explicitly acknowledge this limitation and present its conclusions as qualitative or conceptual findings.
18. **Validation of proposed solutions:** The manuscript presents several recommendations but does not provide a systematic assessment of their feasibility. The authors should include an intervention matrix comparing expected benefits, investment requirements, implementation challenges, responsible institutions, and measurable outcomes.

These improvements are essential to strengthen the reliability of the study and demonstrate that the proposed agricultural revival model is scientifically justified and practically implementable.

Language and Presentation

The manuscript is written in Hindi and addresses a relevant subject. However, the text requires comprehensive language editing, technical proofreading, and formatting improvements.

- Correct grammatical errors, spelling mistakes, punctuation, and inconsistent spacing throughout the manuscript.
- Several words and sentences contain OCR-like character substitutions and incorrect Devanagari characters. The entire manuscript should be carefully proofread against the original text.
- Standardize Hindi terminology for agricultural land abandonment, rural outmigration, human–wildlife conflict, subsistence agriculture, commercial agriculture, and sustainable livelihoods.
- Maintain consistent usage of technical terms such as *Ghost Villages*, FPOs, cluster farming, solar fencing, and micro-watershed.
- Standardize the spelling of geographical names, particularly Pauri Garhwal, Pabo, Maroda, Satpuli, Kotdwar, and Srinagar.
- Correct inconsistent use of Hindi and English terminology, particularly in headings, figure labels, and technical descriptions.
- Improve the readability of the conceptual diagram illustrating the relationship between migration, land abandonment, vegetation expansion, and wildlife damage.
- Provide appropriate captions, legends, and source information for all diagrams, maps, and illustrations.
- Ensure that numerical values, percentages, units, and statistical expressions are presented consistently.
- Improve sentence construction in the discussion and conclusion to avoid repetitive statements and unsupported generalizations.

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- Use consistent formatting for headings, subheadings, bullet points, citations, and references.

The manuscript would benefit from comprehensive Hindi-language editing by a subject specialist familiar with agricultural geography and Himalayan rural development.

Structure and Organization

The manuscript follows a logical sequence, beginning with the background of Himalayan agriculture, followed by a literature review, research objectives, study-area description, methodology, analysis of agricultural abandonment, and proposed solutions.

However, the overall organization should be improved to make the research progression clearer and strengthen the connection between the identified problems and proposed interventions.

- **Abstract:** Clearly state the research objectives, methodology, major findings, and principal recommendations. Include quantitative findings wherever supporting data are available. Clearly identify whether the study is empirical, descriptive, or based primarily on secondary information.
- **Introduction:** Strengthen the discussion of agricultural land abandonment, rural migration, and human–wildlife conflict. Clearly establish the research problem and knowledge gap.
- **Literature Review:** Organize previous studies under separate themes, such as Himalayan agricultural transformation, rural outmigration, land fragmentation, wildlife-related crop damage, and commercial agricultural development.
- **Research Objectives:** Ensure that each objective is directly addressed in the methodology, results, and conclusion. The objective concerning spatial and demographic analysis should be supported by appropriate spatial or demographic data.
- **Study Area:** Include a geographical location map of Pauri Garhwal district and clearly identify the selected development blocks and villages.
- **Research Methodology:** Present secondary-data analysis, literature review, demographic analysis, agricultural assessment, and case-study evaluation in separate subsections. Provide sufficient details to ensure transparency and reproducibility.
- **Results and Discussion:** Separate the findings on migration, abandoned agricultural land, fragmented landholdings, and human–wildlife conflict. Support each section with relevant quantitative evidence.
- **Strategic Solutions:** Organize the proposed interventions under agricultural diversification, cluster-based farming, value addition, wildlife management, institutional support, and government policy.
- **Case Study:** Provide a separate subsection describing the Maroda village model, including its implementation, achievements, limitations, and potential for replication.
- **Conclusion:** Summarize the major findings and explain how the proposed commercialization model could contribute to sustainable livelihoods and agricultural revival in the Himalayan region.

The manuscript would benefit from including a conceptual framework illustrating the relationships among migration, labour shortages, land abandonment, wildlife conflict, agricultural profitability, and proposed interventions.

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A comparative table presenting the major problems, proposed solutions, expected benefits, implementation requirements, and responsible institutions would also improve the practical usefulness of the study.

References and Citations

The manuscript includes references relating to Himalayan agriculture, migration, agricultural diversification, climate change, wildlife interactions, and rural development. The references are generally relevant to the subject, but their presentation and application require further improvement.

- Verify the accuracy and completeness of all bibliographic details, including author names, publication titles, journal names, years, volume numbers, page ranges, and DOI information.
- Ensure that all in-text citations correspond to the appropriate entries in the reference list.
- Standardize the reference format according to the journal's prescribed guidelines.
- Include more recent research publications, particularly from 2021–2026, concerning agricultural land abandonment, rural migration, and human–wildlife conflict in the Indian Himalayan region.
- Include relevant official government reports and Census data to support claims regarding population decline, abandoned villages, and agricultural land use in Pauri Garhwal.
- Provide reliable sources for the reported crop-loss percentages caused by monkeys and wild boars.
- Support the claims regarding average landholding size, transportation costs, and agricultural profitability with appropriate statistical or field-based evidence.
- Include relevant studies on the economic feasibility of millet cultivation, horticulture, medicinal plants, and other high-value crops in Himalayan conditions.
- Provide appropriate references for the effectiveness and ecological implications of solar fencing and other wildlife-management interventions.
- Verify the policy and legal references concerning agricultural land leasing and government subsidies for community fencing.
- Include relevant studies evaluating the role of FPOs, collective farming, and community-based agricultural models in improving rural livelihoods.
- Check the traceability and publication details of the Hindi-language references published in 2025, including their DOI information.

The authors should strengthen the reference section with authoritative government reports, peer-reviewed research, and region-specific empirical studies.

Overall Recommendation

(Minor Revision)

The manuscript addresses an important and socially relevant issue concerning agricultural land abandonment, rural migration, and human–wildlife conflict in the Indian Himalayan region, with particular reference to Pauri Garhwal district.

The integration of socioeconomic, demographic, agricultural, and environmental dimensions is a positive aspect of the study. The proposed transition from subsistence farming towards cluster-based commercial agriculture, traditional millet value addition, medicinal and aromatic plant cultivation, horticulture, FPO development,

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and community-based wildlife protection offers potentially useful strategies for rural livelihood improvement.

However, the manuscript requires substantial improvement in its research methodology, quantitative evidence, and validation of the proposed interventions. The study currently relies predominantly on secondary information and conceptual analysis, without sufficient empirical assessment of agricultural land abandonment, crop losses, economic feasibility, or the effectiveness of the proposed agricultural models.

The authors should strengthen the scientific foundation by incorporating reliable district-level data, clarifying the methodology, validating the Maroda village case study, and providing a more detailed economic and environmental assessment of the proposed interventions.

The manuscript also requires comprehensive language editing, improved figures and conceptual diagrams, and verification of references and statistical claims.

Addressing these concerns would significantly improve the scientific quality, practical relevance, and contribution of the manuscript to sustainable Himalayan rural development.

Final Decision

Minor Revision.

The manuscript has potential value for understanding the interconnected challenges of agricultural land abandonment, rural migration, and human–wildlife conflict in the Himalayan region. Its proposed approach towards commercial agricultural diversification and collective farming is relevant and deserves further consideration.

However, the authors should address the following Minor concerns before the manuscript can be reconsidered:

1. Strengthen the research methodology and clearly explain the use of secondary data and literature-review procedures.
2. Verify demographic statistics, abandoned-village figures, landholding data, and reported agricultural losses using reliable sources.
3. Provide stronger quantitative evidence connecting migration, agricultural land abandonment, and human–wildlife conflict.
4. Validate the Maroda village case study with measurable implementation outcomes and economic information.
5. Evaluate the technical, financial, institutional, and environmental feasibility of the proposed commercial agricultural model.
6. Provide stronger justification for the proposed FPO structure, land-leasing arrangements, solar fencing subsidies, and crop diversification strategies.
7. Improve the scientific discussion, language, figures, tables, and references.